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MATERIALS SCIENCE MONOGRAPHS, 42C

MATERIALS DATA FOR CYCLIC LOADING

PART C: HIGH-ALLOY STEELS

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ELSEVIER

Amsterdam – Oxford – New York – Tokyo 1987

ELSEVIER SCIENCE PUBLISHERS B.V.
Sara Burgerhartstraat 25
P.O. Box 211, 1000 AE Amsterdam, The Netherlands

Distributors for the United States and Canada:

ELSEVIER SCIENCE PUBLISHING COMPANY INC.
52, Vanderbilt Avenue
New York, NY 10017, U.S.A.

Library of Congress Cataloging-in-Publication Data

Boller, Chr.
Material data for cyclic loading.

(Materials science monographs ; 42)

Bibliography: p.

Contents: pt. A. Unalloyed steels -- pt. B. Low-alloys

-- pt. C. High-alloy steels -- [etc.]

1. Metals--Testing--Tables. 2. Alloys--Testing--

Tables. I. Seeger, T. II. Title. III. Series.

TA460.B65 1987 620.1'6 87-22149

ISBN 0-444-42875-5 (U.S. : set)

ISBN 0-444-42870-4 (Vol. 42A)

ISBN 0-444-42871-2 (Vol. 42B)

ISBN 0-444-42872-0 (Vol. 42C)

ISBN 0-444-42873-9 (Vol. 42D)

ISBN 0-444-42874-7 (Vol. 42E)

ISBN 0-444-42875-5 (Vol. 42, set)

ISBN 0-444-41685-4 (series)

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Printed in The Netherlands

Introduction

Metal Fatigue has traditionally been related to stress. Since the works of Manson [1.1] and Coffin [1.2], however, it has become clear that as well as stress, strains must be taken into account too. If this is done, then we can get a fairly adequate picture of a material's fatigue behaviour. The reason for this is that in fatigue there is usually an elastic-plastic correlation between stresses and strains, quite often in the region of the endurance limit. Therefore the traditional stress-strain curves for monotonic loading are completed by the stress-strain curves for cyclic loading and the traditional stress life curves by the strain life curves for elastic, plastic and total strains. Mean stress effects are described by so-called mean stress (damage) parameter life curves.

Stress-strain curves, strain life curves and mean stress parameter life curves for cyclic loading are the components of "materials data for cyclic loading".

These materials data provide the basis for materials assessment by direct comparison of data or characteristic values and for estimating the crack initiation lives of structural parts under constant and variable amplitude loading.

In the latter case, local stress-strain paths are evaluated by applying a load notch relationship from finite element calculations or from approximation formulas such as Neuber's rule $\sigma_t \epsilon = K_t^2 \cdot S \cdot e$ (K_t = stress concentration factor, S = nominal stress, e = nominal strain, mainly $e = S/E$), and the stress-strain curve for cyclic loading of the material being studied. With the help of the material's life curve - and in the case of random loading taking damage accumulation into account - the crack initiation lives of structural parts can be calculated. To achieve satisfactory accuracy with this evaluation method, called the Local Strain or Notch Strain Approach, it must be assumed that the conditions of the unnotched specimen for which the materials data have been determined agree sufficiently with the local notch conditions of a structural part regarding the definition of crack initiation, surface roughness or finish and the size of the highly stressed material volume.

The advantage of this method is a great reduction in the cost of evaluating experimental data. Regarding strengths, the multitude of notch effects are eliminated and transferred to the calculation of local stresses and strains. Of course, the accuracy of the life estimation depends on the accuracy of the local stresses and strains calculated, the transferability

of the materials data used and the validity of the damage accumulation rule applied.

For many years now materials data for cyclic loading have been published in the scientific literature. However, these data have been collected in quite different ways. In this book, these materials data have been gathered together, evaluated according to uniform approach and methods and compiled on standardized data sheets.

In gathering the data, special attention was given to ensuring that as far as possible the shape of the specimens and the experimental procedure conformed to ASTM E 606-80 [1.3]. ASTM E 606 is recommended for further evaluation of data on cyclic loaded materials.

The data are now published for the first time in a handbook, suitable for a wide range of applications and divided into the following sections according to material groups:

Part A: Unalloyed Steels

Part B: Low-Alloy Steels

Part C: High-Alloy Steels

Part D: Aluminium and Titanium Alloys

Part E: Cast and Welded Metals

Each data sheet takes up a maximum of four pages. The first page gives a description of the material and testing procedure. In the upper left corner the material designation is given in the following order:

- designation according to DIN 17 006 or DIN 1725
- designation according to DIN 17 007
- usual commercial designation (e.g. ASTM, SAE, JIS)

The chemical composition is always given in weight percent. It corresponds to the values given in the literature referred to.

The second and third pages show the diagrams for

- stress-strain curves for monotonic and cyclic loading
- strain life curve

- mean stress (damage) parameter life curve according to the parameter of Smith, Watson and Topper [1.4].

Unless indicated otherwise in the plots, the experiments were carried out at room temperature in laboratory air.

The diagrams for the stress-strain relationships contain at the most three curves, one for monotonic and two for cyclic loading, the latter being evaluated from incremental step tests and constant amplitude tests. All three curves can be described approximately by an analytical function, for monotonic loading by the equation

$$\varepsilon = \varepsilon_e + \varepsilon_p = \frac{\sigma}{E} + \left(\frac{\sigma}{K}\right)^{1/n} \quad (1a)$$

and for cyclic loading by the equation

$$\varepsilon_a = \varepsilon_{a,e} + \varepsilon_{a,p} = \frac{\sigma_a}{E} + \left(\frac{\sigma_a}{K'}\right)^{1/n'} \quad (1b)$$

The values of the constants K , n and K' , n' are given in the data sheets. They were evaluated by regression analysis (minimum of the squares of the distances rectangular to the regression line) from the values of the appropriate experimental data in the literature referred to. For unalloyed and low-alloy steels the analytical description of the stress-strain curve for monotonic loading according to eq. (1a) is sometimes only meaningful for strains beyond 2%, because yield strength and Lüder's area cannot be accounted for in that equation. The stress-strain curves for cyclic loading were determined on the basis of constant amplitude and/or incremental step test data. Unless noted otherwise in the data sheet, the results are valid for a stabilized state or half fatigue life, respectively. The stress-strain curves obtained from constant amplitude tests are represented by a solid line in the experimentally proved part and by a dashed line in the remaining part. Their constants K' and n' are denoted once more in the diagrams. The stress-strain curves obtained from incremental step tests are drawn up to the maximum strain amplitude tested. Irrespective of the number of curves drawn in the diagram, the legend always contains the symbols for all three curves.

The analytical description for the strain life curves corresponds to the functions of Manson [1.5] and Morrow [1.6]:

$$\epsilon_{a,e}(N) = \frac{\sigma_f'}{E} \cdot (2N)^b \quad (2)$$

$$\epsilon_{a,p}(N) = \epsilon_f' \cdot (2N)^c \quad (3)$$

$$\epsilon_a(N) = \epsilon_{a,e}(N) + \epsilon_{a,p}(N) \quad (4)$$

The number of cycles N characterizes crack initiation or rupture of the specimen according to its loading conditions.

For datasets with no runouts, or only a few, the constants σ_f' , b , ϵ_f' and c were evaluated on the basis of experimental σ_a - ϵ_a - N data from the literature by the aforementioned regression analysis for elastic strains and plastic strains separately. If only a few runouts were available, they were neglected as they give no reliable information about the endurance limit. There is no significant difference between these evaluations of the constants and those obtained according to ASTM E 739-80 [1.7], even though the types of regression analysis are slightly different.

For some data sets with a large number of experimental results in the region of the endurance limit, the constants were evaluated by maximum likelihood method. This was again done separately for elastic and plastic strain according to a proposal made in [1.8] for the evaluation of S-N-curves. The endurance limits obtained are denoted by horizontal straight lines in the strain life curves. The endurance limit for total strain was obtained according to eq. (4). In general, the endurance limits obtained here must be seen as approximate values as they are based only on a few experimental results of unbroken specimens (runouts).

One of the three equations (1b), (2) and (3) is dependent on the remaining two equations. Therefore a dependency of the constants exists in the form $n' = b/c$ and $K' = \sigma_f' / \epsilon_f'^{b/c}$. This dependency, however, has been neglected in this handbook as it requires a large amount of calculation in the statistical analysis. Comparative studies show that this dependency is sufficiently fulfilled even though the three equations are treated as independent.

Unless noted otherwise, experimental results with plastic strain amplitudes of less than 0.01% have been neglected in the regression analysis, as they mainly

lead to an unsatisfactory description of the life curve according to eqs. (2)-(4) in the low cycle regime. All three life curves for elastic, plastic and total strain are denoted with their appropriate constants in the diagram. The curves are solid in the part where experimental results have been taken into account for regression analysis and dashed in the other parts.

In the diagram of the damage parameter life curve the parameter according to Smith, Watson and Topper [1.4]

$$P_{SWT} = \sqrt{(\sigma_a + \sigma_m) \cdot \epsilon_a \cdot E} \quad (5)$$

was chosen. The analytical description of the damage parameter life curve is obtained by using eqs. (2)-(4) in eq. (5) with $\sigma_m = 0$ leading to

$$P_{SWT}(N) = \sqrt{\sigma_f'^2 \cdot (2N)^{2b} + E \cdot \sigma_f' \cdot \epsilon_f' \cdot (2N)^{(b+c)}} \quad (6)$$

For reasons of uniformity, datasets with experimental results $\epsilon_m \neq 0$ and $\sigma \neq 0$ were treated as if the regression line had been evaluated for $\sigma_m \neq 0$. From the idea that P_{SWT} accounts for mean stresses, P_{SWT} -life curves evaluated from the experimental results with $\sigma_m = 0$ should be plotted into the diagrams with experimental results $\sigma_m \neq 0$, leading to better coincidence between life curve and experiments.

For uniformity, the experimental results for high and low temperatures are presented in a P_{SWT} diagram as well. How far Smith, Watson and Topper's parameter is valid for high and low temperatures has not yet been proven.

The criteria for the solid and dashed part of the curves are the same as for the strain life curves. The endurance limit obtained by maximum likelihood was calculated according to eq. (5) and is indicated in the plot.

The results of stress- and strain-controlled constant amplitude tests are listed on the third and if necessary on the fourth page, specifying the following:

- specimen number
- stress amplitude
- mean stress
- amplitude of total strain
- number of cycles

Unless stated otherwise, stresses and strains are noted in the data sheet for stabilized material behaviour or half failure life.

Blanks in the data sheets indicate that the information was not given in the literature referred to.

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Nomenclature

A_5	elongation related to 5x diameter of specimen
A_{25}	elongation related to 25x diameter of specimen
b	fatigue strength exponent
c	fatigue ductility exponent
E	Young's modulus
ϵ	strain
ϵ_f	true fracture strain
ϵ'_f	fatigue ductility coefficient
K	monotonic hardening coefficient
K'	cyclic hardening coefficient
N	number of cycles until rupture
N_i	number of cycles until crack initiation
N_T	number of cycles for $\epsilon_{a,e} = \epsilon_{a,p}$ (transition point)
n	monotonic hardening exponent
n'	cyclic hardening exponent
ν	Poisson's ratio
P_{SWT}	damage parameter according to Smith, Watson and Topper
R	stress ratio
R_m	ultimate tensile strength
$R_{p0.2}$	monotonic 0.2% proof stress
$R'_{p0.2}$	cyclic 0.2% proof stress
σ	stress
σ_f	true fracture stress
σ'_f	fatigue strength coefficient
T_σ	$\sigma_{a,10\%}/\sigma_{a,90\%}$ scatter ratio of stress amplitudes for 10% and 90% probability of survival
$T_{\epsilon p}$	$\epsilon_{a,10\%}/\epsilon_{a,90\%}$ scatter ratio of plastic strain amplitudes for 10% and 90% probability of survival
Z	reduction of area

Indexes

a	amplitude
e	elastic
g	value at $2 \cdot 10^6$ cycles
m	mean value
p	plastic

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X 4 NiCrTi 73 15 3	Inconel X
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Heat treatment : 1120°C/4h, air, 843°C/24h, air, 704°C/20h, air
 Test temperature : +23°C
 Semifinished material : blanks, Ø 19 mm
 Reference : [4,12]
 Year : 1963

Hardness : Rockwell C-34 to 35

Chemical composition

C	Mn	Si	Cr	Ni	Cb	Ti	Al	Fe
0.04	0.70	0.30	15.0	72.56	1.0	2.5	0.30	7.0

Microstructure :

Monotonic properties

E	=	214055	N/mm ²	ν	=	0.31	-
R _{p0.2}	=	704	N/mm ²	K	=	1522	N/mm ²
R _m	=	1215	N/mm ²	n	=	0.135	-
A ₅	=		%	σ _f	=	1512	N/mm ²
Z	=	20	%	ε _f	=	0.22	-

Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 6.35 mm
 Specimen location : in rolling direction
 Gauge length : 38.1 mm
 Testing machine : Rhiele, universal testing machine
 Strain rate :

Cyclic properties

R' _{p0.2}	=	962	N/mm ²	K'	=	2130	N/mm ²
σ' _g	=	405	N/mm ²	n'	=	0.128	-
ε _g	=	0.191	%	σ' _f	=	1990	N/mm ²
N _T	=	195	cycles	ε' _f	=	0.177	-
T _σ	=	1.259	-	b	=	-0.105	-
T _{εp}	=	3.858	-	c	=	-0.599	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

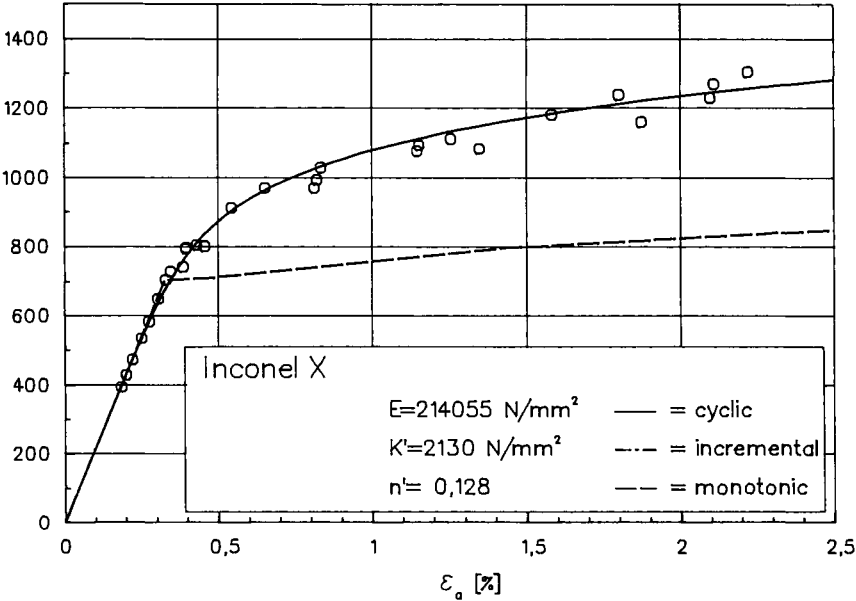
Cyclic test

Loading condition : total diametral strain control, R_{ed} = -1
 Specimen : hourglass shaped, Ø 6.35 mm
 Surface : machined
 Specimen location : in rolling direction
 Gauge length : diametral
 Testing machine : self designed
 Frequency :
 Strain rate :
 Waveform :

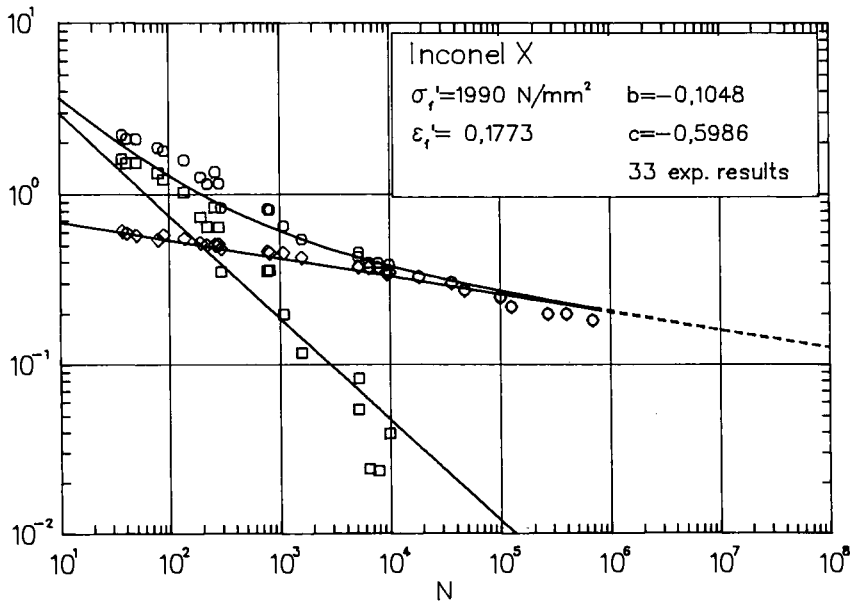
Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks :

Remarks :

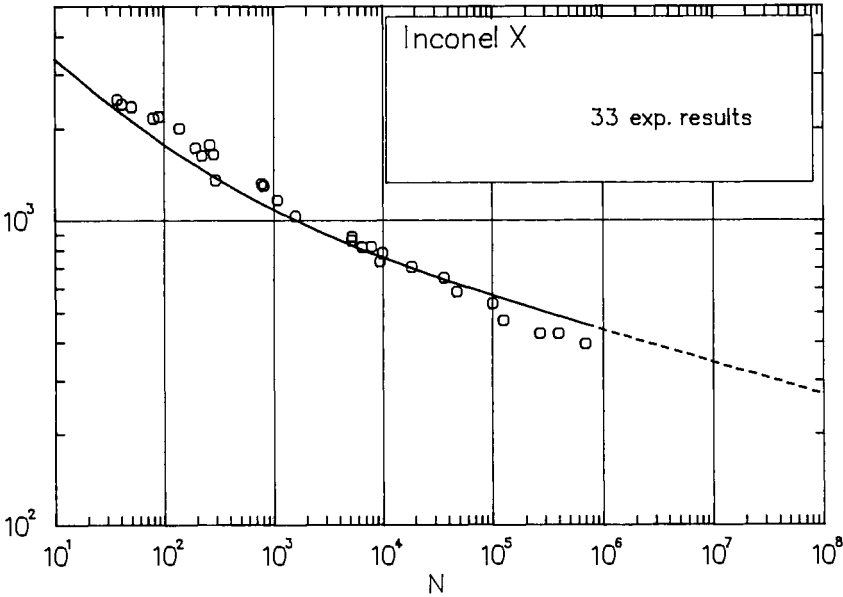
σ_a [N/mm²]



ϵ_a [%]



PSWT [N/mm²]



Material : Inconel X

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	1318.7	0.0	4.0260	2.0
2.0000	1456.7	0.0	3.2700	4.0
3.0000	1367.0	0.0	2.6420	6.0
4.0000	1408.4	0.0	2.5540	9.0
5.0000	1304.9	0.0	2.2200	37.0
6.0000	1270.3	0.0	2.1090	41.0
7.0000	1228.9	0.0	2.0970	50.0
8.0000	1159.9	0.0	1.8730	79.0
9.0000	1239.3	0.0	1.7990	89.0
10.0000	1180.6	0.0	1.5810	137.0
11.0000	1111.5	0.0	1.2570	193.0
12.0000	1077.0	0.0	1.1470	220.0
13.0000	1083.9	0.0	1.3480	261.0
14.0000	1094.3	0.0	1.1530	282.0
15.0000	1028.7	0.0	0.8330	296.0
16.0000	994.2	0.0	0.8200	779.0
17.0000	970.0	0.0	0.8120	813.0
18.0000	970.0	0.0	0.6520	1080.0
19.0000	911.3	0.0	0.5430	1580.0
20.0000	804.3	0.0	0.4300	5160.0
21.0000	800.9	0.0	0.4570	5210.0
22.0000	794.0	0.0	0.3950	6440.0
23.0000	797.4	0.0	0.3960	7800.0

continued

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
24.0000	728.4	0.0	0.3450	9400.0
25.0000	742.2	0.0	0.3860	9940.0
26.0000	704.2	0.0	0.3290	18400.0
27.0000	649.0	0.0	0.3040	36400.0
28.0000	583.4	0.0	0.2740	47500.0
29.0000	535.1	0.0	0.2500	99800.0
30.0000	472.9	0.0	0.2200	125000.0
31.0000	428.0	0.0	0.2000	267000.0
32.0000	428.0	0.0	0.2000	395000.0
33.0000	393.5	0.0	0.1840	688000.0

X 5 NiCrTi 26 15	1.4890	SUH 660-B
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Heat treatment : 928°C/1h, water, 715°C/16h, air
Test temperature : +23°C
Semifinished material : bar, Ø 22 mm
Reference : [4,8]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Ti	Al
0.032	0.55	1.14	0.020	0.004	24.65	13.91	1.27	2.50	0.26

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	777	N/mm ²	K	=	N/mm ²
R _m	=	1158	N/mm ²	n	=	-
A _g	=	23	%	σ_f	=	N/mm ²
Z	=	52	%	ϵ_f	=	-

Cyclic properties

R _{p0.2}	=	711	N/mm ²	K'	=	1543	N/mm ²
σ_g	=	444	N/mm ²	n'	=	0.125	-
ϵ_g	=	0.216	%	σ'_f	=	1574	N/mm ²
N _T	=	2854	cycles	ϵ'_f	=	1.109	-
Γ_σ	=	1.038	-	b	=	-0.083	-
T _{ep}	=	1.841	-	c	=	-0.661	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remark: : Young's modulus estimated

Hardness : HV 30 : 337

Microstructure : JIS G 0551 grain size: 8.5

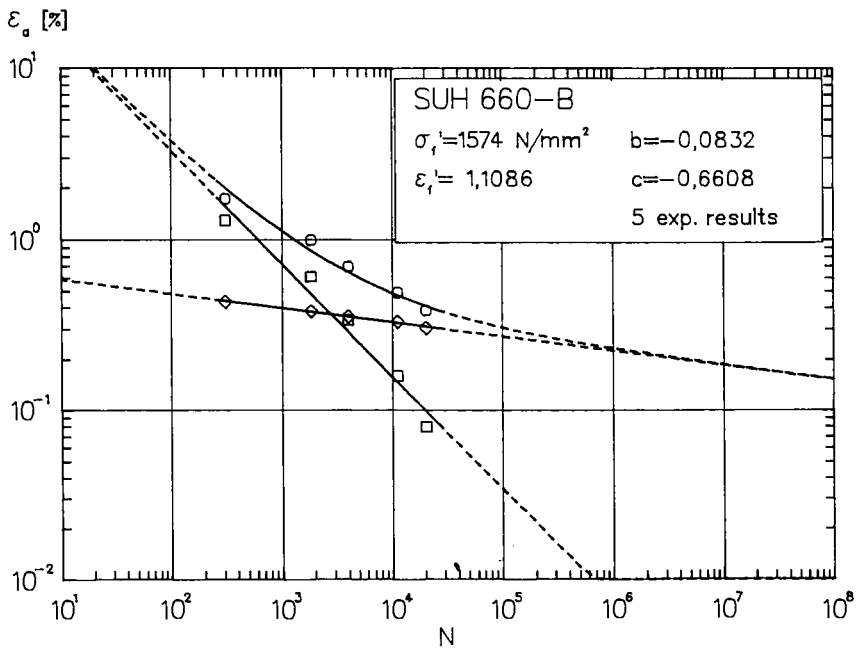
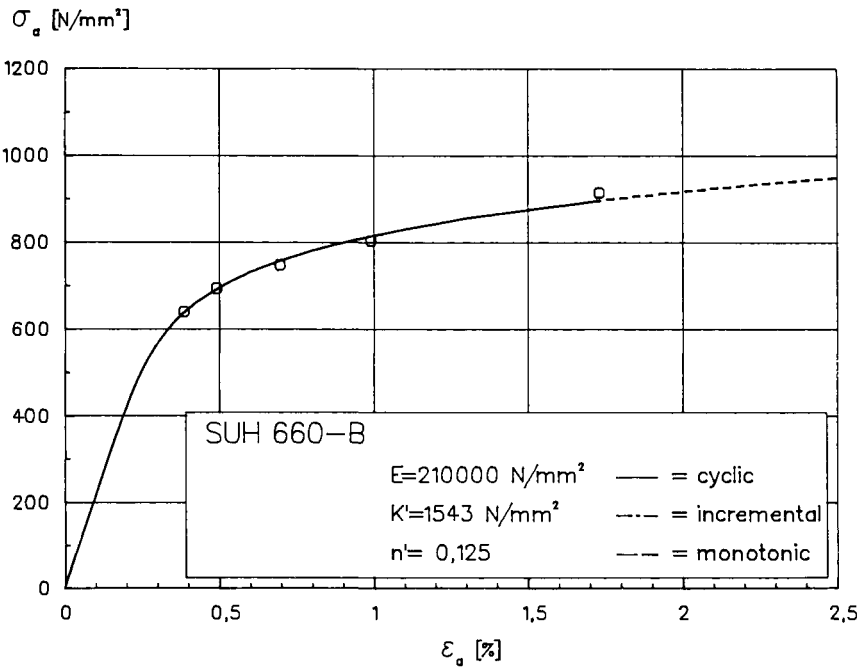
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

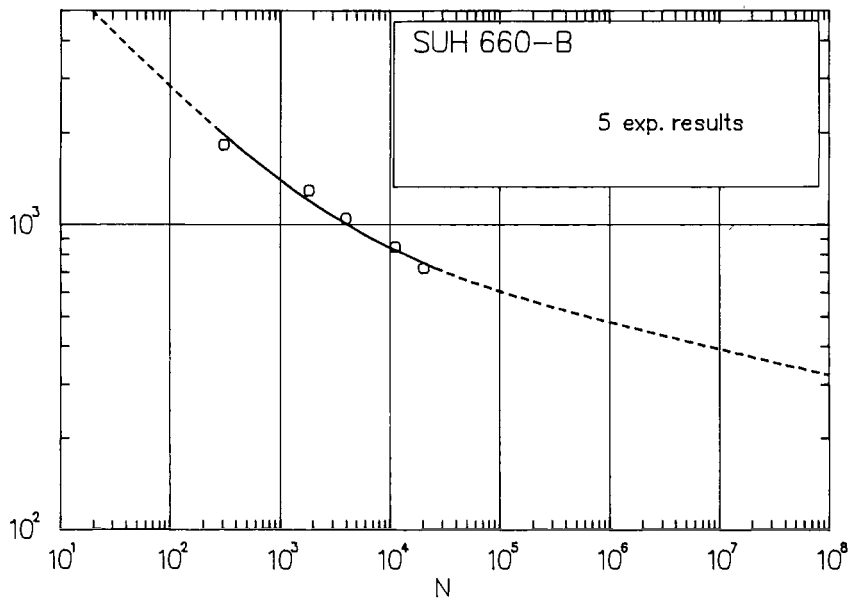
Cyclic test

Loading condition : total strain control, R_e = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 39 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUH 660-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	915.3	0.0	1.7300	307.0
2.0000	803.4	0.0	0.9900	1830.0
3.0000	747.5	0.0	0.6950	3968.0
4.0000	693.6	0.0	0.4900	11120.0
5.0000	640.5	0.0	0.3850	20277.0

X 5 NiCrTi 26 15	1.4890	SUH 660-B
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Heat treatment : 928°C/1h, water, 715°C/16h, air
 Test temperature : +23°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4,8]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Ti	Al
0.032	0.55	1.14	0.020	0.004	24.65	13.91	1.27	2.50	0.26

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	777	N/mm ²	K	=	N/mm ²
R _m	=	1158	N/mm ²	n	=	-
A _g	=	23	%	σ_f	=	N/mm ²
Z	=	52	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	713	N/mm ²	K'	=	1617	N/mm ²
σ'_g	=	453	N/mm ²	n'	=	0.132	-
ϵ'_g	=	0.222	%	σ'_f	=	1537	N/mm ²
N _r	=	2616	cycles	ϵ'_f	=	0.662	-
T _{σ}	=	1.044	-	b	=	-0.080	-
T _{ϵ_p}	=	1.657	-	c	=	-0.606	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness : HV 30 : 337

Microstructure : JIS G 0551 grain size: 8.5

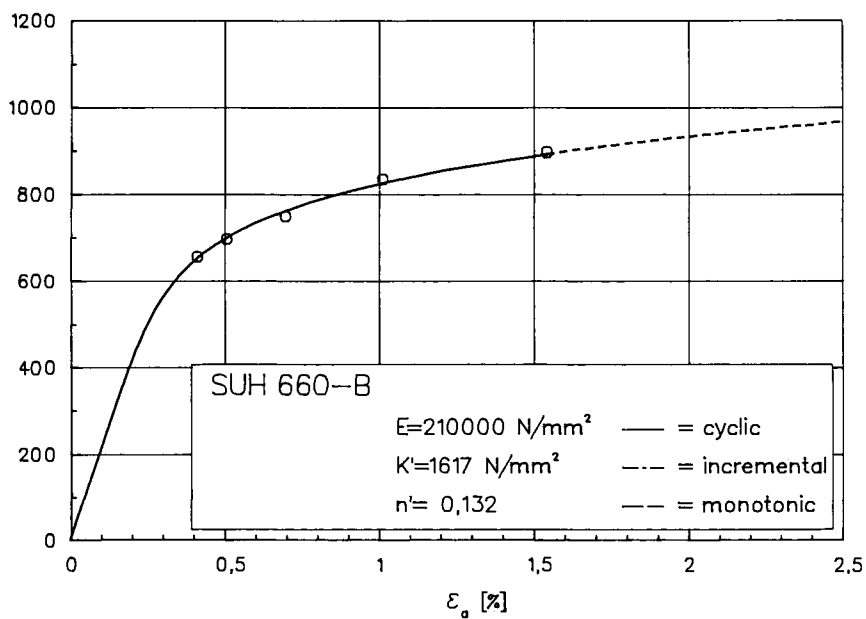
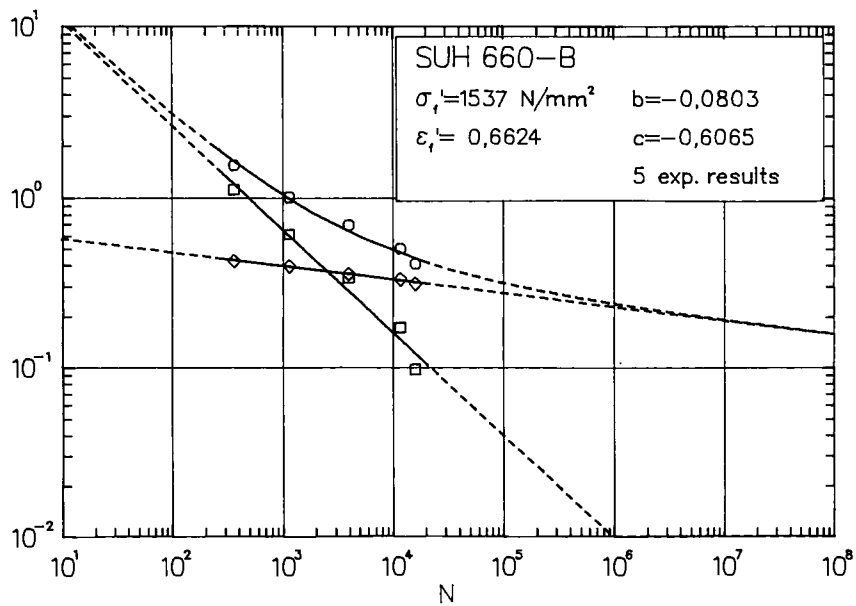
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

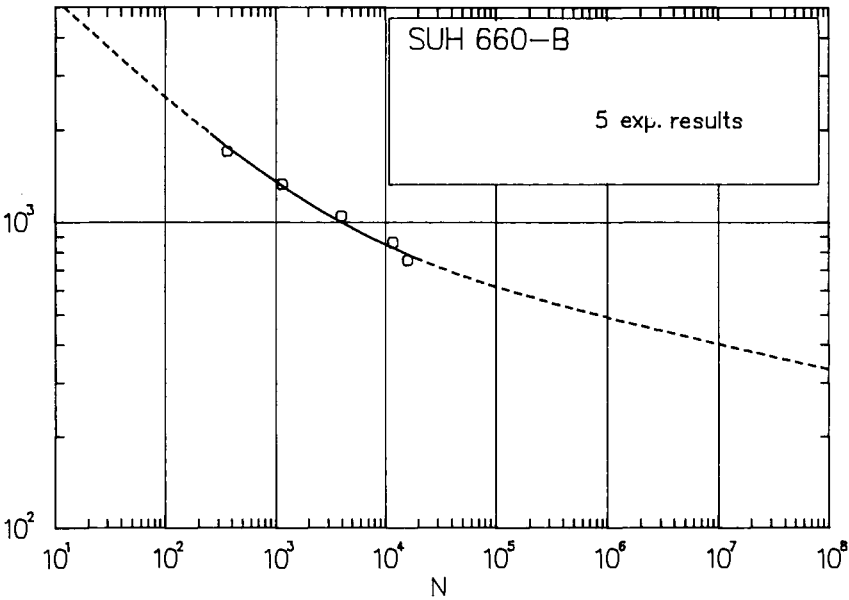
Cyclic test

Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 4.0 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUH 660-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	897.6	0.0	1.5400	363.0
2.0000	834.3	0.0	1.0100	1142.0
3.0000	749.0	0.0	0.6950	3950.0
4.0000	697.0	0.0	0.5050	11655.0
5.0000	655.8	0.0	0.4100	15871.0

X 5 NiCrTi 26 15	1.4890	SUH 660-B
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Heat treatment : 928°C/1h, water, 715°C/16h, air
Test temperature : +450°C
Semifinished material : bar, Ø 22 mm
Reference : [4.8]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Ti	Al
0.032	0.55	1.14	0.020	0.004	24.65	13.91	1.27	2.50	0.26

Monotonic properties

E	=	174950	N/mm ²	ν	=	-
R _{p0.2}	=	711	N/mm ²	K	=	N/mm ²
R _m	=	1011	N/mm ²	n	=	-
A ₅	=	18	%	σ_f	=	N/mm ²
Z	=	49	%	ϵ_f	=	-

Cyclic properties

R _{p0.2}	=	762	N/mm ²	K'	=	1574	N/mm ²
σ_g	=	471	N/mm ²	n'	=	0.117	-
ϵ_g	=	0.273	%	σ'_f	=	1477	N/mm ²
N _T	=	847	cycles	ϵ'_f	=	0.570	-
T _σ	=	1.049	-	b	=	-0.075	-
T _{εp}	=	1.054	-	c	=	-0.642	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

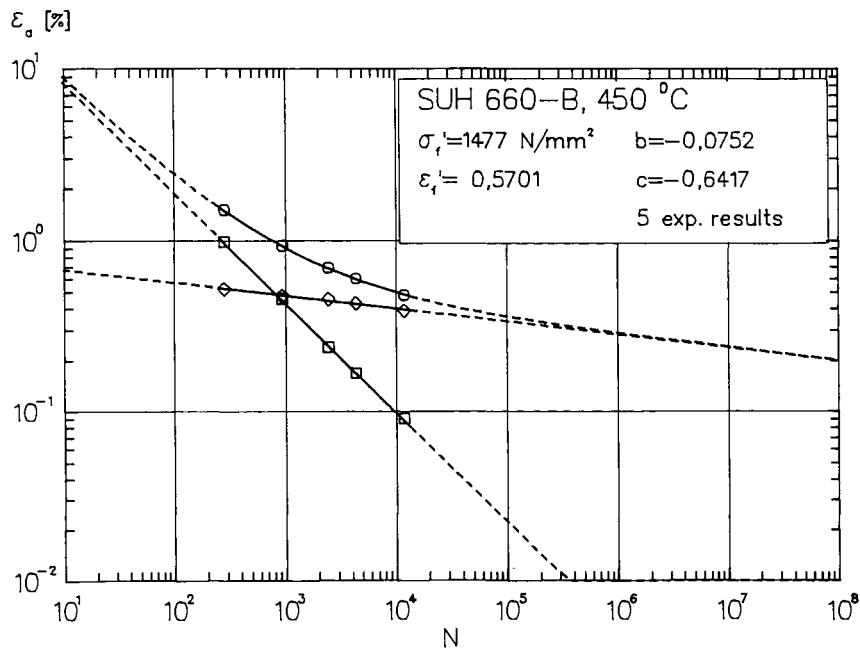
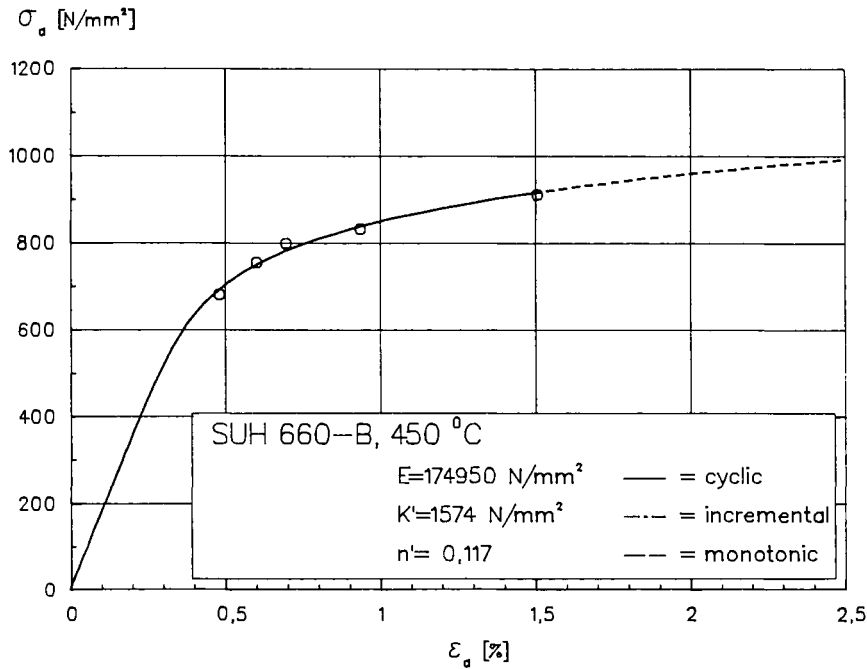
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

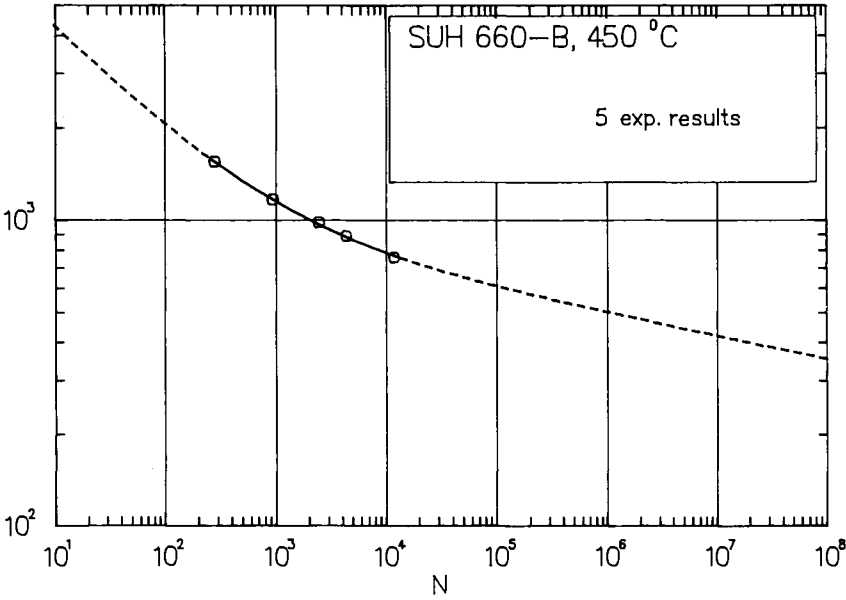
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 39 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUH 660-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	911.3	0.0	1.5050	281.0
2.0000	832.4	0.0	0.9350	936.0
3.0000	798.5	0.0	0.6950	2434.0
4.0000	753.9	0.0	0.6000	4322.0
5.0000	681.3	0.0	0.4800	11773.0

X 5 NiCrTi 26 15	1.4890	SUH 660-B
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Heat treatment : 928°C/1h, water, 715°C/16h, air
Test temperature : +450°C
Semifinished material : bar, Ø 22 mm
Reference : [4.8]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Ti	Al
0.032	0.55	1.14	0.020	0.004	24.65	13.91	1.27	2.50	0.26

Monotonic properties

E	=	174950	N/mm ²	ν	=	-
R _{p0.2}	=	711	N/mm ²	K	=	N/mm ²
R _m	=	1011	N/mm ²	n	=	-
A ₅	=	18	%	σ_f	=	N/mm ²
Z	=	49	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	778	N/mm ²	K'	=	1638	N/mm ²
σ_g	=	454	N/mm ²	n'	=	0.120	-
ϵ_g	=	0.262	%	σ'_f	=	1559	N/mm ²
N _f	=	689	cycles	ϵ'_f	=	0.665	-
T _{σ}	=	1.040	-	b	=	-0.081	-
T _{ϵ_p}	=	1.360	-	c	=	-0.678	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

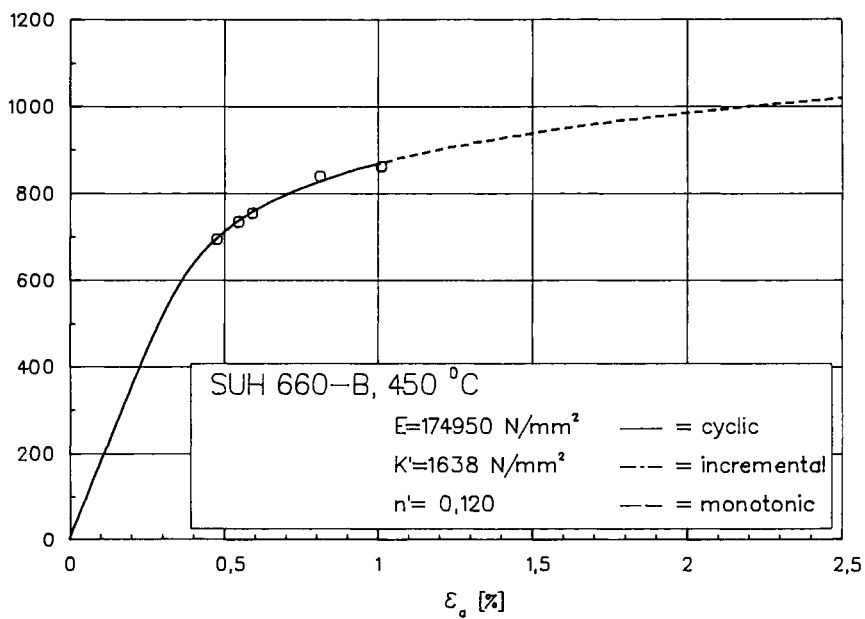
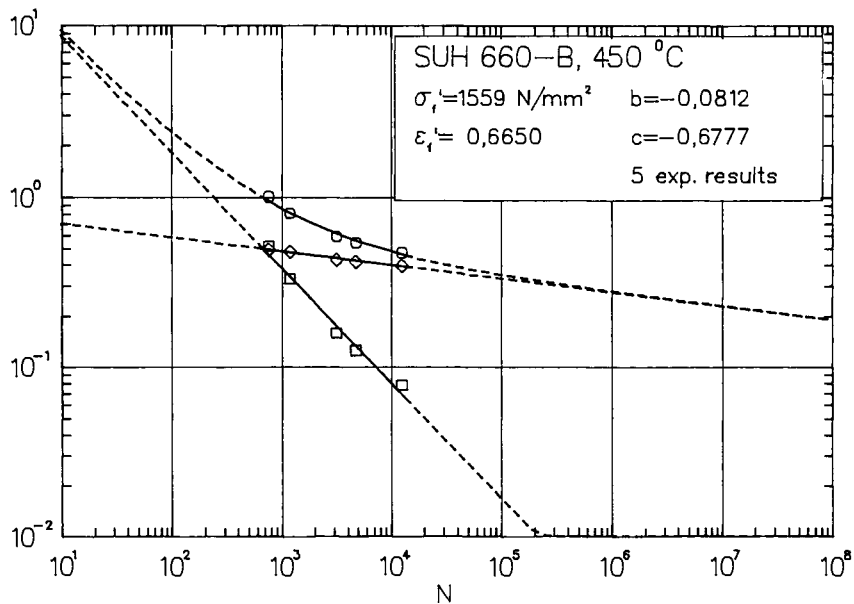
Monotonic test

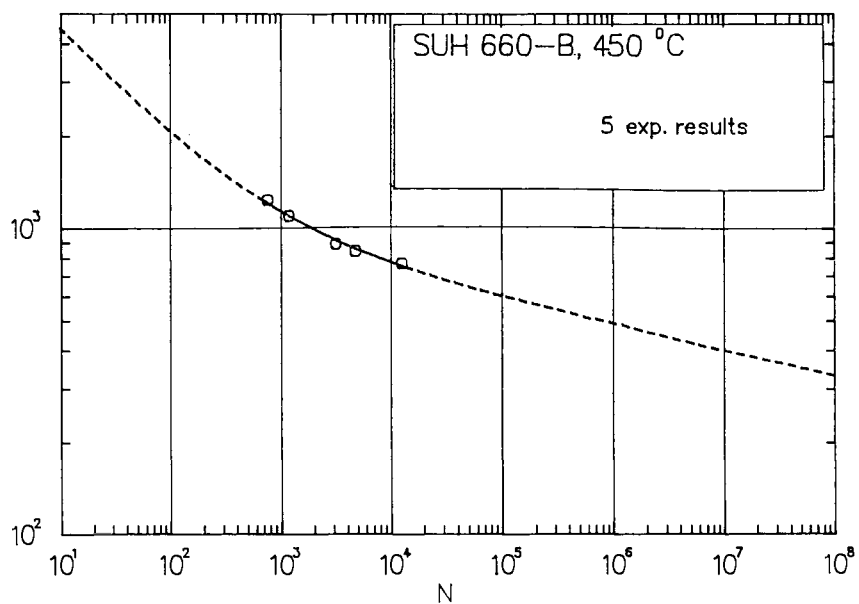
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

Loading condition : total strain control, R_e = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.40 (%/min)
Waveform : triangular

Remarks :

σ_e [N/mm²] ϵ_e [%]

PSWT [N/mm²]

Material : SUH 660-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	862.3	0.0	1.0100	755.0
2.0000	839.7	0.0	0.8100	1184.0
3.0000	754.4	0.0	0.5900	3146.0
4.0000	734.3	0.0	0.5450	4745.0
5.0000	694.5	0.0	0.4750	12481.0

X 5 NiCrTi 26 15	1.4890	SUH 660-B
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Heat treatment : 928°C/1h, water, 715°C/16h, air
 Test temperature : +600°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.8]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Ti	Al
0.032	0.55	1.14	0.020	0.004	24.65	13.91	1.27	2.50	0.26

Monotonic properties

E	=	162800	N/mm ²	ν	=	-
R _{p0.2}	=	713	N/mm ²	K	=	N/mm ²
R _m	=	912	N/mm ²	n	=	-
A ₅	=	22	%	σ_f	=	N/mm ²
Z	=	56	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	626	N/mm ²	K'	=	1842	N/mm ²
σ'_g	=	383	N/mm ²	n'	=	0.174	-
ϵ'_g	=	0.246	%	σ'_f	=	1217	N/mm ²
N _T	=	511	cycles	ϵ'_f	=	0.093	-
T _{σ}	=	1.098	-	b	=	-0.076	-
T _{ep}	=	1.663	-	c	=	-0.440	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

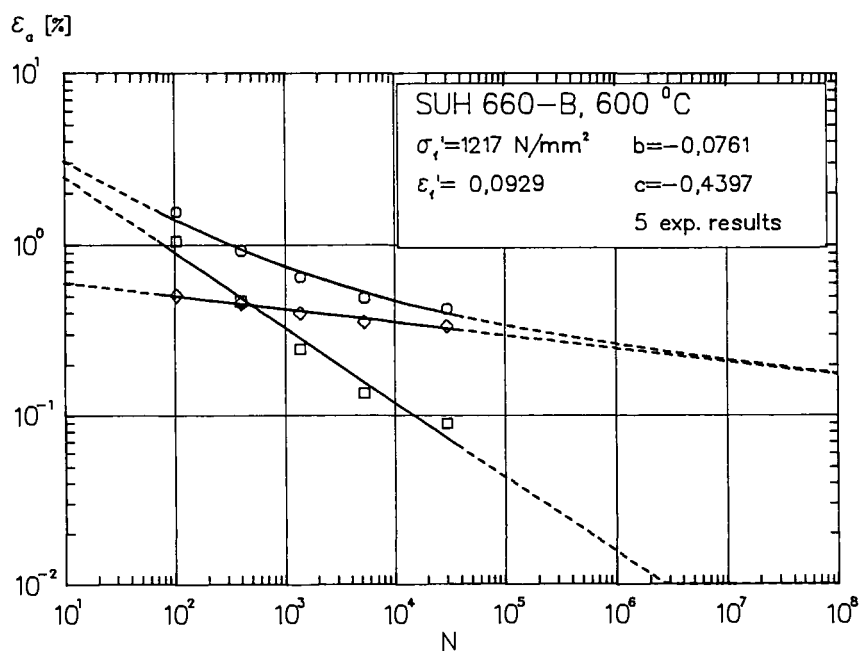
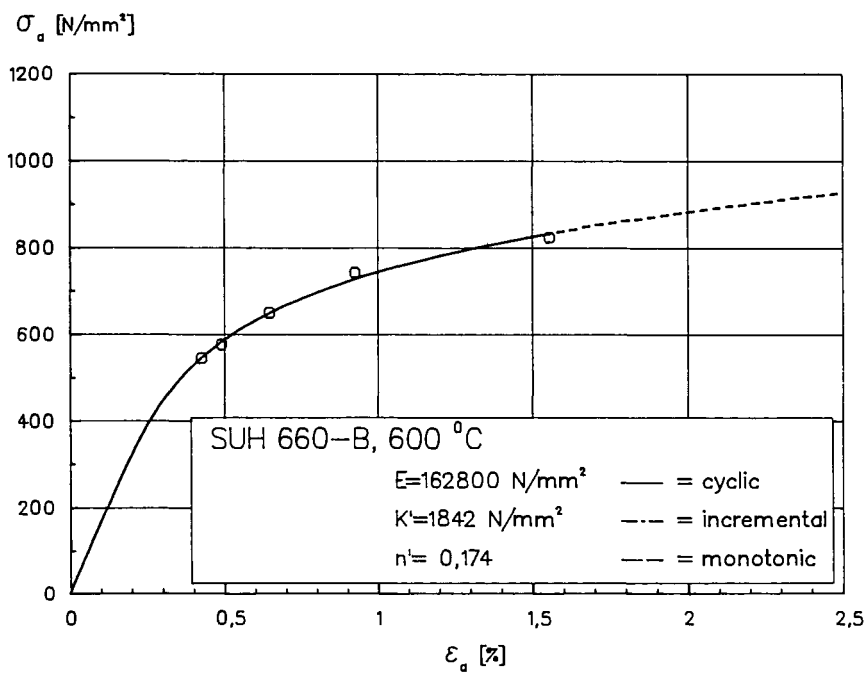
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

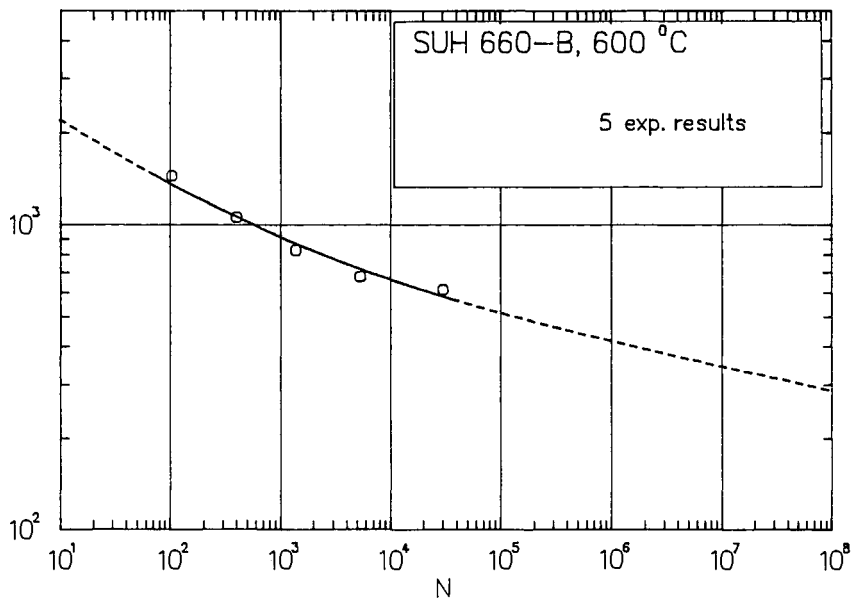
Cyclic test

Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUH 660-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	823.5	0.0	1.5550	103.0
2.0000	742.1	0.0	0.9250	397.0
3.0000	650.4	0.0	0.6450	1367.0
4.0000	577.3	0.0	0.4900	5290.0
5.0000	545.9	0.0	0.4250	29991.0

X 5 NiCrTi 26 15	1.4890	SUH 660-B
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Heat treatment : 928°C/1h, water, 715°C/16h, air
Test temperature : +600°C
Semifinished material : bar, Ø 22 mm
Reference : [4.8]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Ti	Al
0.032	0.55	1.14	0.020	0.004	24.65	13.91	1.27	2.50	0.26

Monotonic properties

E	=	162800	N/mm ²	v	=	-
R _{p0.2}	=	713	N/mm ²	K	=	N/mm ²
R _m	=	912	N/mm ²	n	=	-
A ₅	=	22	%	σ _f	=	N/mm ²
Z	=	56	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	601	N/mm ²	K'	=	3221	N/mm ²
σ _g	=	333	N/mm ²	n'	=	0.270	-
ε _g	=	0.229	%	σ' _f	=	1120	N/mm ²
N _T	=	64	cycles	ε' _f	=	0.019	-
T _σ	=	1.091	-	b	=	-0.080	-
T _{εp}	=	1.472	-	c	=	-0.287	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

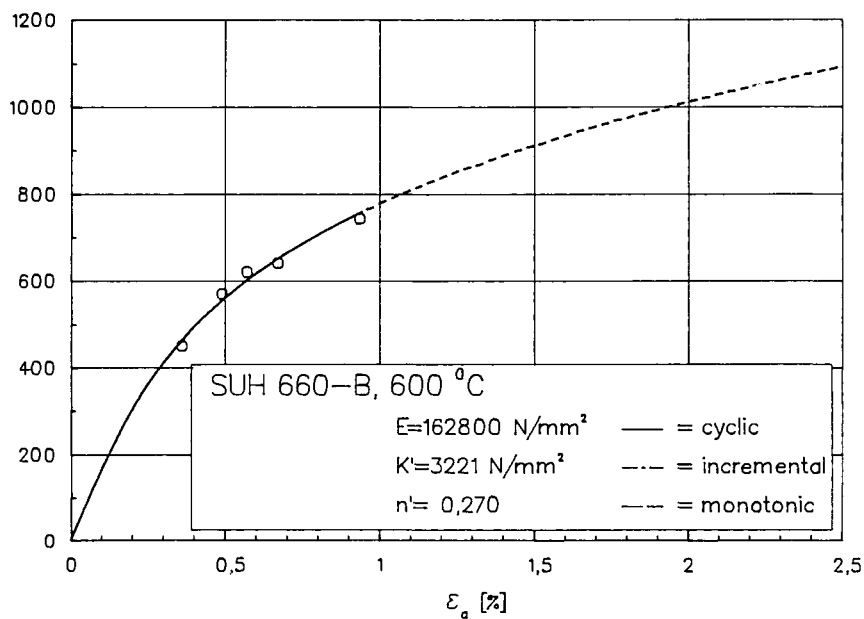
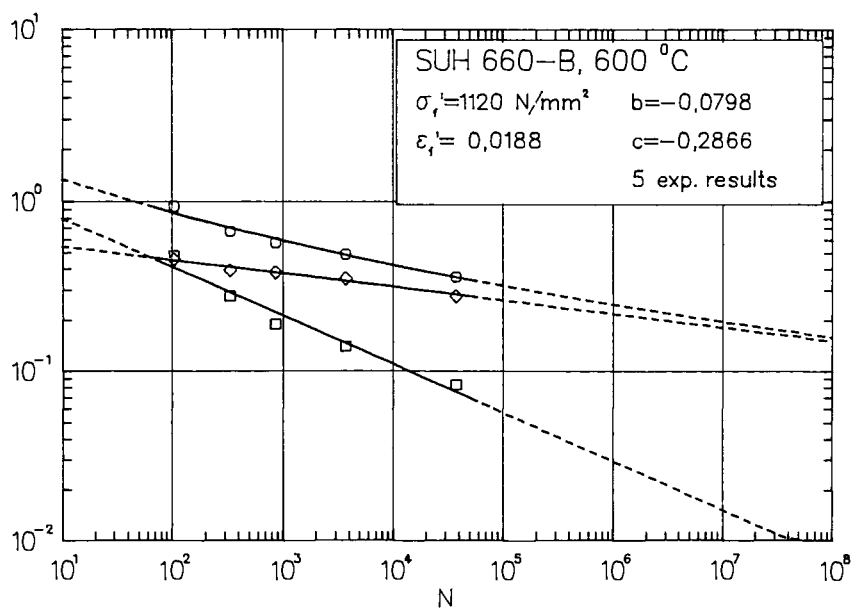
Monotonic test

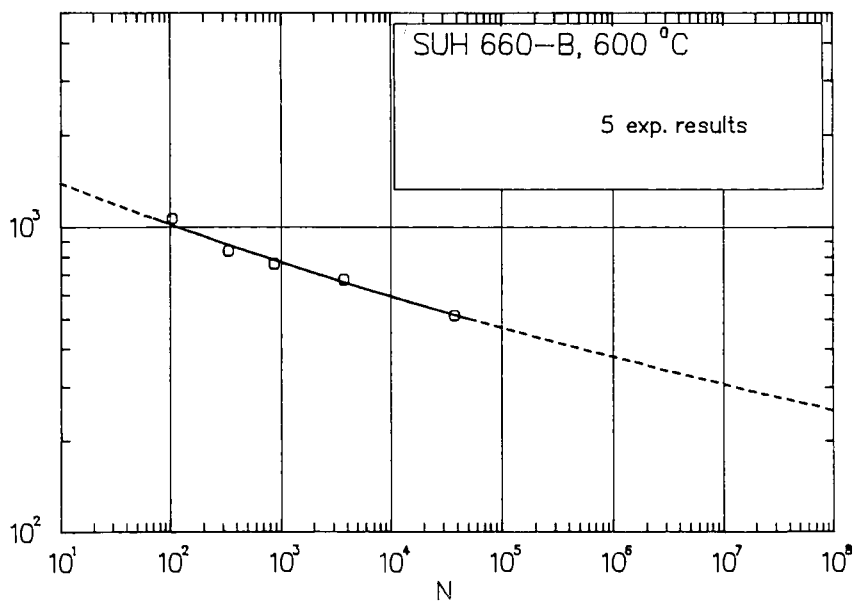
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.39 (%/min)
Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]

Material : SUH 660-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	743.6	0.0	0.9350	104.0
2.0000	641.1	0.0	0.6700	335.0
3.0000	620.5	0.0	0.5700	864.0
4.0000	570.5	0.0	0.4900	3740.0
5.0000	450.8	0.0	0.3600	37581.0

X 5 NiCrTi 26 15	1.4890	SUH 660-B
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Heat treatment : 928°C/1h, water, 715°C/16h, air
 Test temperature : 700°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.8]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Ti	Al
0.032	0.55	1.14	0.020	0.004	24.65	13.91	1.27	2.50	0.26

Monotonic properties

E	=	164650	N/mm ²	ν	=	-
R _{p0.2}	=	595	N/mm ²	K	=	N/mm ²
R _m	=	751	N/mm ²	n	=	-
A ₅	=	34	%	σ_f	=	N/mm ²
Z	=	55	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	463	N/mm ²	K'	=	1691	N/mm ²
σ_g	=	248	N/mm ²	n'	=	0.208	-
ϵ_g	=	0.162	%	σ'_f	=	1049	N/mm ²
N _T	=	1054	cycles	ϵ'_f	=	0.086	-
T _{σ}	=	1.116	-	b	=	-0.095	-
T _{ep}	=	1.943	-	c	=	-0.435	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

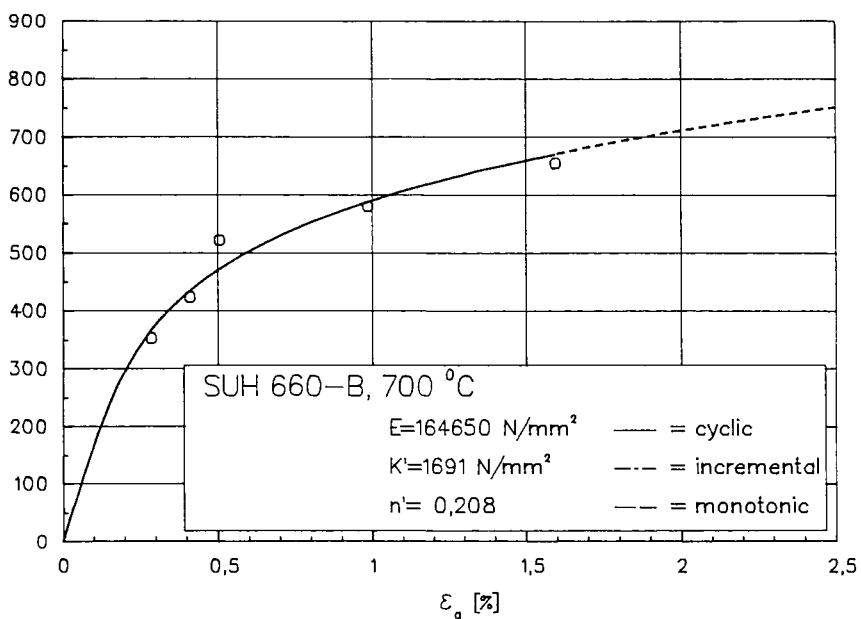
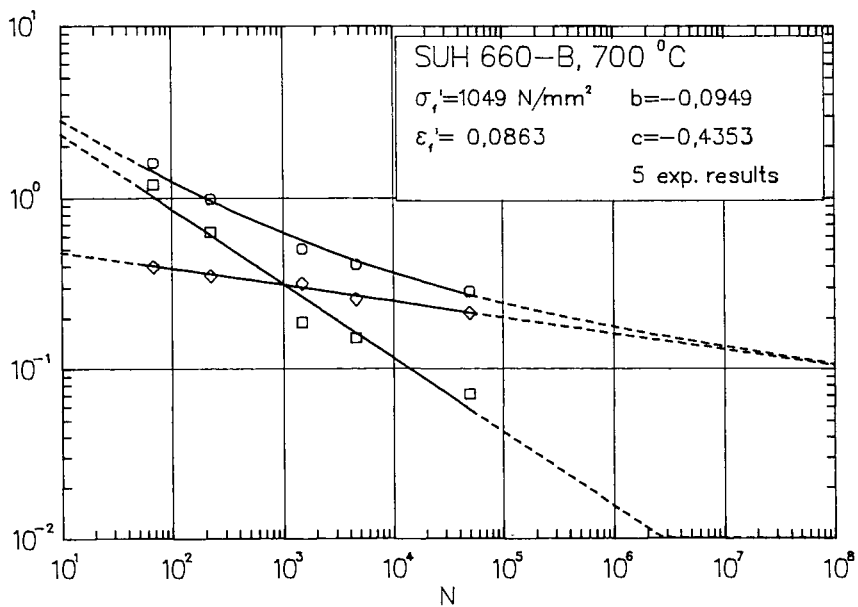
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

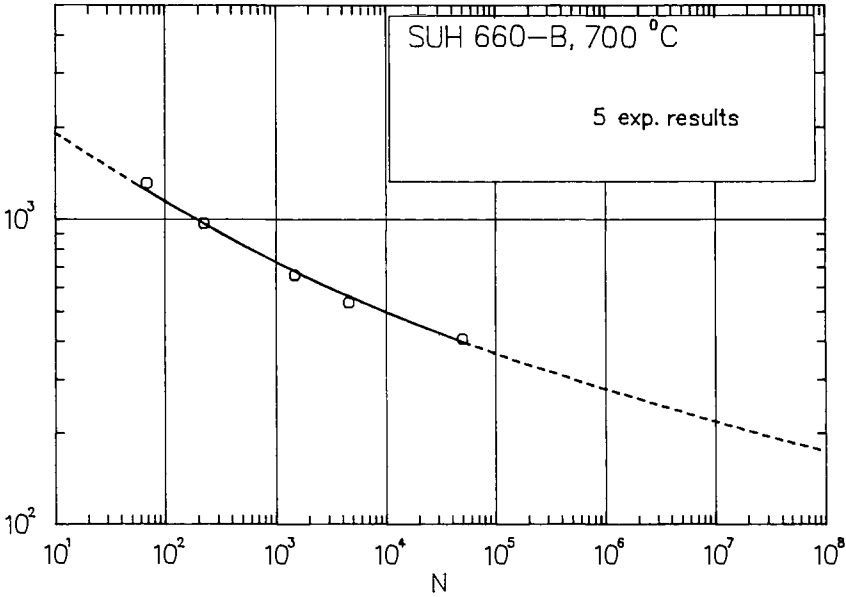
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks

σ_e [N/mm²]

 ϵ_e [%]


PSWT [N/mm²]



Material : SUH 660-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	655.3	0.0	1.5950	68.0
2.0000	580.3	0.0	0.9850	223.0
3.0000	521.4	0.0	0.5050	1475.0
4.0000	423.8	0.0	0.4100	4564.0
5.0000	352.7	0.0	0.2850	49805.0

X 5 NiCrTi 26 15	1.4890	SUH 660-B
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Heat treatment : 928°C/1h, water, 715°C/16h, air
 Test temperature : +700°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4,8]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Ti	Al
0.032	0.55	1.14	0.020	0.004	24.65	13.91	1.27	2.50	0.26

Monotonic properties

E	=	164650	N/mm ²	ν	=	-
R _{p0.2}	=	595	N/mm ²	K	=	N/mm ²
R _m	=	751	N/mm ²	n	=	-
A ₅	=	34	%	σ_f	=	N/mm ²
Z	=	55	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	372	N/mm ²	K'	=	2929	N/mm ²
σ_g	=	171	N/mm ²	n'	=	0.332	-
ϵ_g	=	0.125	%	σ'_f	=	891	N/mm ²
N _T	=	898	cycles	ϵ'_f	=	0.025	-
T _{σ}	=	1.047	-	b	=	-0.108	-
T _{ep}	=	1.572	-	c	=	-0.315	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

Loading condition :

Specimen : cylindrical, Ø 10 mm

Specimen location : in rolling direction

Gauge length : 50 mm

Testing machine :

Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

Loading condition : total strain control, R _{ϵ} = -1

Specimen : cylindrical, Ø 6 mm

Surface : mechanically polished

Specimen location : in rolling direction

Gauge length : 15 mm

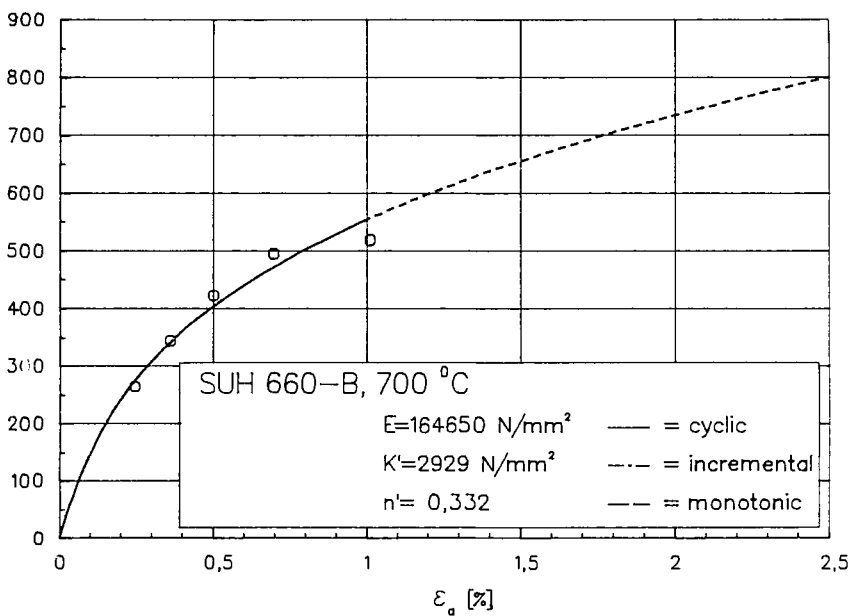
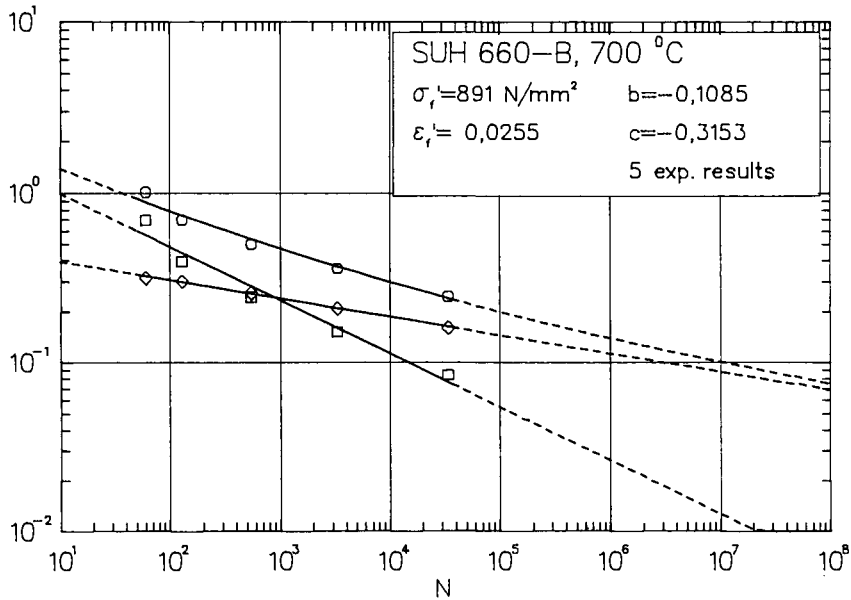
Testing machine : servohydraulic, max. 50 kN

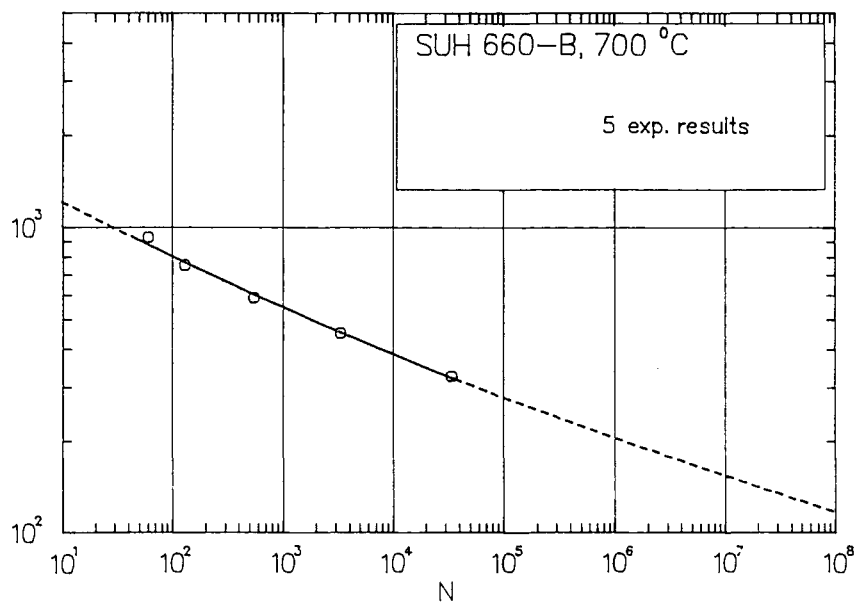
Frequency :

Strain rate : 0.40 (%/min)

Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]

Material : SUH 660-B, 700 °C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	518.5	0.0	1.0100	60.0
2.0000	494.9	0.0	0.6950	129.0
3.0000	422.8	0.0	0.5000	545.0
4.0000	343.8	0.0	0.3600	3314.0
5.0000	264.4	0.0	0.2450	33931.0

X 6 NiCr 32 20	Incoloy 800H
----------------	--------------

Heat treatment : solution treated, 1066°C, 1149°C, 1177°C, water
 Test temperature : +22°C
 Semifinished material :
 Reference : [4.18]
 Year : 1981

Hardness :

Chemical composition

Microstructure :

C	Ni	Mn	Cr	Ti	Al
0.05	32.17	0.67	19.83	0.43	0.39

Monotonic properties

E	=	210000	N/mm ²	v	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A _g	=		%	σ _f	=	N/mm ²
Z	=		%	ε _f	=	-

Monotonic test

Loading condition :
 Specimen :
 Specimen location :
 Gauge length :
 Testing machine :
 Strain rate :

Cyclic properties

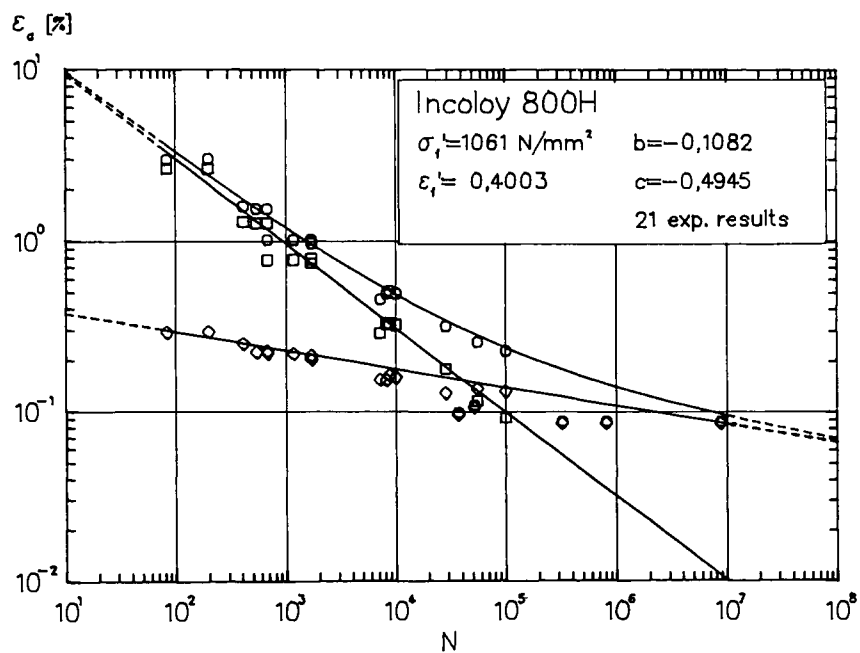
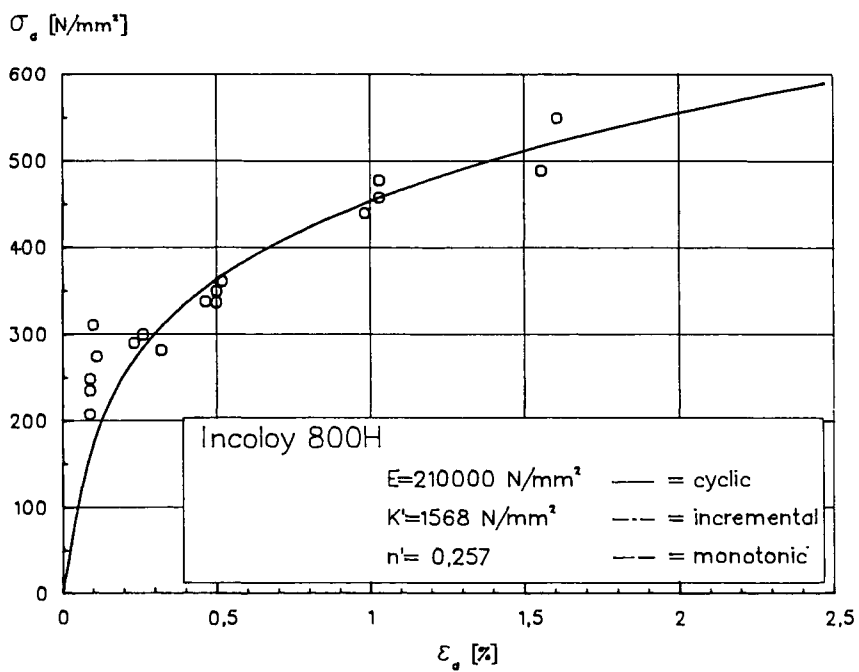
R _{p0.2}	=	318	N/mm ²	K'	=	1568	N/mm ²
σ _g	=	205	N/mm ²	n'	=	0.257	-
ε _g	=	0.119	%	σ' _f	=	1061	N/mm ²
N _T	=	41199	cycles	ε' _f	=	0.400	-
T _σ	=	1.226	-	b	=	-0.108	-
T _{εp}	=	1.490	-	c	=	-0.494	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Cyclic test

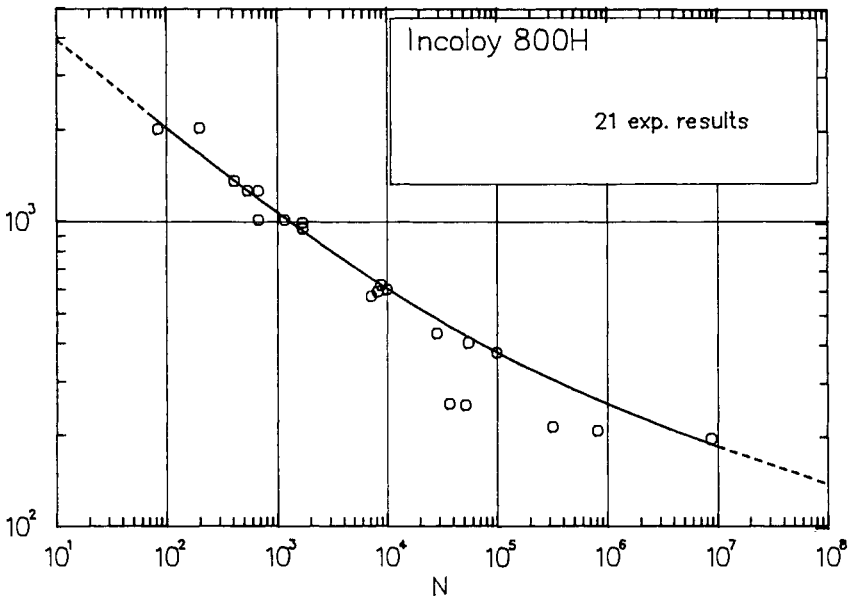
Loading condition : total strain control¹⁾, R_e = -1
 Specimen : hourglass shaped, Ø 6.4 mm
 Surface :
 Specimen location :
 Gauge length :
 Testing machine : MTS, electrohydraulic
 Frequency : max. 40 Hz
 Strain rate : 24 (%/min) for low cycle fatigue tests
 Waveform : sinusoidal

Failure criterion :
 σ/ε-values valid for : half failure life
 Remarks :

Remarks : 1) tests beyond 5·10³ cycles were done in load control



PSWT [N/mm²]



Material : Incoloy 800H

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	637.1	0.0	3.0000	83.0
2.0000	642.9	0.0	3.0290	198.0
3.0000	550.0	0.0	1.6070	409.0
4.0000	489.0	0.0	1.5540	539.0
5.0000	489.0	0.0	1.5540	674.0
6.0000	478.0	0.0	1.0290	674.0
7.0000	478.0	0.0	1.0290	1171.0
8.0000	458.0	0.0	1.0290	1692.0
9.0000	440.0	0.0	0.9820	1692.0
10.0000	338.1	0.0	0.4640	7197.0
11.0000	337.1	0.0	0.5000	8209.0
12.0000	361.0	0.0	0.5180	8767.0
13.0000	349.5	0.0	0.5000	10000.0
14.0000	282.0	0.0	0.3210	28651.0
15.0000	310.3	0.0	0.1000	37276.0
16.0000	274.4	0.0	0.1110	51795.0
17.0000	300.0	0.0	0.2610	55317.0
18.0000	290.0	0.0	0.2320	100000.0
19.0000	247.9	0.0	0.0890	322531.0
20.0000	234.9	0.0	0.0890	810161.0
21.0000	207.2	0.0	0.0890	8767124.0

X 6 NiCr 32 20	Incoloy 800H
----------------	--------------

Heat treatment : solution treated, 1066°C, 1149°C, 1177°C, water
 Test temperature : +538°C
 Semifinished material :
 Reference : [4.18]
 Year : 1981

Hardness :

Chemical composition

Microstructure :

C Ni Mn Cr Ti Al
 0.05 32.17 0.67 19.83 0.43 0.39

Monotonic properties

E = 193000 N/mm² v = -
 $R_{p0.2}$ = N/mm² K = N/mm²
 R_m = N/mm² n = -
 A_5 = % σ_f = N/mm²
 Z = % ϵ_f = -

Monotonic test

Loading condition :
 Specimen :
 Specimen location :
 Gauge length :
 Testing machine :
 Strain rate :

Cyclic properties

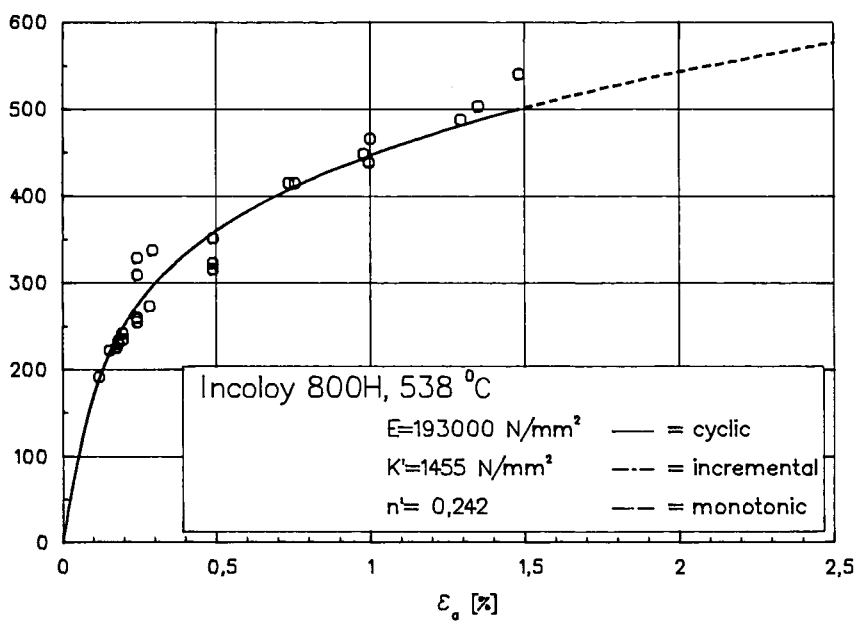
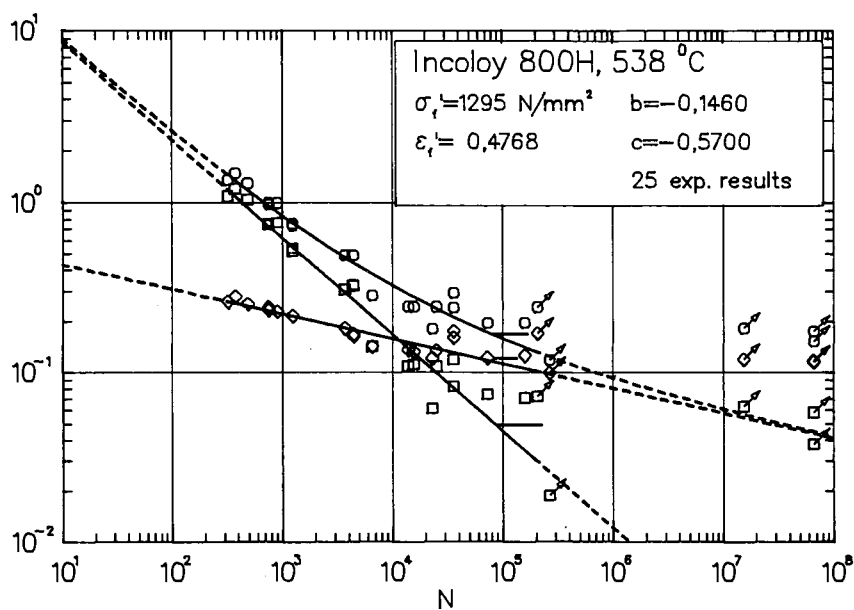
$R'_{p0.2}$ = 323 N/mm² K' = 1455 N/mm²
 σ'_g = 141 N/mm² n' = 0.242 -
 ϵ_g = 0.081 % σ'_f = 1295 N/mm²
 N_T = 2184532 cycles ϵ'_f = 0.4768 -
 T_σ = 1.403 - b = -0.146 -
 $T_{\epsilon p}$ = 2.646 - c = -0.570 -
 Incremental step test : K' = N/mm²
 n' = -

Cyclic test

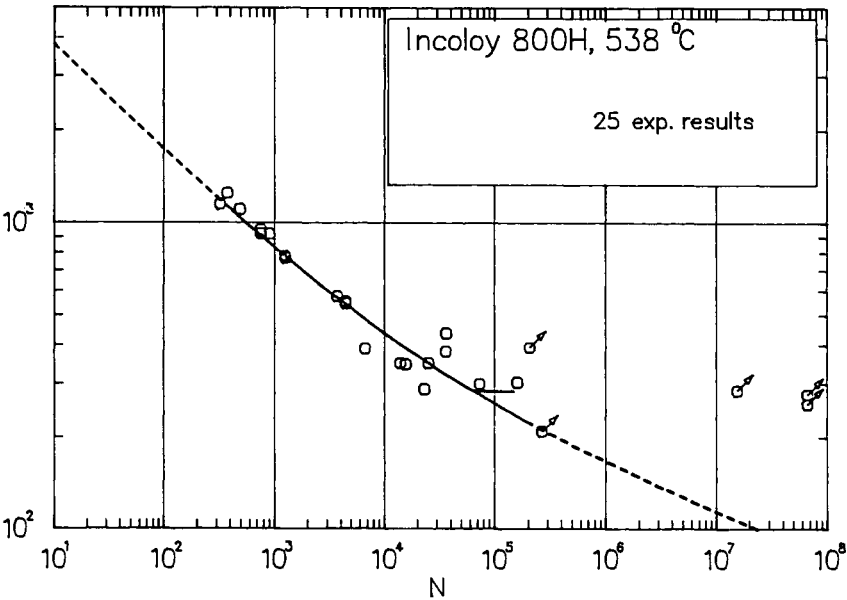
Loading condition : total strain control¹⁾, $R_g = -1$
 Specimen : hourglass shaped, Ø 6.4 mm
 Surface :
 Specimen location :
 Gauge length :
 Testing machine : MTS, electrohydraulic
 Frequency : max. 40 Hz
 Strain rate : 24 (%/min) for low cycle fatigue tests
 Waveform : sinusoidal

Failure criterion :
 σ/ϵ -values valid for : half failure life
 Remarks :

Remarks : 1) tests beyond $4 \cdot 10^5$ cycles were done in load control

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : Incoloy 800H, 538°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
2.0000	503.4	0.0	1.3510	321.0
1.0000	540.5	0.0	1.4820	376.0
3.0000	487.8	0.0	1.2940	487.0
4.0000	465.9	0.0	1.0000	750.0
5.0000	448.3	0.0	0.9780	750.0
6.0000	439.0	0.0	0.9960	904.0
7.0000	414.6	0.0	0.7550	1241.0
8.0000	414.6	0.0	0.7350	1241.0
9.0000	351.4	0.0	0.4900	3705.0
10.0000	323.3	0.0	0.4900	4403.0
10.0000	315.2	0.0	0.4900	4403.0
11.0000	274.0	0.0	0.2840	6588.0
12.0000	260.0	0.0	0.2430	13924.0
13.0000	255.0	0.0	0.2430	15623.0
14.0000	233.5	0.0	0.1820	23041.0
15.0000	259.5	0.0	0.2430	25119.0
16.0000	338.1	0.0	0.2940	35996.0
17.0000	309.5	0.0	0.2430	35996.0
18.0000	235.0	0.0	0.1960	72862.0
19.0000	242.0	0.0	0.1960	158489.0
21.0000	191.5	0.0	0.1180	> 266073.0
22.0000	230.0	0.0	0.1820	>15399265.0
23.0000	225.5	0.0	0.1750	>65564184.0

continued

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
24.0000	222.5	0.0	0.1530	>65564184.0
20.0000	329.0	0.0	0.2430	> 205353.0

X 6 NiCr 32 20	Incoloy 800H
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Heat treatment : solution treated, 1066°C, 1149°C, 1177°C, water
 Test temperature : +593°C
 Semifinished material :
 Reference : [4.18]
 Year : 1981

Hardness :

Chemical composition

C	Ni	Mn	Cr	Ti	Al
0.05	32.17	0.67	19.83	0.43	0.39

Microstructure :

Monotonic properties

E	=	171000	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=	%		σ_f	=	N/mm ²
Z	=	%		ϵ_f	=	-

Monotonic test

Loading condition :
 Specimen :
 Specimen location :
 Gauge length :
 Testing machine :
 Strain rate :

Cyclic properties

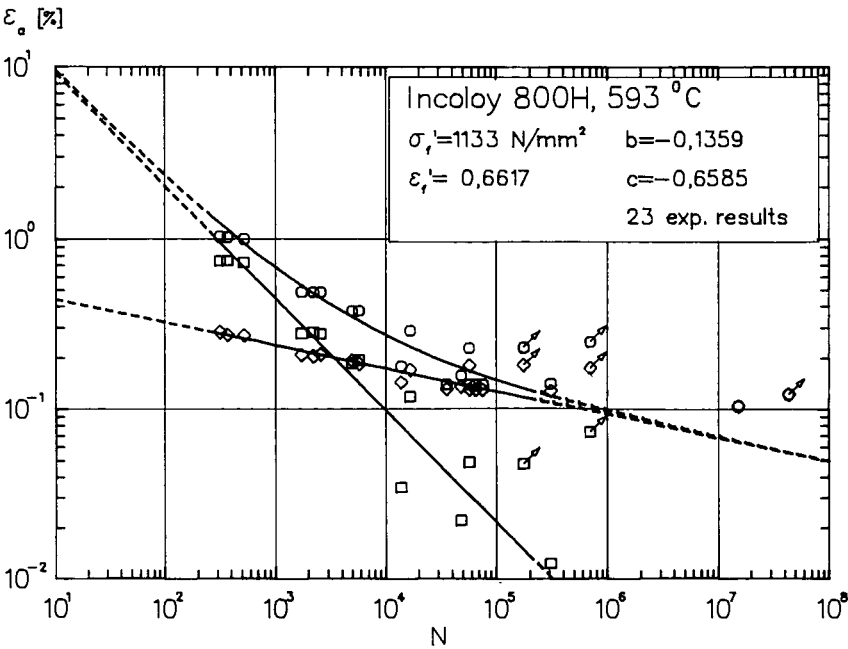
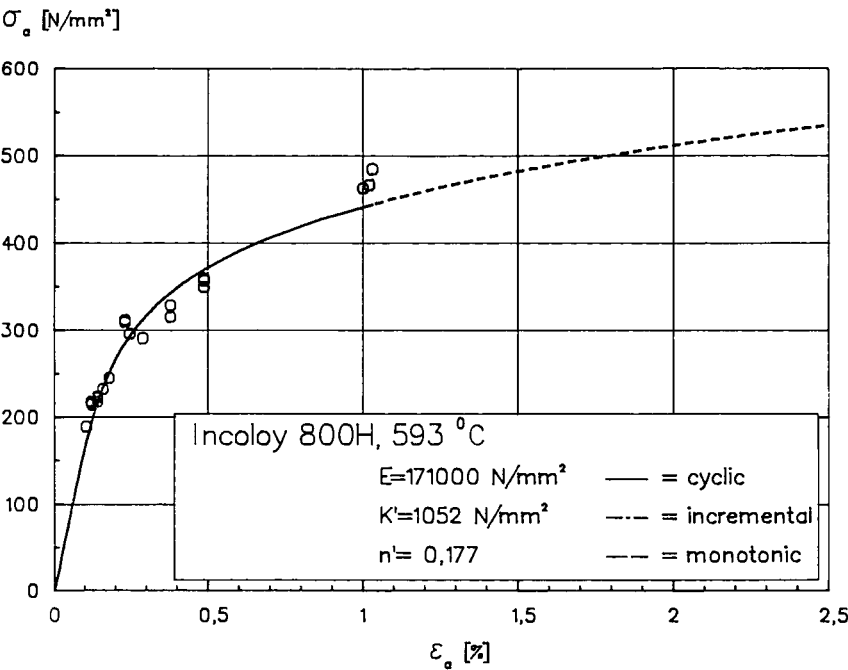
R' _{p0.2}	=	351	N/mm ²	K'	=	1052	N/mm ²
σ_g	=	144	N/mm ²	n'	=	0.177	-
ϵ_g	=	0.087	%	σ'_f	=	1133	N/mm ²
N _T	=	3347	cycles	ϵ'_f	=	0.6617	-
T _{σ}	=	1.279	-	b	=	-0.136	-
T _{ϵ_p}	=	2.848	-	c	=	-0.658	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

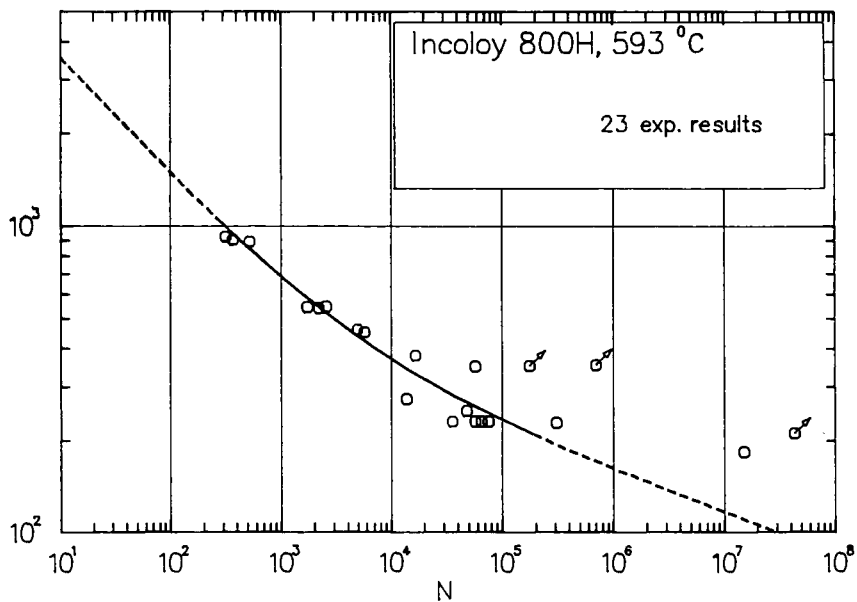
Cyclic test

Loading condition : total strain control¹⁾, R_e = -1
 Specimen : hourglass shaped, Ø 6.4 mm
 Surface :
 Specimen location :
 Gauge length :
 Testing machine : MTS, electrohydraulic
 Frequency : max. 40 Hz
 Strain rate : 24 (%/min) for low cycle fatigue tests
 Waveform : sinusoidal

Failure criterion :
 σ/ϵ -values valid for : half failure life
 Remarks :

Remarks : 1) tests beyond 4·10⁵ cycles were done in load control



PSWT [N/mm²]

Material : Incoloy 800H, 593°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	484.8	0.0	1.0300	316.0
2.0000	466.7	0.0	1.0200	370.0
3.0000	462.9	0.0	1.0000	523.0
4.0000	356.7	0.0	0.4860	1728.0
5.0000	349.5	0.0	0.4860	2207.0
6.0000	359.0	0.0	0.4860	2548.0
7.0000	328.6	0.0	0.3780	4940.0
8.0000	315.2	0.0	0.3780	5705.0
9.0000	245.2	0.0	0.1780	13725.0
10.0000	291.0	0.0	0.2880	16548.0
11.0000	223.8	0.0	0.1400	35481.0
12.0000	232.4	0.0	0.1580	48001.0
13.0000	309.5	0.0	0.2300	57049.0
14.0000	222.9	0.0	0.1400	57049.0
15.0000	222.9	0.0	0.1400	64938.0
16.0000	222.9	0.0	0.1400	74989.0
18.0000	218.1	0.0	0.1400	307256.0
20.0000	189.1	0.0	0.1040	15179239.0
22.0000	222.9	0.0	0.1400	>*****
23.0000	218.1	0.0	0.1200	>*****
19.0000	296.2	0.0	0.2460	> 697831.0
17.0000	311.9	0.0	0.2300	> 175287.0
21.0000	214.8	0.0	0.1220	>43401028.0

X7 NiCrCo 56 19	Waspaloy A
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Heat treatment : 1080°C/4h, air, 843°C/2-4h, furnace, 760°C/16h, furnace Hardness : HRC: 22
Test temperature : +23°C
Semifinished material : turbine wheel forgings
Reference : [4.13]
Year : 1965

Chemical composition

C	Si	Mn	Fe	Al	Ti	Mo	Co	Cr	Ni
0.07	0.4	0.7	1.0	1.3	3.0	4.3	14.0	19.0	56.0

Microstructure :

Monotonic properties

E	=	210000	N/mm ²	v	=	-
R _{p0.2}	=	545	N/mm ²	K	=	713 N/mm ²
R _m	=		N/mm ²	n	=	0.043
A ₅	=		%	σ _f	=	N/mm ²
Z	=		%	ε _f	=	-

Monotonic test

Loading condition :
Specimen : tubular, outer Ø 9.5 mm, inner Ø 8.0 mm
Specimen location :
Gauge length : 25.4 mm
Testing machine :
Strain rate :

Cyclic properties

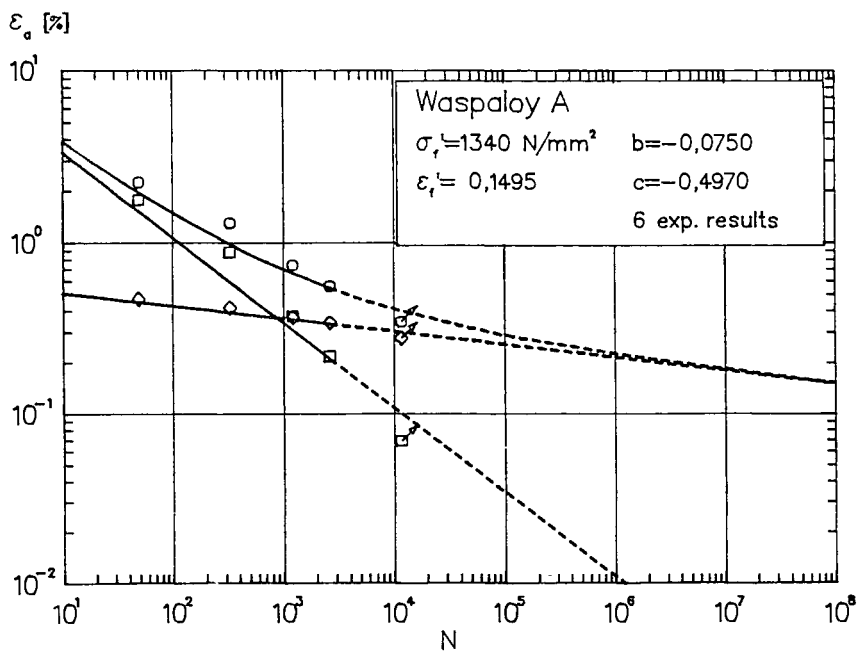
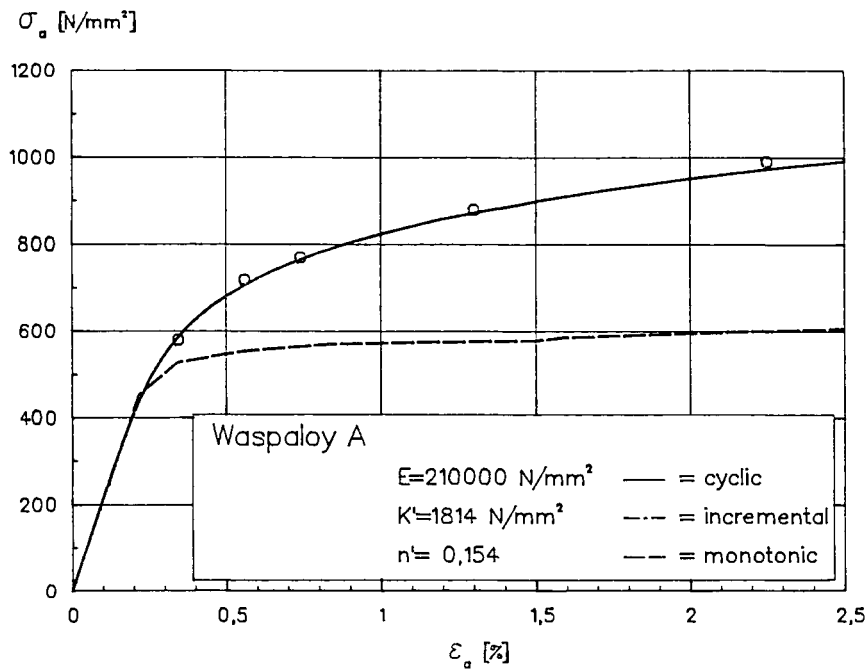
R' _{p0.2}	=	696	N/mm ²	K'	=	1814 N/mm ²
σ _g	=	428.5	N/mm ²	n'	=	0.154
ε _g	=	0.212	%	σ' _f	=	1340 N/mm ²
N _T	=	13128	cycles	ε' _f	=	0.1495
T _σ	=	1.168	-	b	=	-0.075
T _{εp}	=	2.483	-	c	=	-0.497
Incremental step test :				K'	=	N/mm ²
				n'	=	-

Cyclic test

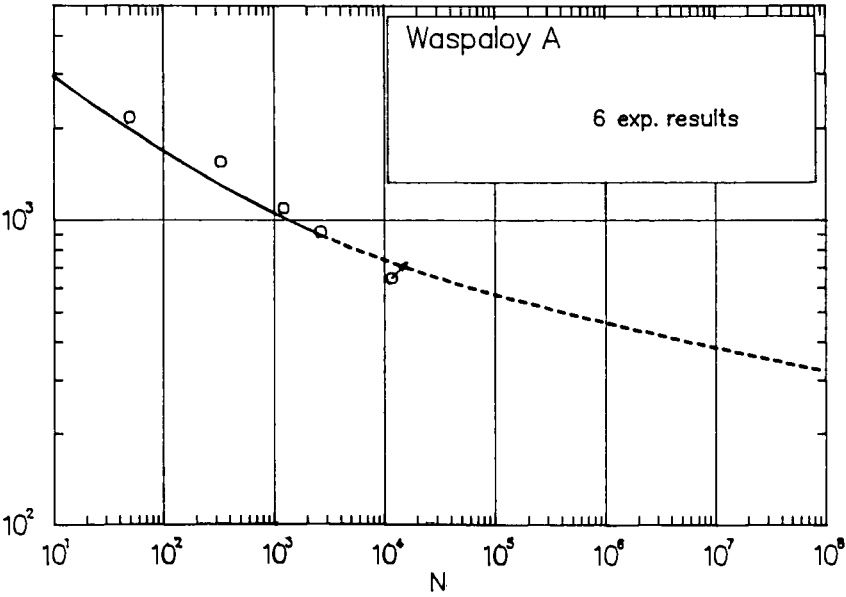
Loading condition : total strain control, R_ε = -1
Specimen : tubular, outer Ø 9.5 mm, inner Ø 8.0 mm
Surface :
Specimen location :
Gauge length : 24.4 mm¹⁾
Testing machine : Instron, max. 45 kN
Frequency :
Strain rate :
Waveform : triangular

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks :

Remarks : 1) extensometer clamped to the shoulders of the specimen



PSWT [N/mm²]



Material : Waspaloy A

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	1001.2	0.0	3.0000	8.5
2.0000	990.9	0.0	2.2500	49.0
3.0000	880.4	0.0	1.3000	330.0
4.0000	769.9	0.0	0.7400	1220.0
5.0000	718.1	0.0	0.5600	2625.0
6.0000	580.0	0.0	0.3450	11590.0

X7 NiCrCo 56 19		Waspaloy A
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Heat treatment : 1080°C/4h, air, 843°C/2-4h, furnace, 760°C/16h, furnace Hardness : HRC: 35
 Test temperature : +23°C
 Semifinished material : turbine wheel forgings
 Reference : [4.13]
 Year : 1965

Chemical composition

C	Si	Mn	Fe	Al	Ti	Mo	Co	Cr	Ni
0.07	0.4	0.7	1.0	1.3	3.0	4.3	14.0	19.0	56.0

Microstructure :

Monotonic properties

E	=	210000	N/mm ²	v	=	-
R _{p0.2}	=	787	N/mm ²	K	=	713 N/mm ²
R _m	=	1091	N/mm ²	n	=	0.043 -
A ₅	=	7	%	σ _f	=	N/mm ²
Z	=		%	ε _f	=	-

Monotonic test

Loading condition :
 Specimen : tubular, outer Ø 9.5 mm, inner Ø 8.0 mm
 Specimen location :
 Gauge length : 25.4 mm
 Testing machine :
 Strain rate :

Cyclic properties

R _{p0.2}	=	869	N/mm ²	K'	=	1931 N/mm ²
σ _E	=	476	N/mm ²	n'	=	0.128 -
ε _E	=	0.229	%	σ' _f	=	1510 N/mm ²
N _r	=	1175	cycles	ε' _f	=	0.147 -
T _σ	=	1.018	-	b	=	-0.076 -
T _{εp}	=	1.203	-	c	=	-0.591 -
Incremental step test :				K'	=	N/mm ²
				n'	=	-

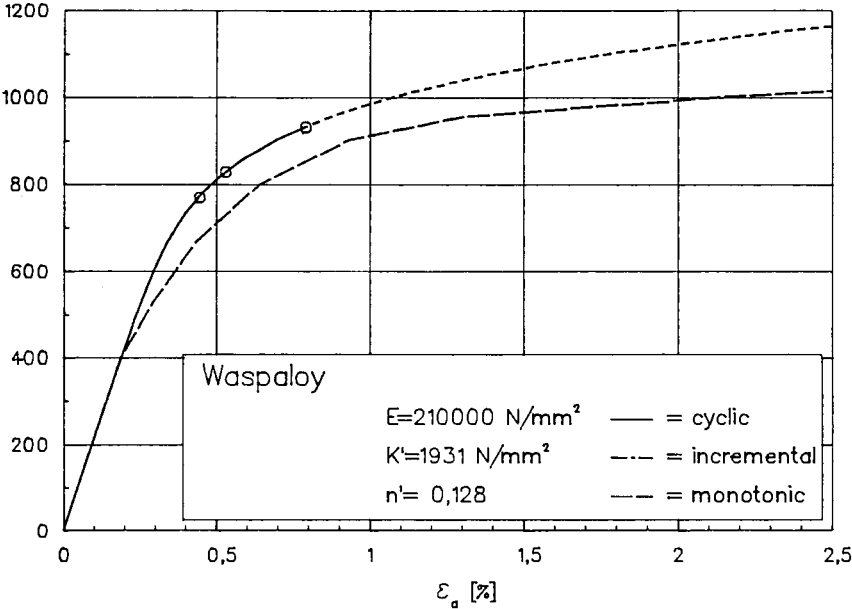
Cyclic test

Loading condition : total strain control, R_e = -1
 Specimen : tubular, outer Ø 9.5 mm, inner Ø 8.0 mm
 Surface :
 Specimen location :
 Gauge length : 24.4 mm¹⁾
 Testing machine : Instron, max. 45 kN
 Frequency :
 Strain rate :
 Waveform : triangular

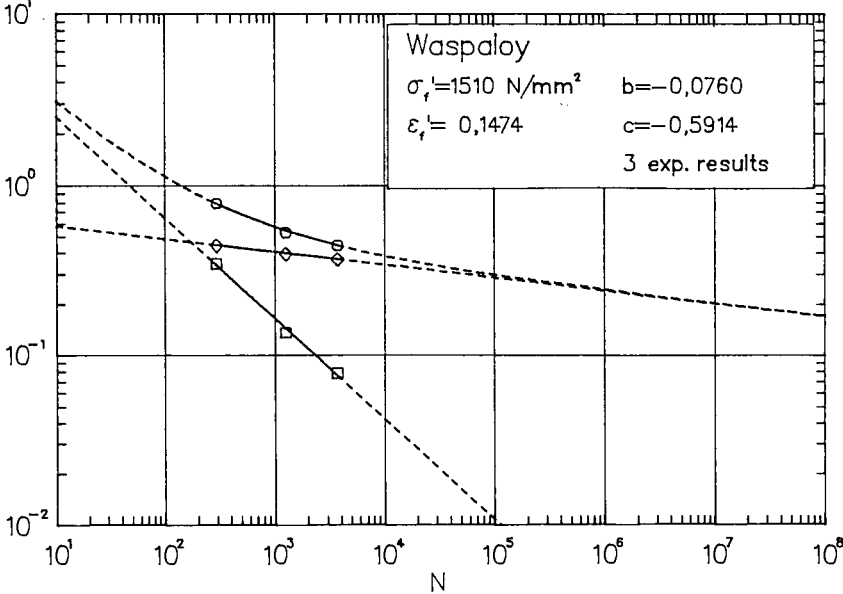
Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks :

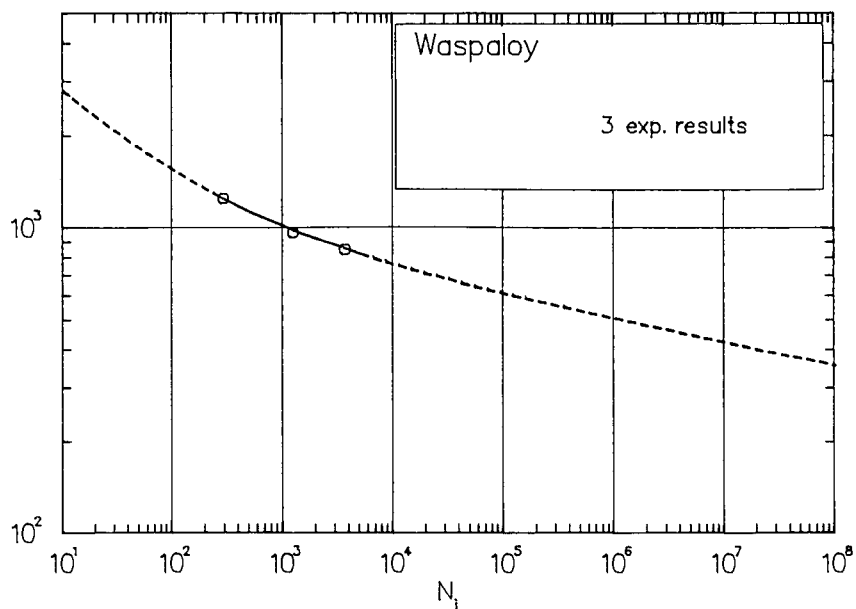
Remarks : 1) extensometer clamped to the shoulders of the specimen

σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]

Material : Waspaloy

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	932.2	0.0	0.7900	296.0
2.0000	828.6	0.0	0.5300	1260.0
3.0000	769.9	0.0	0.4450	3710.0

X7 NiCrCo 56 19		Waspaloy
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Heat treatment : 1000°C/4h, oil, 840°C/2-4h, air, 760°C/16h, air
Test temperature : +23°C
Semifinished material : turbine wheel forgings
Reference : [4.13]
Year : 1965

Hardness : HRC: 36

Chemical composition

Microstructure :

C	Si	Mn	Fe	Al	Ti	Mo	Co	Cr	Ni
0.07	0.4	0.7	1.0	1.3	3.0	4.3	14.0	19.0	56.0

Monotonic properties

Monotonic test

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	815	N/mm ²	K	=	1436 N/mm ²
R _m	=		N/mm ²	n	=	0.090
A ₅	=		%	σ_f	=	N/mm ²
Z	=		%	ϵ_f	=	-

Loading condition :
Specimen : tubular, outer $\varnothing$ 9.5 mm, inner $\varnothing$ 8.0 mm
Specimen location :
Gauge length : 25.4 mm
Testing machine :
Strain rate :

Cyclic properties

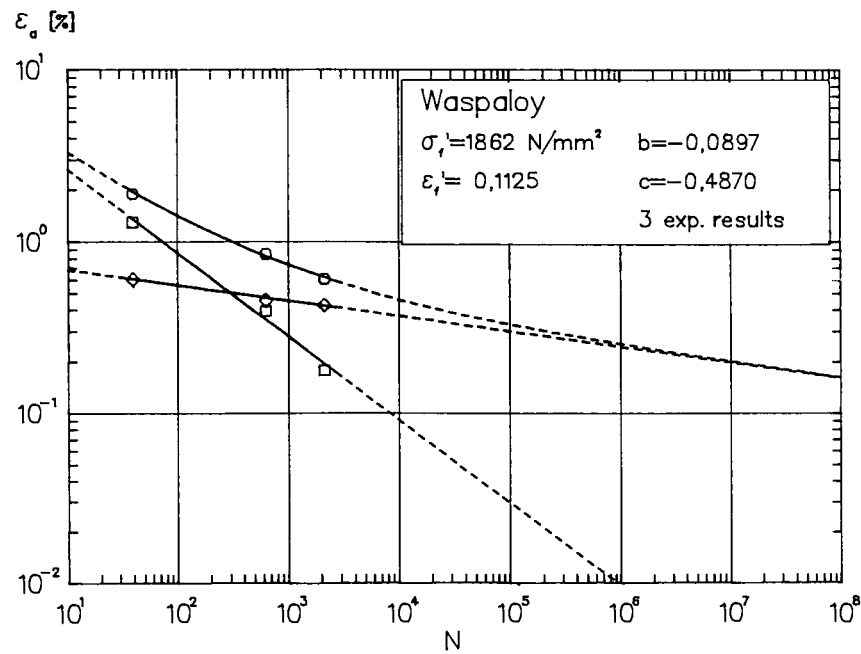
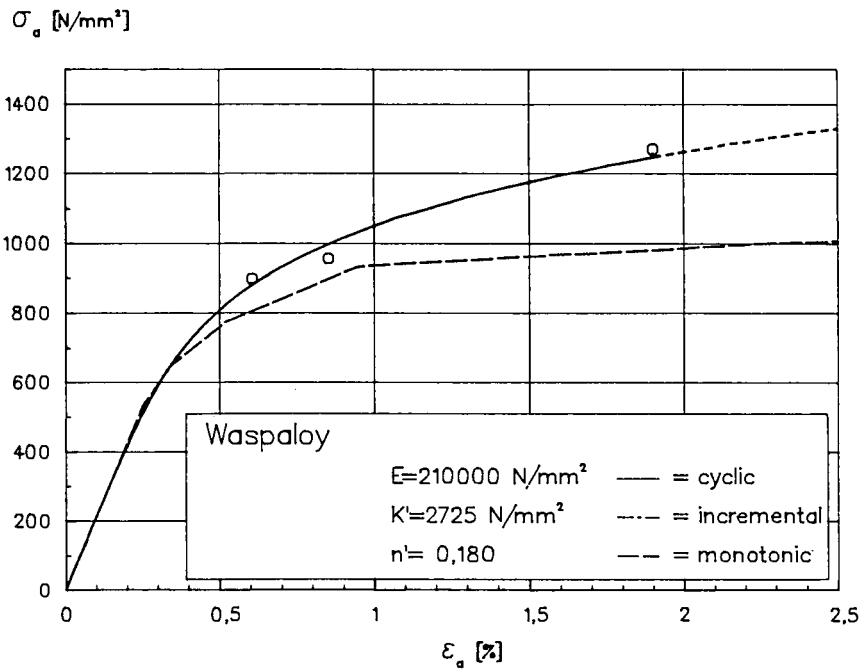
Cyclic test

R' _{p0.2}	=	890	N/mm ²	K'	=	2725 N/mm ²
σ'_g	=	476	N/mm ²	n'	=	0.180
ϵ_g	=	0.234	%	σ'_f	=	1862 N/mm ²
N _T	=	298	cycles	ϵ'_f	=	0.112
T _{σ}	=	1.092	-	b	=	-0.090
T _{ep}	=	2.491	-	c	=	-0.487
Incremental step test :				K'	=	N/mm ²
				n'	=	-

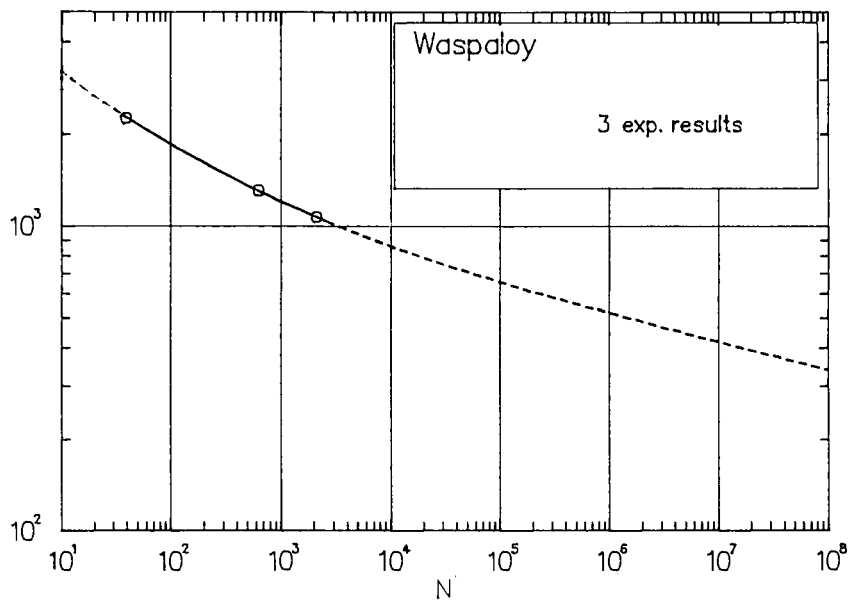
Loading condition : total strain control, R_e = -1
Specimen : tubular, outer $\varnothing$ 9.5 mm, inner $\varnothing$ 8.0 mm
Surface :
Specimen location :
Gauge length : 24.4 mm¹⁾
Testing machine : Instron, max. 45 kN
Frequency :
Strain rate :
Waveform : triangular

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks :

Remarks : 1) extensometer clamped to the shoulders of the specimen



PSWT [N/mm²]



Material : Waspaloy

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	270.5	0.0	1.9000	39.0
2.0000	956.3	0.0	0.8500	625.0
3.0000	897.7	0.0	0.6050	2110.0

		10 Ni
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Heat treatment :
Test temperature : +23°C
Semifinished material :
Reference : [4.20]
Year : 1974

Chemical composition

Hardness :

Microstructure :

Monotonic properties

E	=	186000	N/mm ²	ν	=	-	
R _{p0.2}	=	1305	N/mm ²	K	=		N/mm ²
R _m	=	1422	N/mm ²	n	=	-	
A ₅	=		%	σ _f	=	2085	N/mm ²
Z	=		%	ε _f	=	1.13	-

Cyclic properties

R' _{p0.2}	=	1159	N/mm ²	K'	=	1759	N/mm ²
σ _g	=	786	N/mm ²	n'	=	0.067	-
ε _g	=	0.423	%	σ' _f	=	1898	N/mm ²
N _T	=	605	cycles	ε' _f	=	2.852	-
T _σ	=	1.056	-	b	=	-0.058	-
T _{εp}	=	1.798	-	c	=	-0.851	-
Incremental step test :				K'	=		N/mm ²
				n'	=	-	

Failure criterion :
σ/ε-values valid for : half failure life
Remarks :

Monotonic test

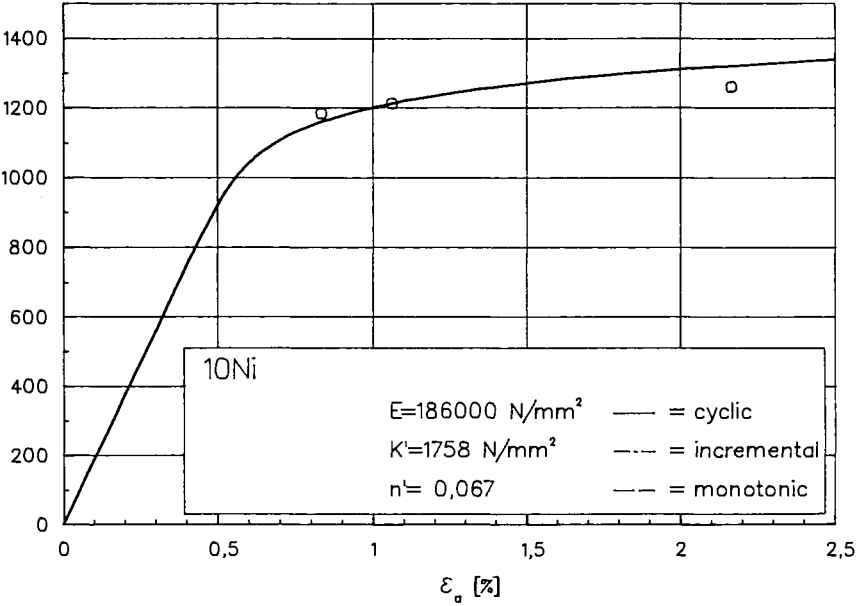
Loading condition :
Specimen :
Specimen location :
Gauge length :
Testing machine :
Strain rate :

Cyclic test

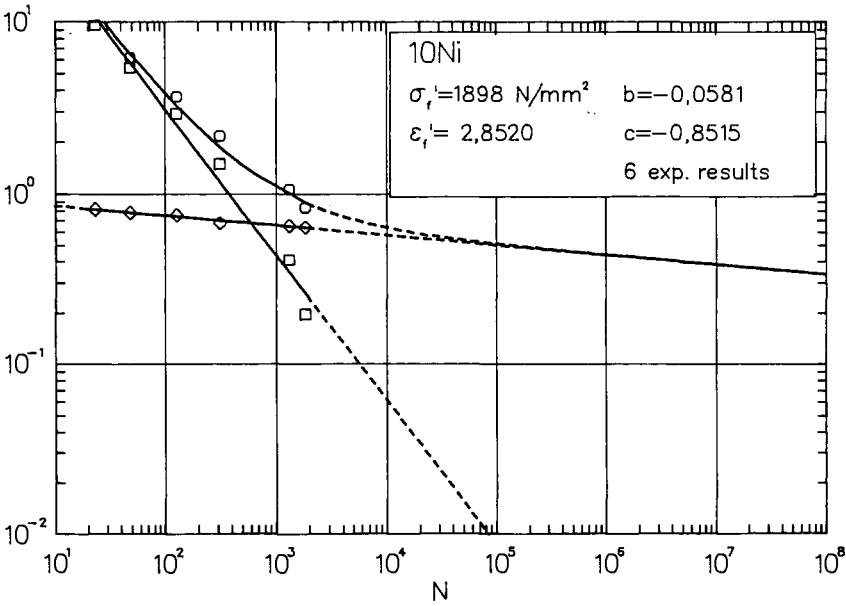
Loading condition :
Specimen : hourglass shaped, Ø 6.35 mm
Surface :
Specimen location :
Gauge length :
Testing machine :
Frequency :
Strain rate :
Waveform :

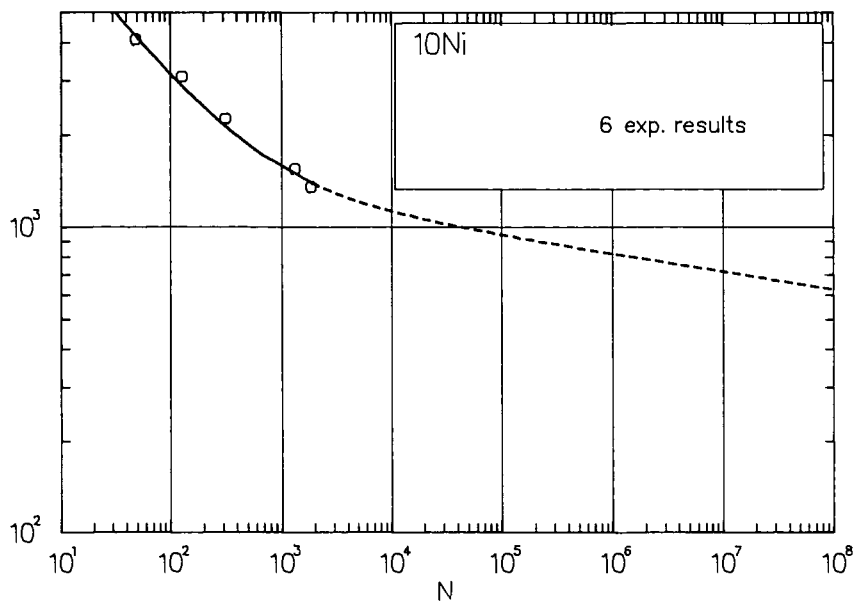
Remarks :

σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]

• Material : 10Ni

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	1524.7	0.0	10.3620	23.0
2.0000	1452.3	0.0	6.1810	48.0
3.0000	1403.6	0.0	3.6580	127.0
4.0000	1261.2	0.0	2.1650	313.0
5.0000	1213.1	0.0	1.0610	1314.0
6.0000	1183.9	0.0	0.8330	1830.0

X 10 NiCrAlTi 32 20	1.4876	Incoloy 800
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Heat treatment : 1100°C/1h, water, 860°C/2h, air
Test temperature : +23°C, H₂ 10 MPa
Semifinished material :
Reference : [4.11]
Year : 1983

Chemical composition

C	Ni	Cr	Mn	Si	Cu	Al	S	P	Ti
0.10	34.0	23.0	<1.5	<1.0	<0.75	<0.6	<0.02	<0.03	<0.30

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	240	N/mm ²	K	=	N/mm ²
R _m	=	550	N/mm ²	n	=	-
A ₅	=	55	%	σ _f	=	N/mm ²
Z	=		%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	252	N/mm ²	K'	=	2071	N/mm ²
σ' _g	=	129	N/mm ²	n'	=	0.339	-
ε _g	=	0.089	%	σ' _f	=	1121	N/mm ²
N _T	=	114142	cycles	ε' _f	=	0.164	-
T _σ	=	1.020	-	b	=	-0.142	-
T _{εp}	=	1.021	-	c	=	-0.420	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : cusp in hysteresisloop
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

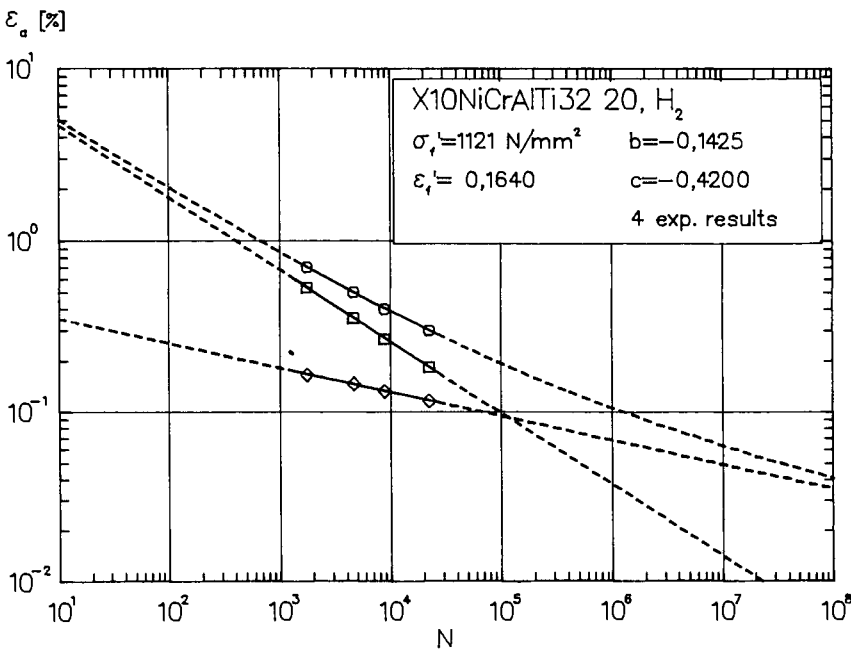
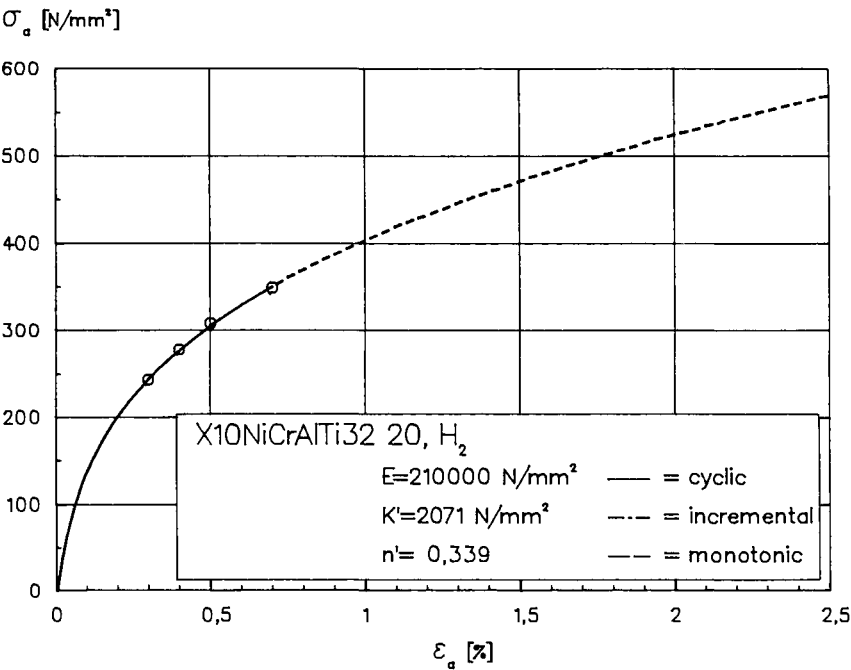
Monotonic test

Loading condition :
Specimen :
Specimen location :
Gauge length :
Testing machine :
Strain rate :

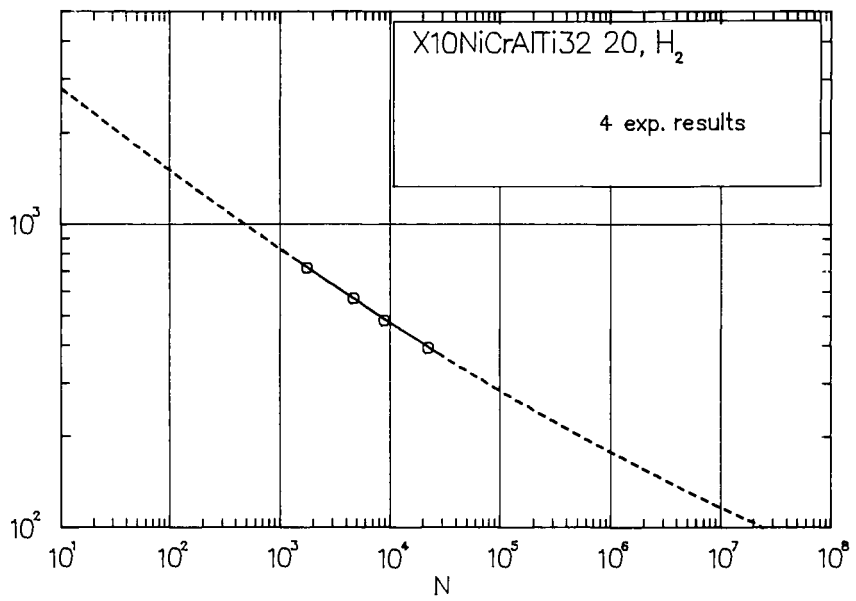
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical
Surface : electrolytically polished
Specimen location :
Gauge length : 20 mm
Testing machine : WalterBai, servohydraulic, max. 125 kN
Frequency :
Strain rate : 0.15 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : X 10 NiCrAlTi 32 20 H₂ 10 MPa

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
4.0000	348.9	0.0	0.7000	1754.0
3.0000	308.0	0.0	0.5000	4649.0
2.0000	278.3	0.0	0.4000	8825.0
1.0000	243.5	0.0	0.3000	22280.0

X11NiCrMo 48 20		Hastelloy X
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Heat treatment : solution treated, 1066°C, 1149°C, 1177°C, water
 Test temperature : +871°C
 Semifinished material :
 Reference : [4.18]
 Year : 1981

Chemical composition

C	Ni	Mn	Cr	Mo	Co	W	Fe
0.11	Bal.	0.50	20.67	8.86	2.1	0.66	18.7

Monotonic properties

E	=	138000	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=		%	σ_f	=	N/mm ²
Z	=		%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	221	N/mm ²	K'	=	1350	N/mm ²
σ_g	=	157	N/mm ²	n'	=	0.291	-
ϵ_g	=	0.115	%	σ'_f	=	478	N/mm ²
N _T	=	6565	cycles	ϵ'_f	=	0.758	-
T _{σ}	=	1.230	-	b	=	-0.073	-
T _{ep}	=	3.365	-	c	=	-0.758	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion :
 σ/ϵ -values valid for : half failure life
 Remarks :

Hardness :

Microstructure :

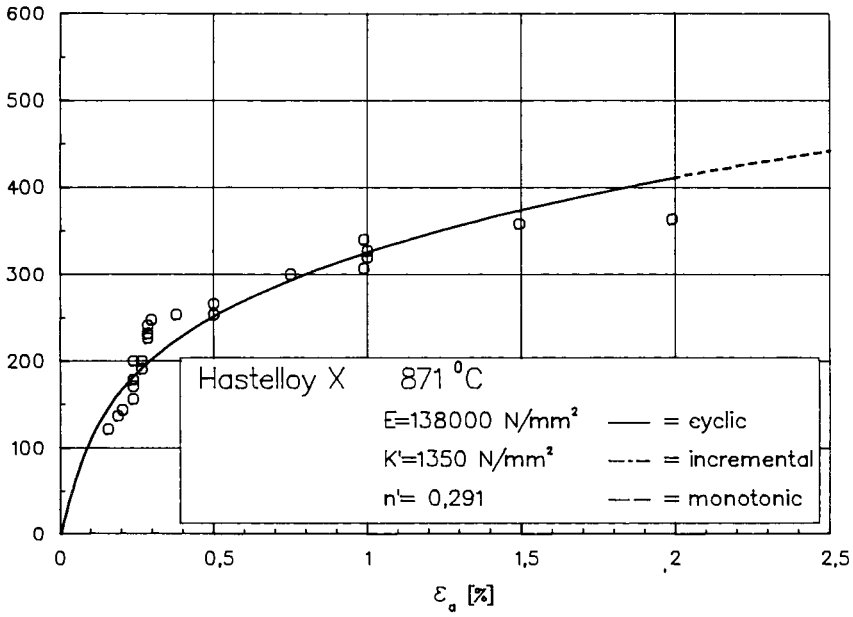
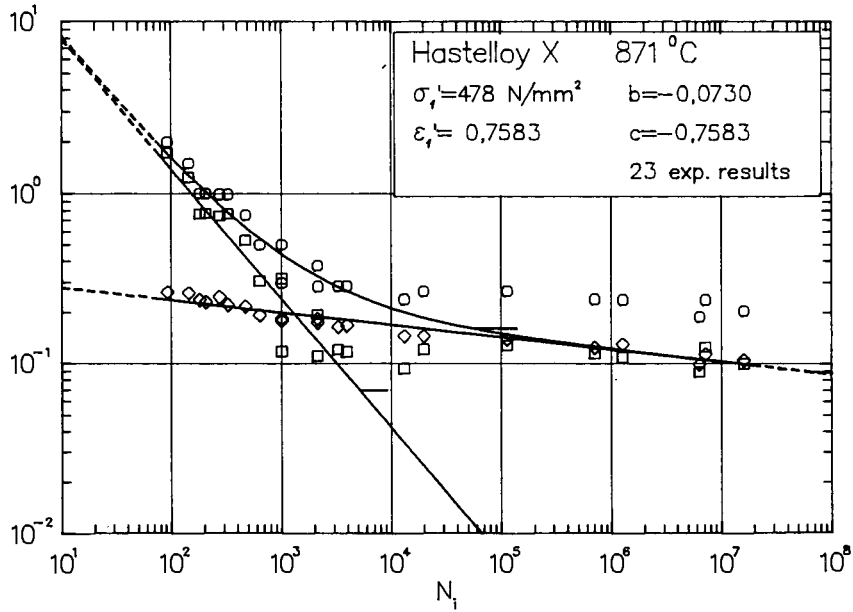
Monotonic test

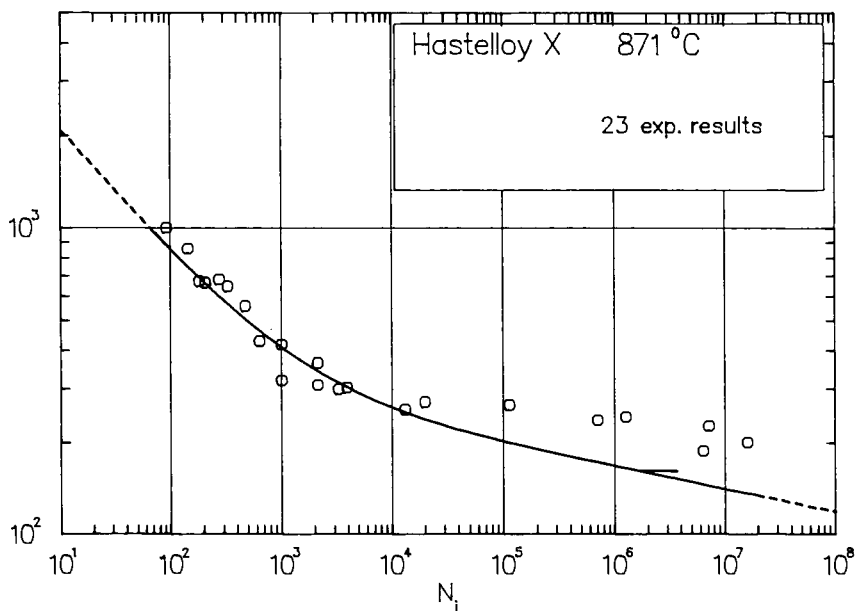
Loading condition :
 Specimen :
 Specimen location :
 Gauge length :
 Testing machine :
 Strain rate :

Cyclic test

Loading condition : total strain control¹⁾, R _{ϵ} = -1
 Specimen : hourglass shaped, $\emptyset$ 6.4 mm
 Surface :
 Specimen location :
 Gauge length :
 Testing machine : MTS, electrohydraulic
 Frequency : max. 40 Hz
 Strain rate : 24 (%/min) for low cycle fatigue tests
 Waveform : sinusoidal

Remarks : 1) tests beyond 10⁴ cycles were done in load control

σ_a [N/mm²]

 ε_a [%]


PSWT [N/mm²]

Material : Hastelloy X, 871°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	363.3	0.0	1.9900	92.0
2.0000	358.0	0.0	1.4940	144.5
3.0000	327.3	0.0	1.0000	182.0
4.0000	319.3	0.0	1.0000	207.0
5.0000	340.7	0.0	0.9880	275.0
6.0000	306.7	0.0	0.9880	328.0
7.0000	300.0	0.0	0.7500	474.0
8.0000	266.0	0.0	0.5000	637.0
9.0000	253.3	0.0	0.5000	1009.0
10.0000	247.3	0.0	0.2970	1009.0
11.0000	253.3	0.0	0.3780	2128.0
12.0000	240.7	0.0	0.2850	2128.0
13.0000	226.7	0.0	0.2850	3281.0
14.0000	232.0	0.0	0.2850	3945.0
15.0000	200.0	0.0	0.2380	13183.0
16.0000	200.0	0.0	0.2660	19953.0
17.0000	191.3	0.0	0.2660	113501.0
18.0000	170.9	0.0	0.2380	707946.0
19.0000	178.7	0.0	0.2380	1258925.0
20.0000	136.5	0.0	0.1880	6309573.0
21.0000	156.5	0.0	0.2380	7161434.0
22.0000	143.5	0.0	0.2030	16037187.0
23.0000	121.7	0.0	0.1570	>*****

		12 Ni
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Heat treatment :
Test temperature : +23°C
Semifinished material :
Reference : [4.20]
Year : 1974

Chemical composition

Hardness :

Microstructure :

Monotonic properties

E	=	186000	N/mm ²	ν	=	-
R _{p0.2}	=	1346	N/mm ²	K	=	N/mm ²
R _m	=	1395	N/mm ²	n	=	-
A ₅	=		%	σ_f	=	1933 N/mm ²
Z	=		%	ϵ_f	=	0.89 -

Cyclic properties

R' _{p0.2}	=	1122	N/mm ²	K'	=	1641	N/mm ²
σ_g	=	832	N/mm ²	n'	=	0.061	-
ϵ_g	=	0.449	%	σ'_f	=	1650	N/mm ²
N _T	=	535	cycles	ϵ'_f	=	1.113	-
T _{σ}	=	1.041	-	b	=	-0.045	-
T _{sp}	=	1.713	-	c	=	-0.738	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion :
 σ/ϵ -values valid for : half failure life
Remarks :

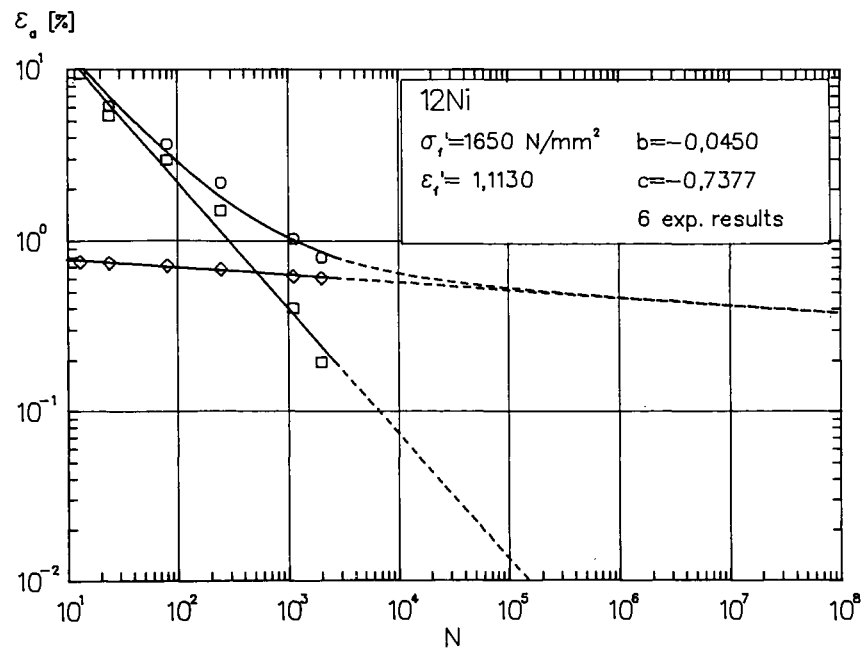
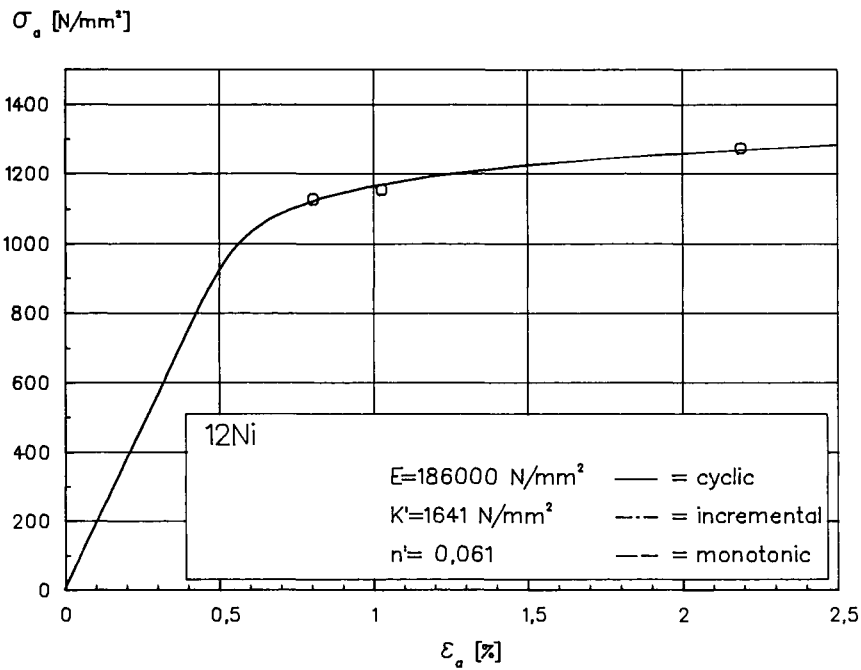
Monotonic test

Loading condition :
Specimen :
Specimen location :
Gauge length :
Testing machine :
Strain rate :

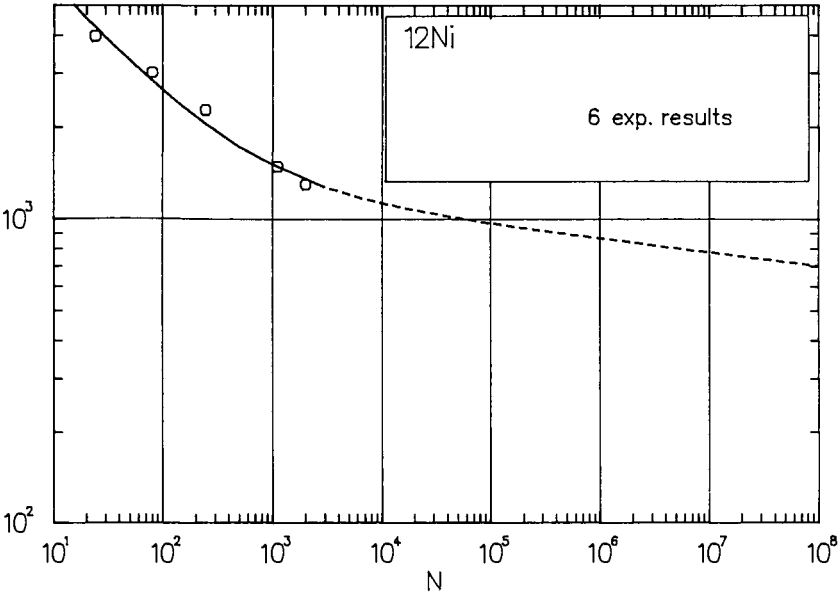
Cyclic test

Loading condition :
Specimen : hourglass shaped, $\emptyset$ 6.35 mm
Surface :
Specimen location :
Gauge length :
Testing machine :
Frequency :
Strain rate :
Waveform :

Remarks :



PSWT [N/mm²]



Material : 12Ni

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	1403.7	0.0	10.2040	13.0
2.0000	1386.7	0.0	6.1450	24.0
3.0000	1330.9	0.0	3.6900	80.0
4.0000	1273.5	0.0	2.1890	245.0
5.0000	1155.5	0.0	1.0250	1113.0
6.0000	1127.7	0.0	0.8030	1998.0

X12 NiCr 72 13	Inconel 713C
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Heat treatment : 1177°C/2h, argon
 Test temperature : +23°C
 Semifinished material : cast cylinders
 Reference : [4.13]
 Year : 1965

Chemical composition

C	Mn	Si	Ti	Fe	Nb	Mo	Al	Cr	Ni
0.12	0.15	0.4	0.6	1.0	2.25	4.5	6.0	13.0	71.98

Monotonic Properties

E	=	208800	N/mm ²	ν	=	-
R _{p0.2}	=	787	N/mm ²	K	=	1383 N/mm ²
R _m	=	932	N/mm ²	n	=	0.093
A ₅	=	2	%	σ_f	=	N/mm ²
Z	=		%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	894	N/mm ²	K'	=	1899 N/mm ²
σ_E	=	490	N/mm ²	n'	=	0.121
ϵ_E	=	0.236	%	σ'_f	=	1264 N/mm ²
N _T	=	22	cycles	ϵ'_f	=	0.032
T _{σ}	=	1.160	-	b	=	-0.062
T _{ϵ_p}	=	1.320	-	c	=	-0.500
Incremental step test :				K'	=	N/mm ²
				n'	=	-

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
 Remarks :

Hardness : HRC: 37

Microstructure :

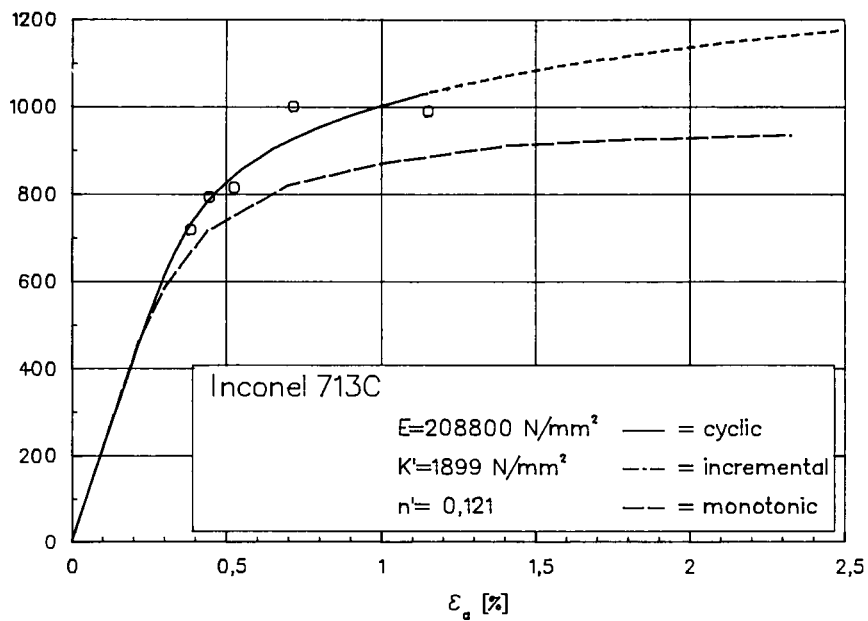
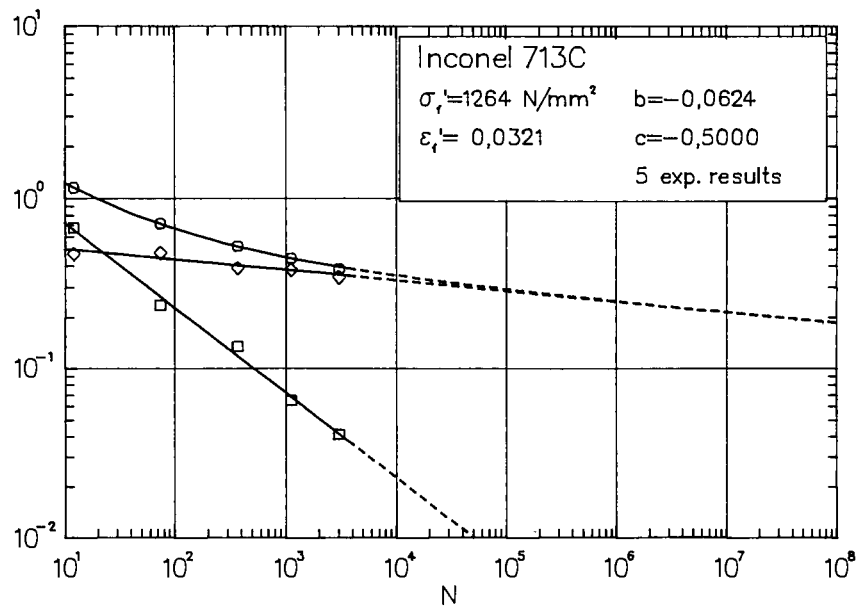
Monotonic test

Loading condition :
 Specimen : tubular, outer $\varnothing$ 9.5 mm, inner $\varnothing$ 8.0 mm
 Specimen location :
 Gauge length : 25.4 mm
 Testing machine :
 Strain rate :

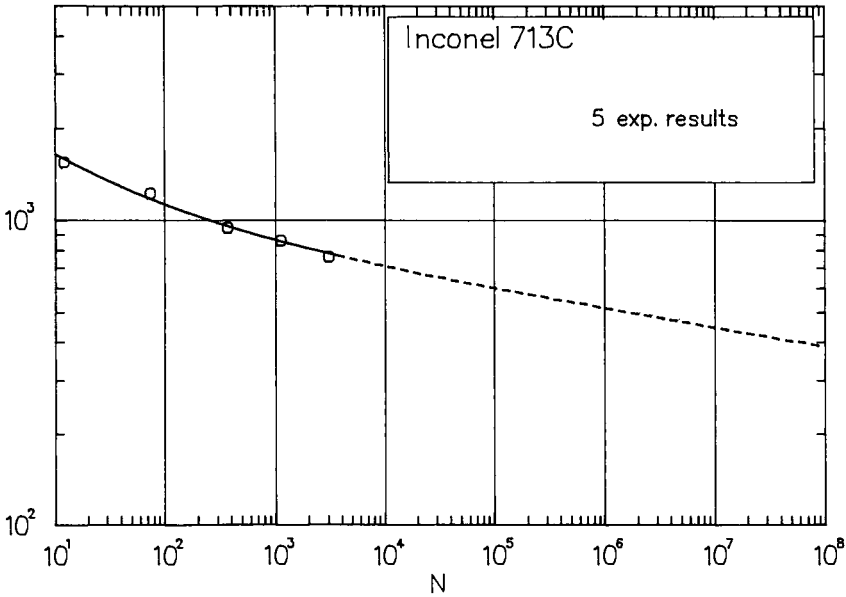
Cyclic test

Loading condition : total strain control, $R_\epsilon = -1$
 Specimen : tubular, outer $\varnothing$ 9.5 mm, inner $\varnothing$ 8.0 mm
 Surface :
 Specimen location :
 Gauge length : 24.4 mm¹⁾
 Testing machine : Instron, max. 45 kN
 Frequency :
 Strain rate :
 Waveform : triangular

Remarks : 1) extensometer clamped to the shoulders of the specimen

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : Inconel 713C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	990.9	0.0	1.1500	12.0
2.0000	1001.2	0.0	0.7150	74.0
3.0000	814.8	0.0	0.5250	370.0
4.0000	794.1	0.0	0.4450	1120.0
5.0000	718.1	0.0	0.3850	3020.0

X12 NiCr 72 13	Inconel 713C
----------------	--------------

Heat treatment : 1177°C/2h, argon
 Test temperature : +23°C
 Semifinished material : cast cylinders
 Reference : [4.13]
 Year : 1965

Chemical composition

C	Mn	Si	Ti	Fe	Nb	Mo	Al	Cr	Ni
0.03	0.15	0.4	0.6	1.0	2.25	4.5	6.0	13.0	71.98

Monotonic properties

E	=	208500	N/mm ²	v	=	-
R _{p0.2}	=	780	N/mm ²	K	=	1282
R _m	=	1001	N/mm ²	n	=	0.084
A ₅	=	10	%	σ _f	=	N/mm ²
Z	=		%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	849	N/mm ²	K'	=	1576	N/mm ²
σ _g	=	506	N/mm ²	n'	=	0.099	-
ε _g	=	0.244	%	σ' _f	=	1140	N/mm ²
N _T	=	34	cycles	ε' _f	=	0.035	-
T _σ	=	1.227	-	b	=	-0.053	-
T _{εp}	=	2.201	-	c	=	-0.492	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks :
 specimen

Hardness : HRC: 36

Microstructure :

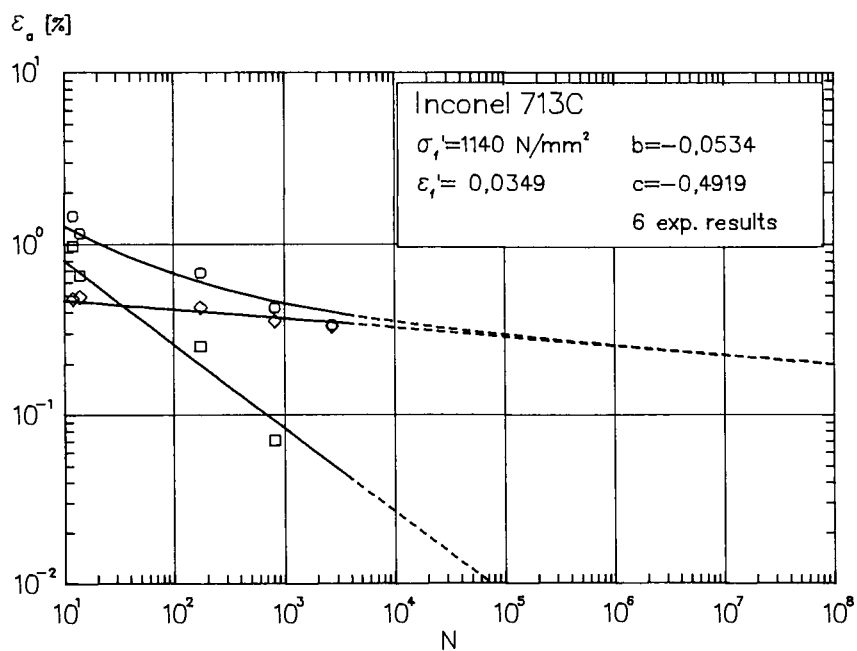
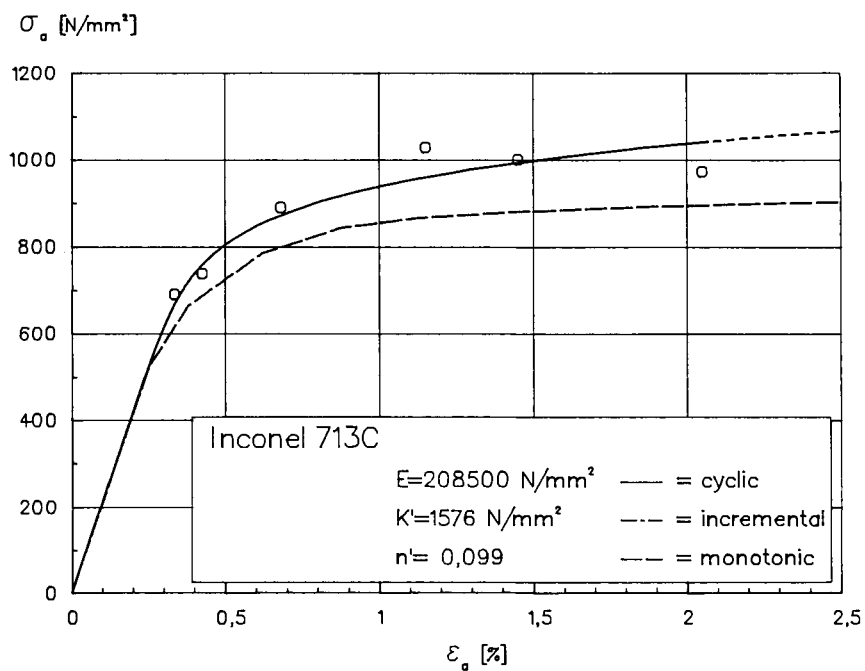
Monotonic test

Loading condition :
 Specimen : tubular, outer Ø 9.5 mm, inner Ø 8.0 mm
 Specimen location :
 Gauge length : 25.4 mm
 Testing machine :
 Strain rate :

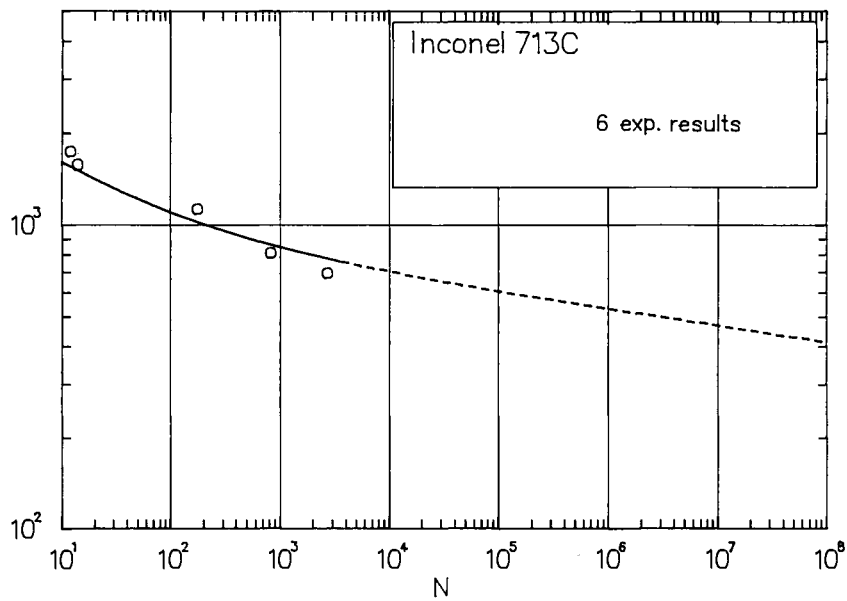
Cyclic test

Loading condition : total strain control, R_c = -1
 Specimen : tubular, outer Ø 9.5 mm, inner Ø 8.0 mm
 Surface :
 Specimen location :
 Gauge length : 24.4 mm¹⁾
 Testing machine : Instron, max. 45 kN
 Frequency :
 Strain rate :
 Waveform : triangular

Remarks : 1) extensometer clamped to the shoulders of the



PSWT [N/mm²]



Material : Inconel 713C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	973.6	0.0	2.0500	1.5
2.0000	1001.2	0.0	1.4500	12.0
3.0000	1028.8	0.0	1.1500	14.0
4.0000	890.8	0.0	0.6800	175.0
5.0000	738.8	0.0	0.4250	820.0
6.0000	690.5	0.0	0.3350	2695.0

X 2 CrNi 18 9		AISI 304
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Heat treatment :
 Test temperature : +23°C
 Semifinished material : plate, 22 mm thick
 Reference : [4.19]
 Year : 1984

Chemical composition

C	Si	Mn	P	S	Cr	Ni
0.025	0.37	1.48	0.026	0.003	18.04	10.13

Monotonic properties

E	=	192000	N/mm ²	ν	=	-
R _{p0.2}	=	280	N/mm ²	K	=	455 N/mm ²
R _m	=	601	N/mm ²	n	=	0.097 -
A ₅	=		%	σ_f	=	N/mm ²
Z	=	46	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	207	N/mm ²	K'	=	2807 N/mm ²
σ_g	=	89	N/mm ²	n'	=	0.419 -
ϵ_g	=	0.073	%	σ'_f	=	1936 N/mm ²
N _T	=	277967	cycles	ϵ'_f	=	0.412 -
T _{σ}	=	1.068	-	b	=	-0.202 -
T _{ep}	=	1.176	-	c	=	-0.483 -
Incremental step test :				K'	=	N/mm ²
				n'	=	-

Failure criterion : macro crack
 σ/ϵ -values valid for : half failure life
 Remarks :

Hardness :

Microstructure :

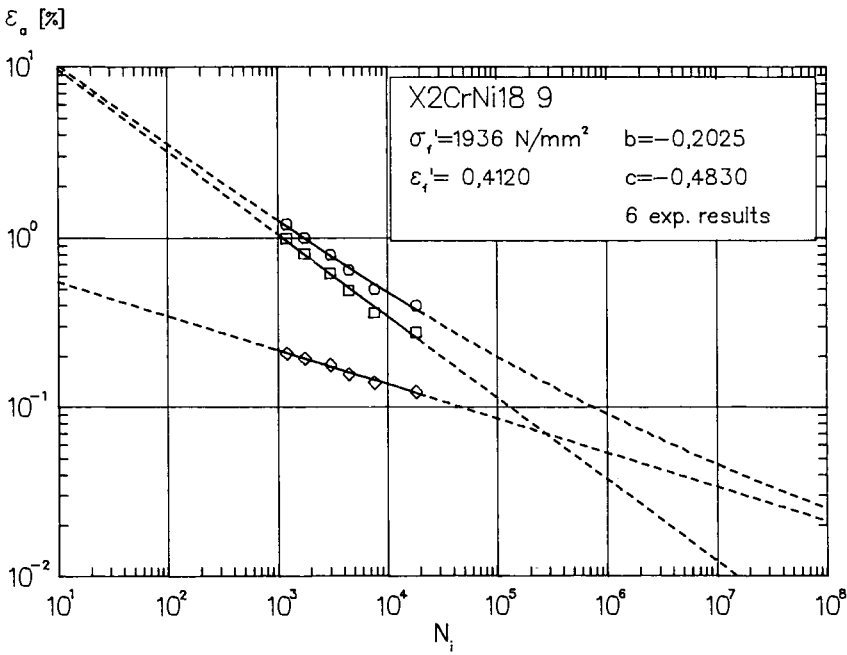
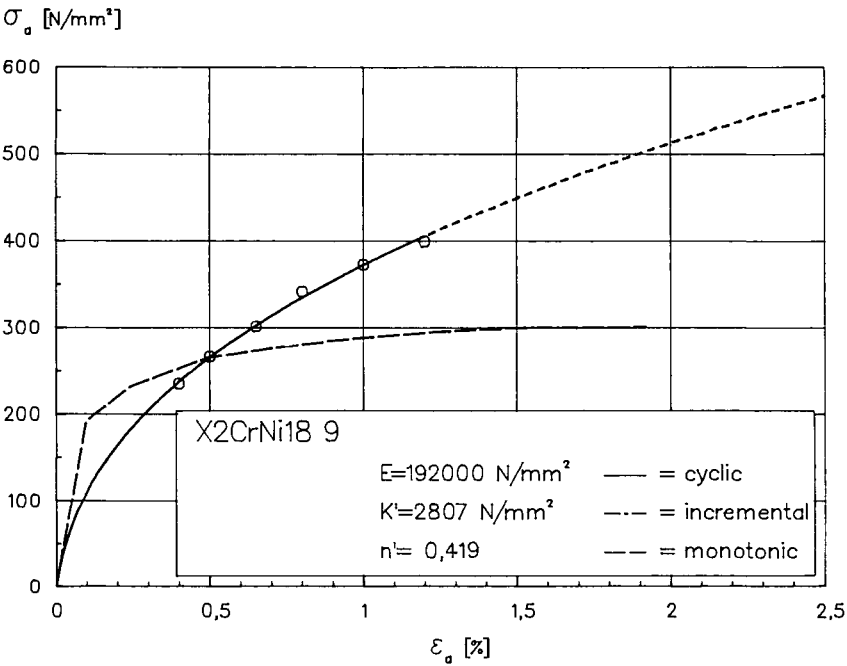
Monotonic test

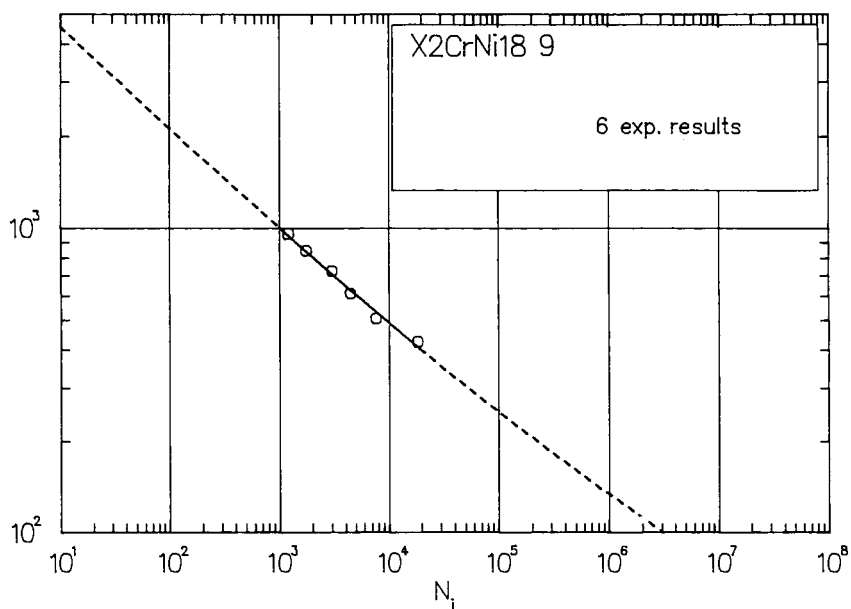
Loading condition :
 Specimen :
 Specimen location :
 Gauge length :
 Testing machine :
 Strain rate :

Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, $\emptyset$ 14 mm
 Surface :
 Specimen location : in rolling direction
 Gauge length : 20 mm
 Testing machine : servohydraulic
 Frequency :
 Strain rate : 25 (%/min)
 Waveform :

Remarks :



PSWT [N/mm²]

Material : X2CrNi18 9

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
6.0000	399.4	0.0	1.2000	1200.0
5.0000	372.5	0.0	1.0000	1750.0
4.0000	341.8	0.0	0.8000	3000.0
3.0000	301.4	0.0	0.6500	4420.0
2.0000	266.9	0.0	0.5000	7600.0
1.0000	235.4	0.0	0.4000	18300.0

X 2 CrNi 18 9	AISI 304
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Heat treatment :
Test temperature : +600°C
Semifinished material : plate, 22 mm thick
Reference : [4.19]
Year : 1984

Chemical composition

C	Si	Mn	P	S	Cr	Ni
0.025	0.37	1.48	0.026	0.003	18.04	10.13

Monotonic properties

E	=	149000	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=		%	σ _f	=	N/mm ²
Z	=		%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	188	N/mm ²	K'	=	1022	N/mm ²
σ _g	=	101	N/mm ²	n'	=	0.272	-
ε _g	=	0.088	%	σ' _f	=	635	N/mm ²
N _T	=	47215	cycles	ε' _f	=	0.177	-
T _σ	=	1.080	-	b	=	-0.121	-
T _{εp}	=	1.144	-	c	=	-0.446	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : macro crack
σ/ε-values valid for : half failure life
Remarks :

Hardness :

Microstructure :

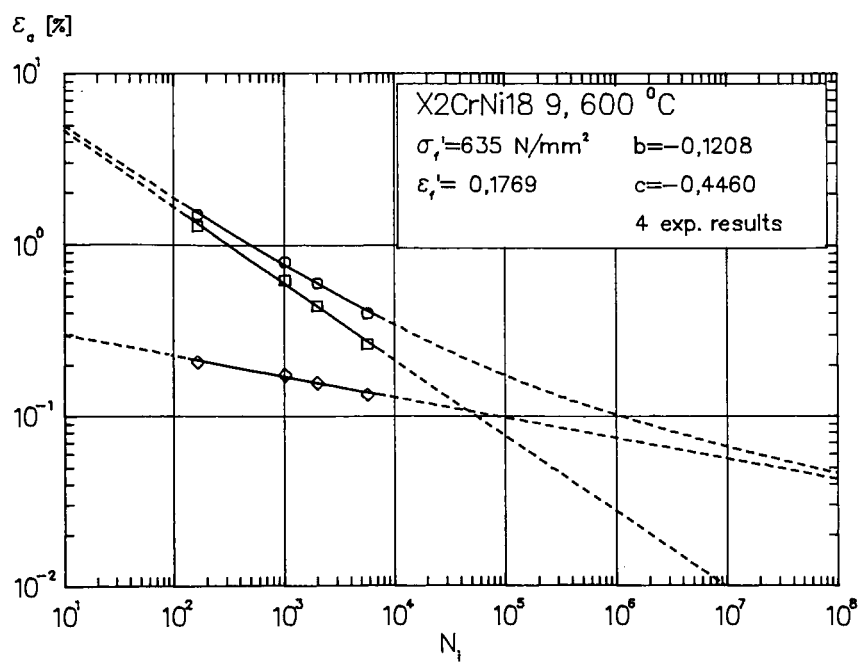
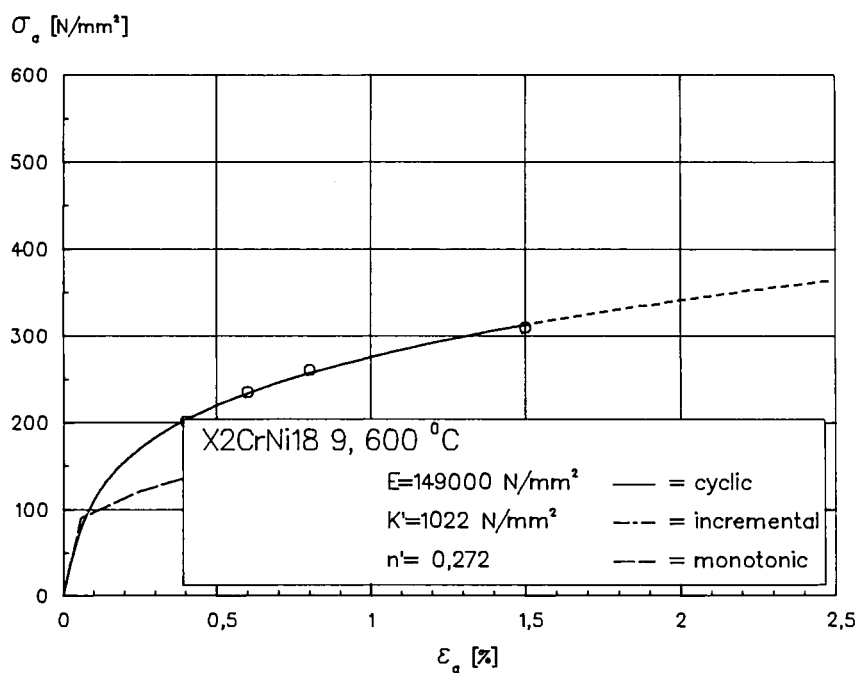
Monotonic test

Loading condition :
Specimen :
Specimen location :
Gauge length :
Testing machine :
Strain rate :

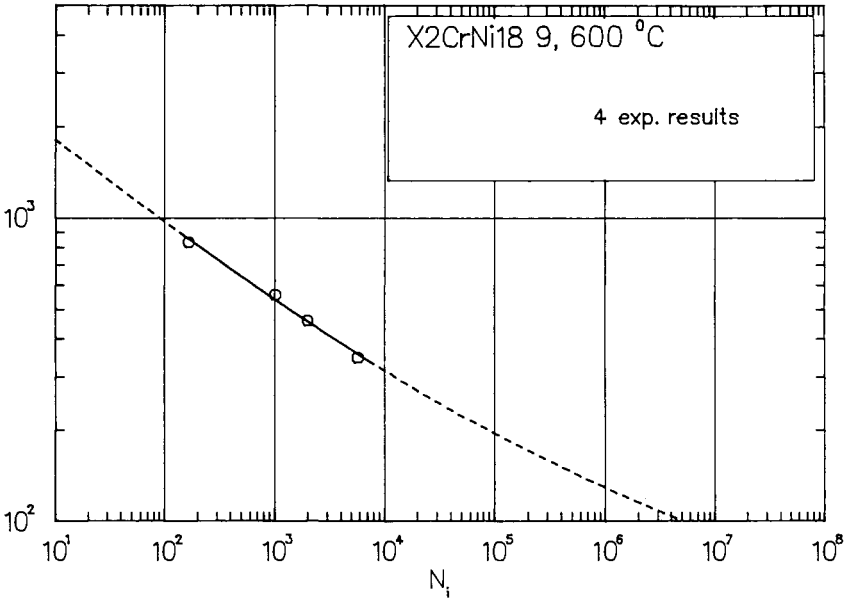
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 14 mm
Surface :
Specimen location : in rolling direction
Gauge length : 20 mm
Testing machine : servohydraulic
Frequency :
Strain rate : 50 (%/min)
Waveform :

Remarks :



PSWT [N/mm²]



Material : X2CrNi18 9, 600 °C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
4.0000	309.9	0.0	1.5000	165.0
3.0000	260.8	0.0	0.8000	1020.0
2.0000	235.4	0.0	0.6000	2000.0
1.0000	201.1	0.0	0.4000	5700.0

X 2 CrNi 18 9		AISI 304
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Heat treatment :
 Test temperature : +600°C
 Semifinished material : plate, 22 mm thick
 Reference : [4.19]
 Year : 1984

Chemical composition

C	Si	Mn	P	S	Cr	Ni
0.025	0.37	1.48	0.026	0.003	18.04	10.13

Monotonic properties

E	=	149000	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=		%	σ_f	=	N/mm ²
Z	=		%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	178	N/mm ²	K'	=	836	N/mm ²
σ'_g	=	71	N/mm ²	n'	=	0.249	-
ϵ'_g	=	0.052	%	σ'_f	=	576	N/mm ²
N _T	=	8223	cycles	ϵ'_f	=	0.226	-
T _{σ}	=	1.144	-	b	=	-0.138	-
T _{ϵ_p}	=	1.027	-	c	=	-0.557	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : macro crack
 σ/ϵ -values valid for : half failure life
 Remarks :

Hardness :

Microstructure :

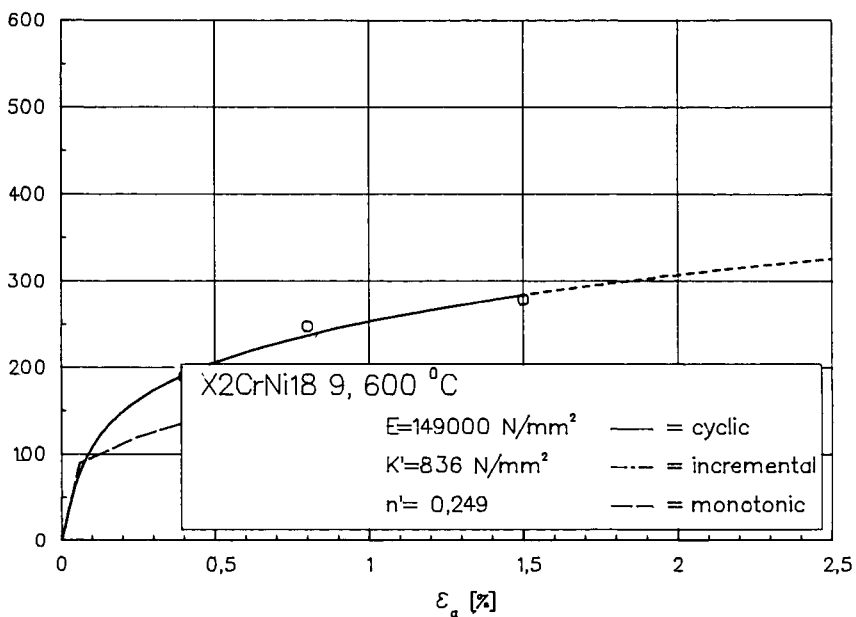
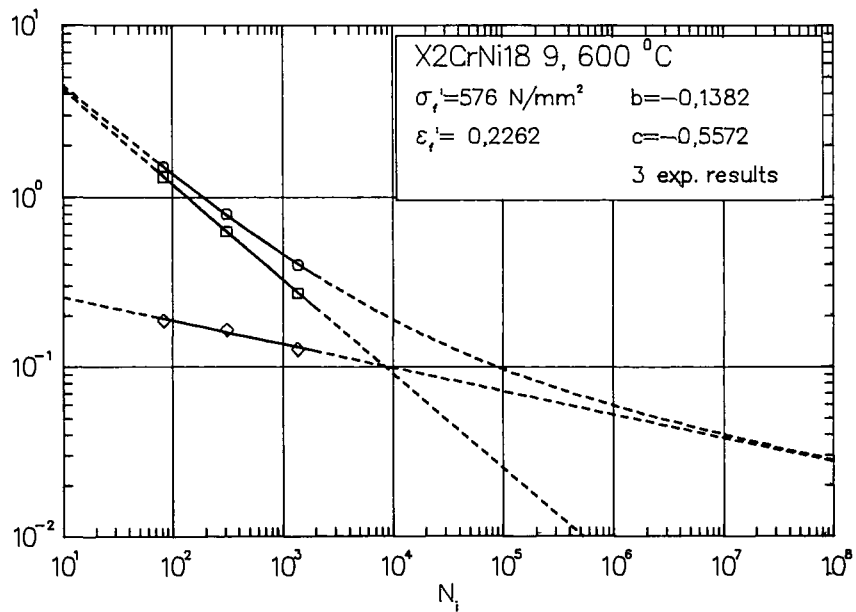
Monotonic test

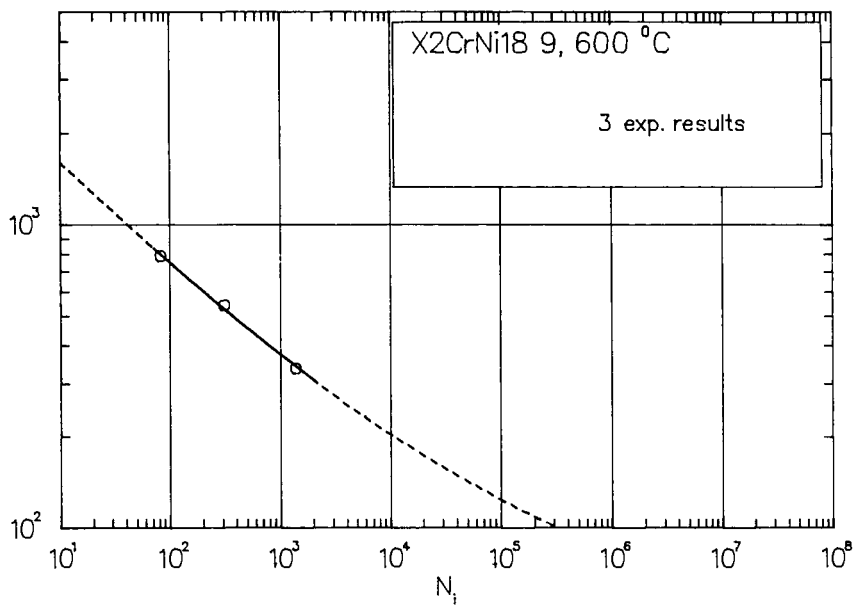
Loading condition :
 Specimen :
 Specimen location :
 Gauge length :
 Testing machine :
 Strain rate :

Cyclic test

Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 14 mm
 Surface :
 Specimen location : in rolling direction
 Gauge length : 20 mm
 Testing machine : servohydraulic
 Frequency :
 Strain rate : 0.25 (%/min)
 Waveform :

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]

Material : X2CrNi18 9, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
3.0000	278.6	0.0	1.5000	82.0
2.0000	247.3	0.0	0.8000	310.0
1.0000	189.2	0.0	0.4000	1375.0

X 2 CrNi 18 9		AISI 304
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Heat treatment :
Test temperature : +600°C
Semifinished material : plate, 22 mm thick
Reference : [4.19]
Year : 1984

Chemical composition

C	Si	Mn	P	S	Cr	Ni
0.025	0.37	1.48	0.026	0.003	18.04	10.13

Monotonic properties

E	=	149000	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=		%	σ_f	=	N/mm ²
Z	=		%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	185	N/mm ²	K'	=	861	N/mm ²
σ'_g	=	96	N/mm ²	n'	=	0.248	-
ϵ'_g	=	0.079	%	σ'_f	=	530	N/mm ²
N _T	=	24969	cycles	ϵ'_f	=	0.141	-
T _{σ}	=	1.018	-	b	=	-0.112	-
T _{ϵ_p}	=	1.081	-	c	=	-0.452	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : macro crack
 σ/ϵ -values valid for : half failure life
Remarks :

Hardness :

Microstructure :

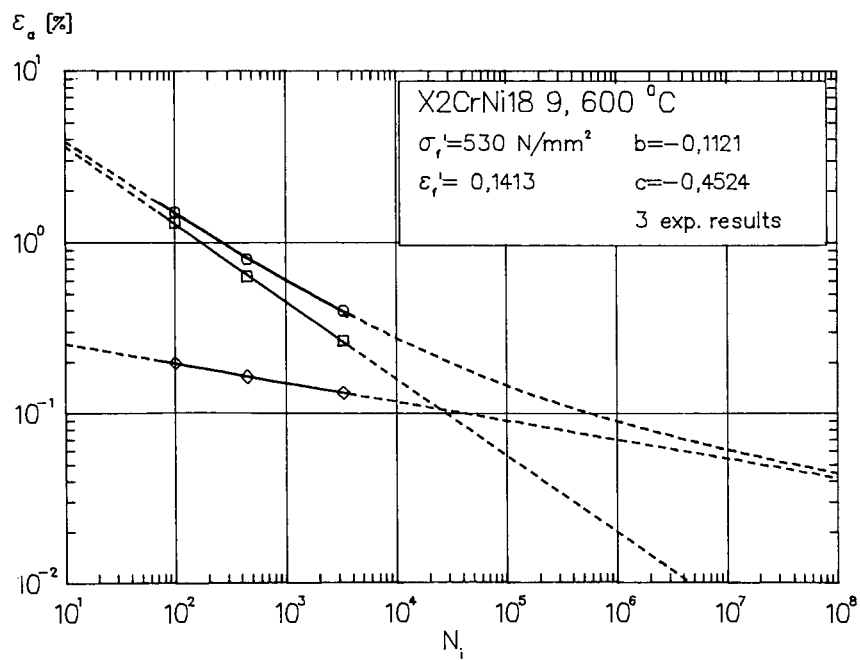
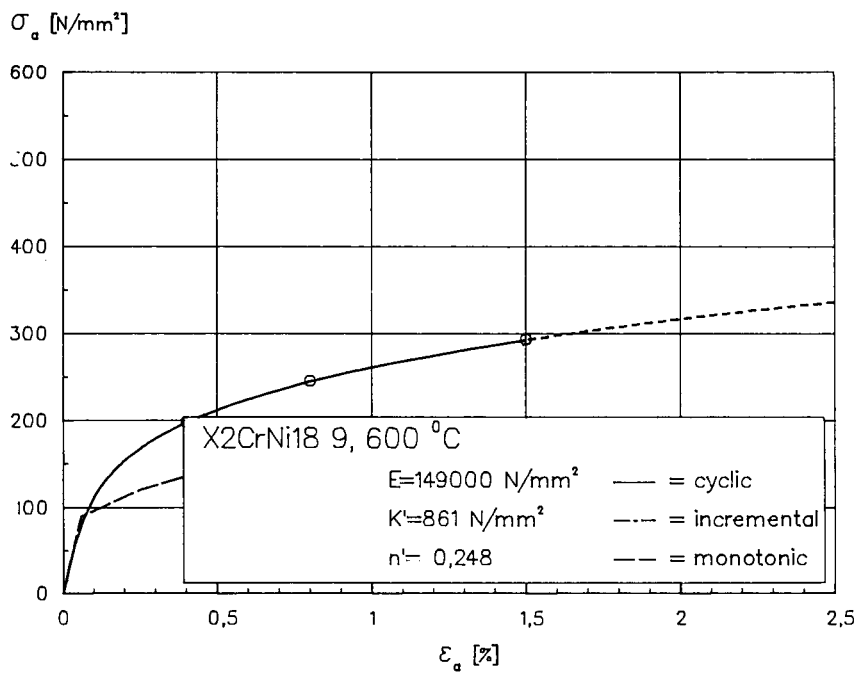
Monotonic test

Loading condition :
Specimen :
Specimen location :
Gauge length :
Testing machine :
Strain rate :

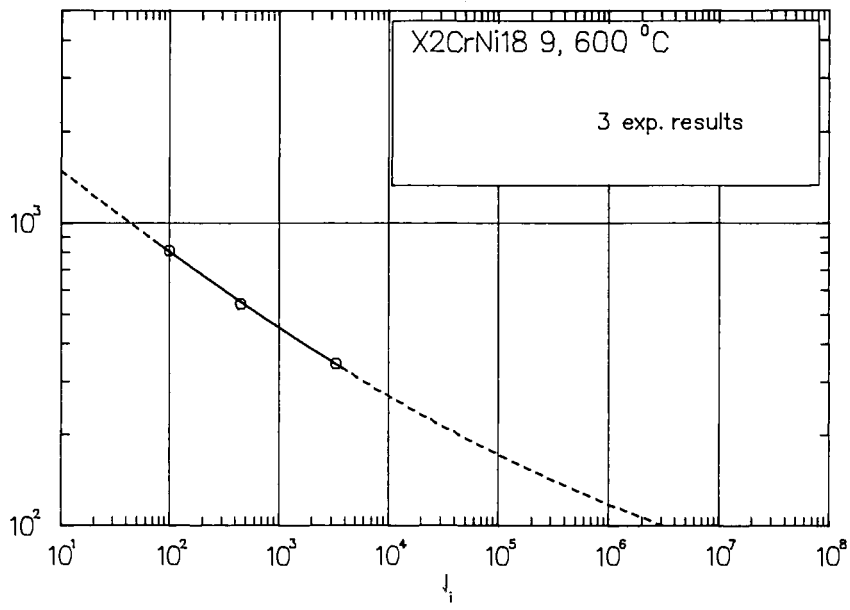
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
Specimen : cylindrical, $\varnothing$ 14 mm
Surface :
Specimen location : in rolling direction
Gauge length : 20 mm
Testing machine : servohydraulic
Frequency :
Strain rate : 2.5 (%/min)
Waveform :

Remarks :



PSWT [N/mm²]



Material : X2CrNi18 9, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
3.0000	293.5	0.0	1.5000	100.0
2.0000	245.9	0.0	0.8000	450.0
1.0000	198.2	0.0	0.4000	3300.0

X 2 CrNi 18 9		AISI 304
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Heat treatment :
 Test temperature : +600°C
 Semifinished material : plate, 22 mm thick
 Reference : [4.19]
 Year : 1984

Chemical composition

C	Si	Mn	P	S	Cr	Ni
0.025	0.37	1.48	0.026	0.003	18.04	10.13

Monotonic properties

E	=	149000	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=		%	σ_f	=	N/mm ²
Z	=		%	ε_f	=	-

Cyclic properties

R' _{p0.2}	=	187	N/mm ²	K'	=	1080	N/mm ²
σ_g	=	103	N/mm ²	n'	=	0.282	-
ε_g	=	0.093	%	σ'_f	=	625	N/mm ²
N _T	=	60512	cycles	ε'_f	=	0.145	-
T _{σ}	=	1.062	-	b	=	-0.119	-
T _{ε}	=	1.072	-	c	=	-0.422	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : macro crack
 σ/ε -values valid for : half failure life
 Remarks :

Hardness :

Microstructure :

Monotonic test

Loading condition :
 Specimen :
 Specimen location :
 Gauge length :
 Testing machine :
 Strain rate :

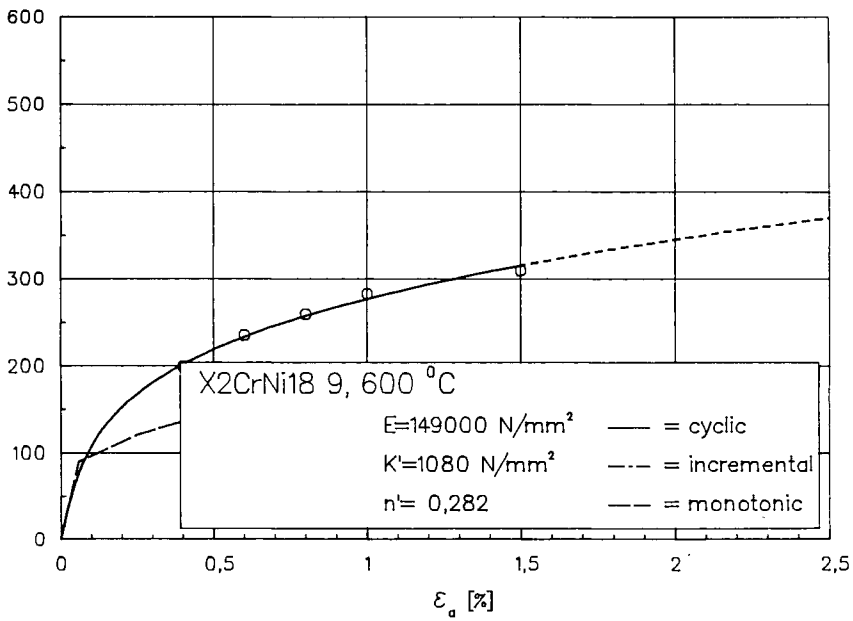
Cyclic test

Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, $\varnothing$ 14 mm
 Surface :
 Specimen location : in rolling direction
 Gauge length : 20 mm
 Testing machine : servohydraulic
 Frequency :
 Strain rate : 25 (%/min)
 Waveform :

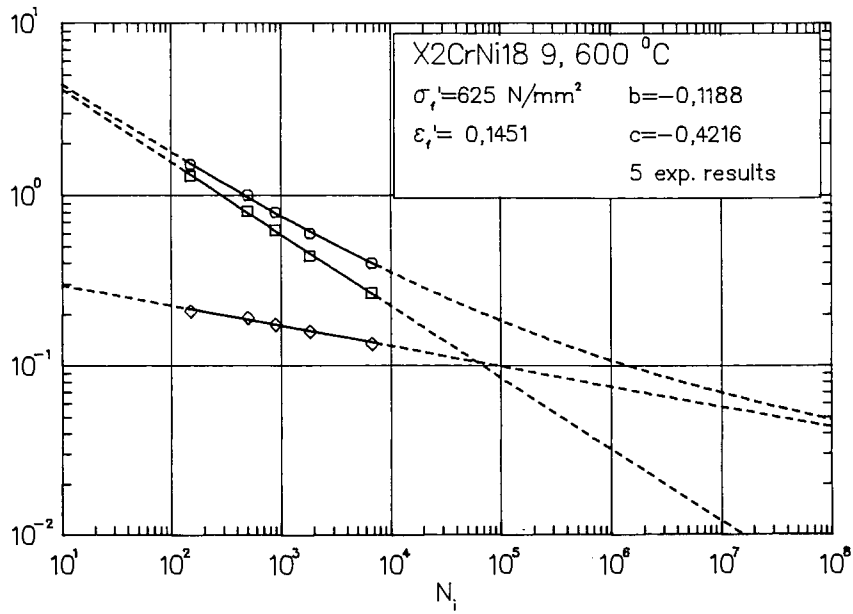
Remarks :

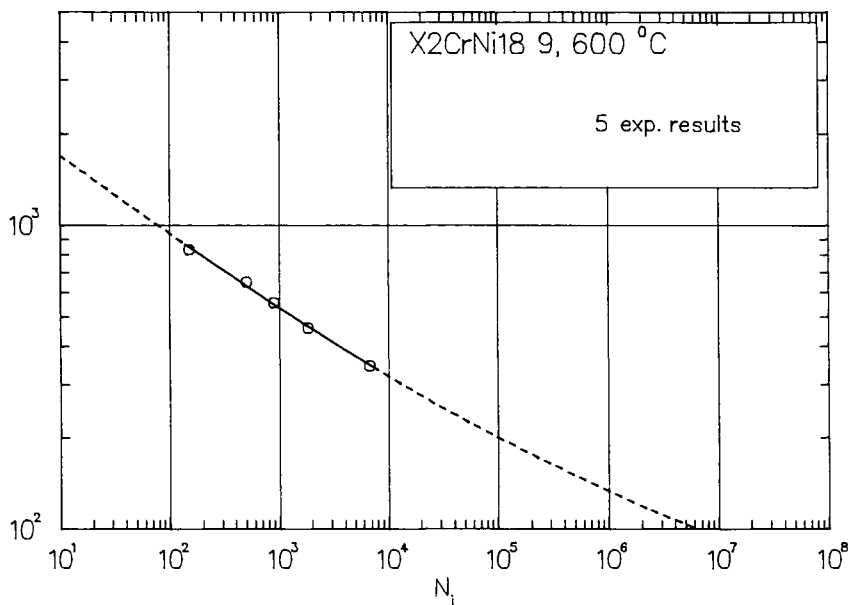
90

σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]

Material : X2CrNi18 9, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
5.0000	309.9	0.0	1.5000	150.0
4.0000	283.1	0.0	1.0000	500.0
3.0000	259.3	0.0	0.8000	890.0
2.0000	235.4	0.0	0.6000	1830.0
1.0000	199.7	0.0	0.4000	6750.0

X 3 CrNi 19 9	AISI 304
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Heat treatment : cold drawn by supplier
 Test temperature : +23°C
 Semifinished material : blanks, Ø 19 mm
 Reference : [4.12]
 Year : 1963

Chemical composition

C	Mn	P	S	Si	Cr	Ni	Mo	Cu
0.026	0.45	0.03	0.014	0.40	18.67	8.50	0.02	0.10

Monotonic properties

E	=	172625	N/mm ²	v	=	0.34	-
R _{p0.2}	=	746	N/mm ²	K	=	1114	N/mm ²
R _m	=	953	N/mm ²	n	=	0.063	-
A ₅	=		%	σ _f	=	2037	N/mm ²
Z	=	69	%	ε _f	=	1.16	-

Cyclic properties

R' _{p0.2}	=	882	N/mm ²	K'	=	2313	N/mm ²
σ _g	=	376	N/mm ²	n'	=	0.155	-
ε _g	=	0.219	%	σ' _f	=	2067	N/mm ²
N _T	=	202	cycles	ε' _f	=	0.301	-
ΔT _σ	=	1.193	-	b	=	-0.112	-
T _{sp}	=	1.793	-	c	=	-0.649	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks :

Hardness : Rockwell C-34 to 36

Microstructure :

Monotonic test

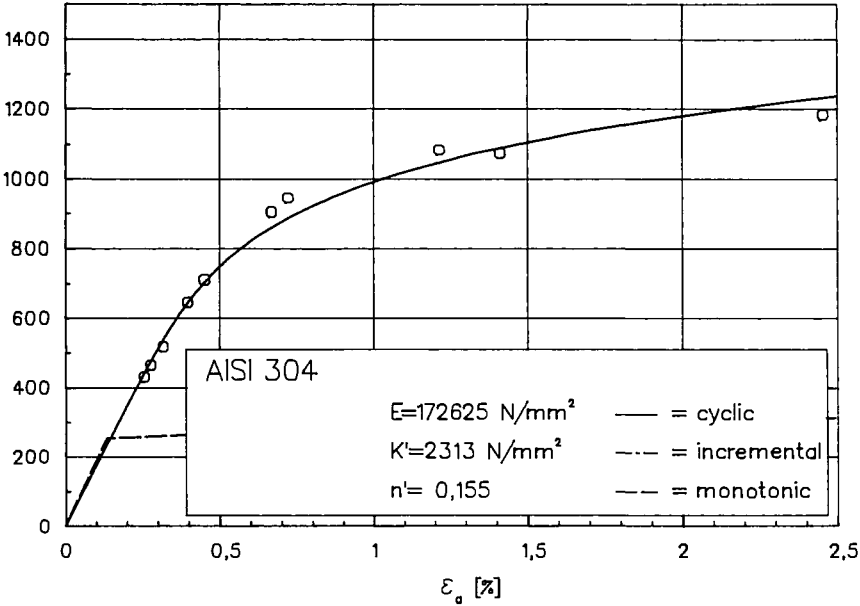
Loading condition :
 Specimen : cylindrical, Ø 6.35 mm
 Specimen location : in rolling direction
 Gauge length : 38.1
 Testing machine : Rhiele, universal testing machine
 Strain rate :

Cyclic test

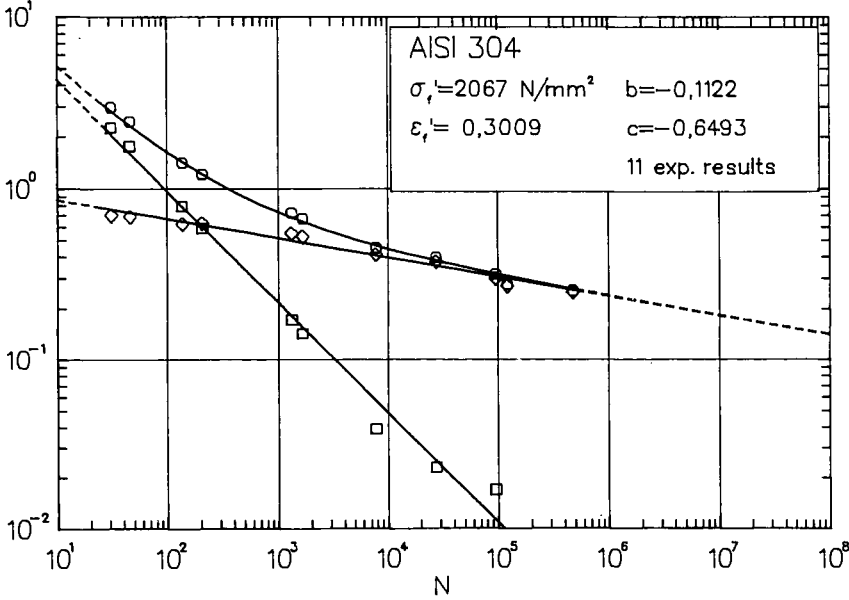
Loading condition : total diametral strain control, R_{εd} = -1
 Specimen : hourglass shaped, Ø 6.35 mm
 Surface : machined
 Specimen location : in rolling direction
 Gauge length : diametral
 Testing machine : self designed
 Frequency :
 Strain rate :
 Waveform :

Remarks :

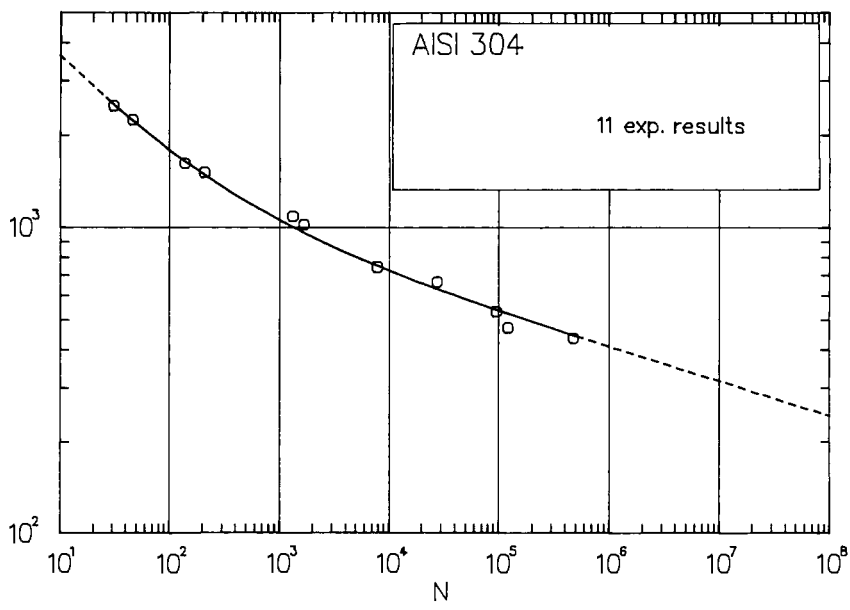
σ_e [N/mm²]



ϵ_e [%]



PSWT [N/mm²]



Material : AISI 304

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	1208.2	0.0	2.9620	31.0
2.0000	1184.0	0.0	2.4530	46.0
3.0000	1073.6	0.0	1.4110	138.0
4.0000	1083.9	0.0	1.2140	208.0
5.0000	945.8	0.0	0.7210	1320.0
6.0000	904.4	0.0	0.6670	1660.0
7.0000	711.1	0.0	0.4510	7780.0
8.0000	645.5	0.0	0.3970	27500.0
9.0000	517.8	0.0	0.3170	95000.0
10.0000	466.0	0.0	0.2770	121000.0
11.0000	431.5	0.0	0.2550	474000.0

X 3 CrNi 19 9		AISI 304 ELC
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Heat treatment : hot rolled and annealed by supplier
 Test temperature : +23°C
 Semifinished material : blanks, Ø 19 mm
 Reference : [4.12]
 Year : 1963

Chemical composition

C	Mn	P	S	Si	Cr	Ni	Mo	Cu
0.026	0.45	0.03	0.014	0.40	18.67	8.50	0.02	0.10

Monotonic Properties

E	=	186435	N/mm ²	ν	=	0.27	-
R _{p0.2}	=	255	N/mm ²	K	=	548	N/mm ²
R _m	=	746	N/mm ²	n	=	0.136	-
A ₅	=		%	σ_f	=	1920	N/mm ²
Z	=	74	%	ϵ_f	=	1.37	-

Cyclic properties

R' _{p0.2}	=	678	N/mm ²	K'	=	4634	N/mm ²
σ'_g	=	237	N/mm ²	n'	=	0.309	-
ϵ'_g	=	0.137	%	σ'_f	=	2377	N/mm ²
N _T	=	214	cycles	ϵ'_f	=	0.068	-
T _{σ}	=	1.205	-	b	=	-0.152	-
T _{ϵ_p}	=	3.761	-	c	=	-0.428	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
 Remarks :

Hardness : Rockwell B-82 to 84

Microstructure :

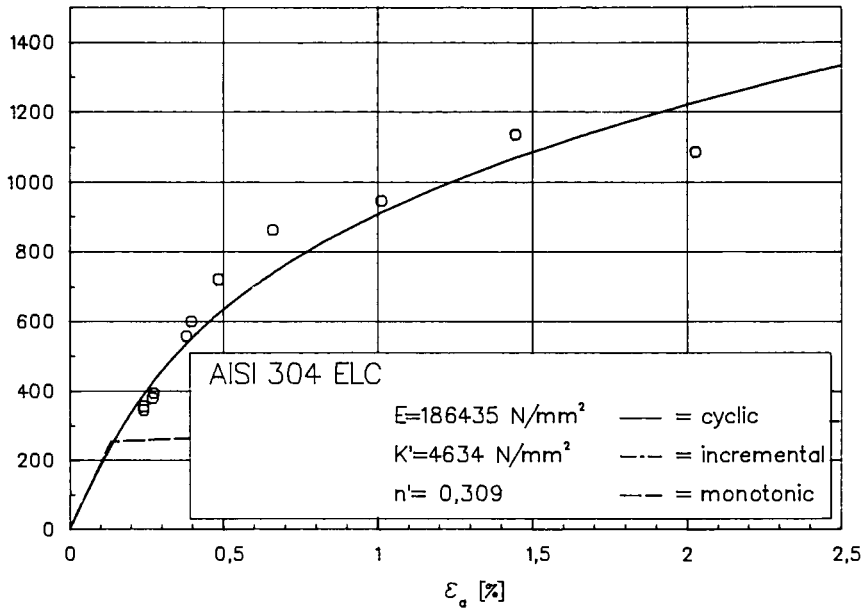
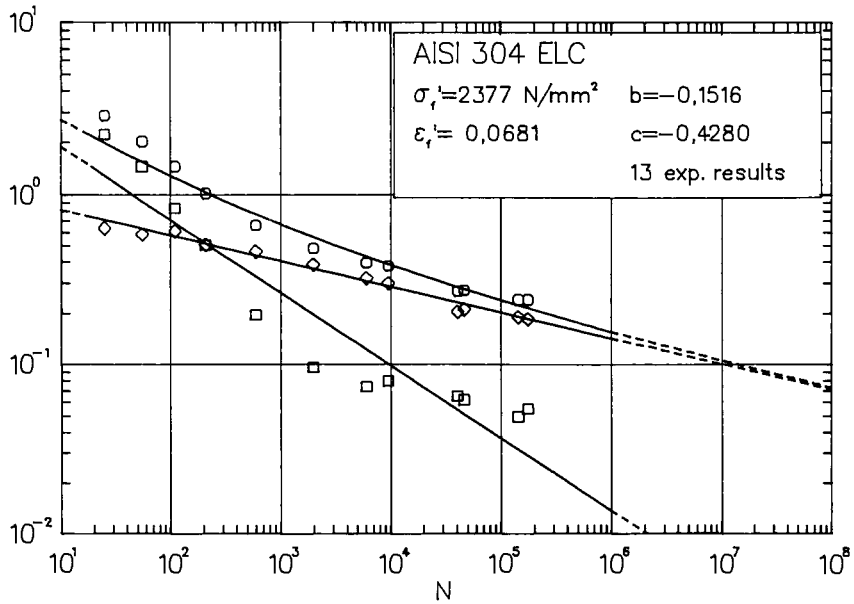
Monotonic test

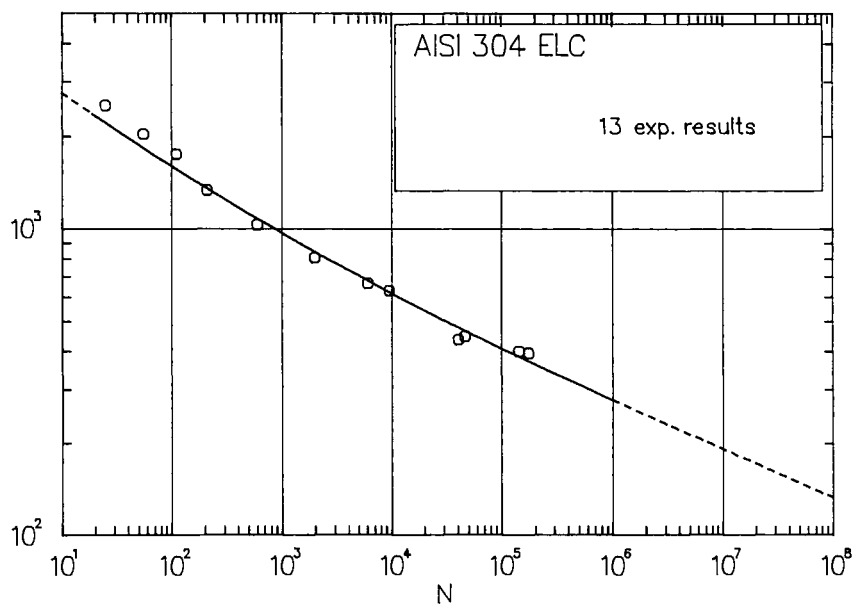
Loading condition :
 Specimen : cylindrical, Ø 6.35 mm
 Specimen location : in rolling direction
 Gauge length : 38.1 mm
 Testing machine : Rhiele, universal testing machine
 Strain rate :

Cyclic test

Loading condition : total diametral strain control, R_{ed} = -1
 Specimen : hourglass shaped, Ø 6.35 mm
 Surface : machined
 Specimen location : in rolling direction
 Gauge length : diametral
 Testing machine : self designed
 Frequency :
 Strain rate :
 Waveform :

Remarks :

σ_a [N/mm²]

 ϵ_a [%]


PSWT [N/mm²]

Material : AISI 304 ELC

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	1184.0	0.0	2.8630	25.0
2.0000	1087.4	0.0	2.0270	55.0
3.0000	1135.7	0.0	1.4450	110.0
4.0000	945.8	0.0	1.0110	210.0
5.0000	863.0	0.0	0.6590	596.0
6.0000	721.5	0.0	0.4830	1970.0
7.0000	721.5	0.0	0.4830	1970.0
7.0000	600.7	0.0	0.3960	6010.0
8.0000	559.2	0.0	0.3800	9460.0
9.0000	379.7	0.0	0.2690	40400.0
10.0000	393.5	0.0	0.2730	46500.0
11.0000	355.6	0.0	0.2400	143000.0
12.0000	345.2	0.0	0.2400	174000.0

X 5 CrNi 18 9	1.4301	SUS 304-B
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Heat treatment : 1075^oC/30', water
Test temperature : +23^oC
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Al
0.067	0.57	1.45	0.033	0.012	8.02	18.28	0.082	0.058	0.001	0.001

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	207	N/mm ²	K	=	N/mm ²
R _m	=	611	N/mm ²	n	=	-
A ₅	=	66	%	σ_f	=	N/mm ²
Z	=	75	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	197	N/mm ²	K'	=	3331	N/mm ²
σ_g	=	97	N/mm ²	n'	=	0.455	-
ϵ_g	=	0.089	%	σ'_f	=	1470	N/mm ²
N _T	=	1492143	cycles	ϵ'_f	=	0.161	-
T _{σ}	=	1.165	-	b	=	-0.179	-
T _{ep}	=	1.288	-	c	=	-0.389	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness : HV 10 : 142

Microstructure : grain size : 3.4

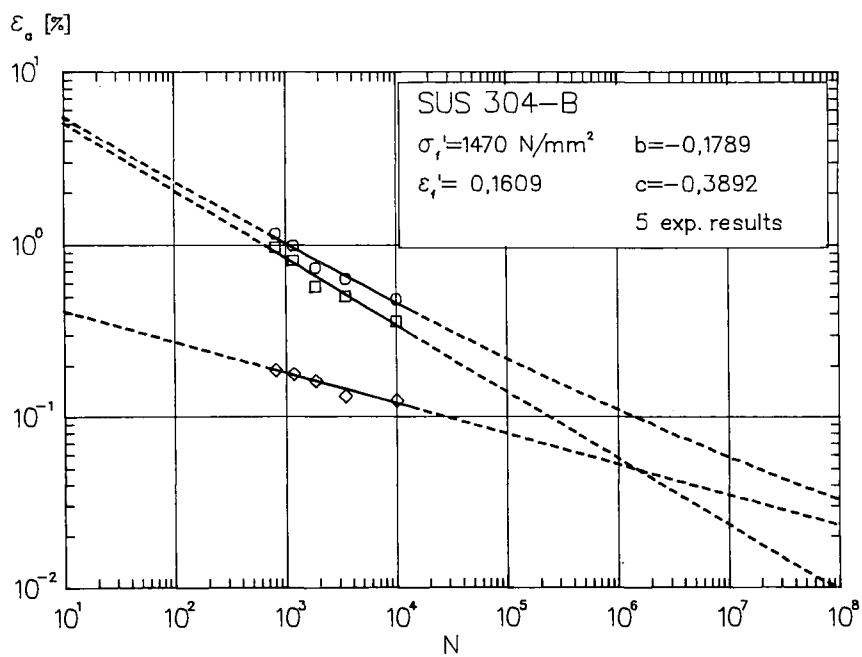
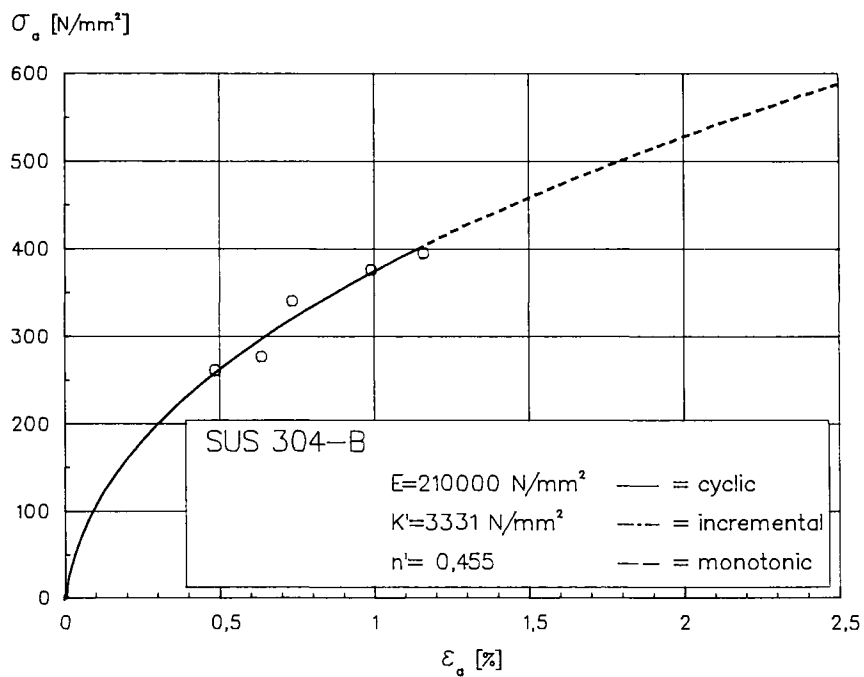
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

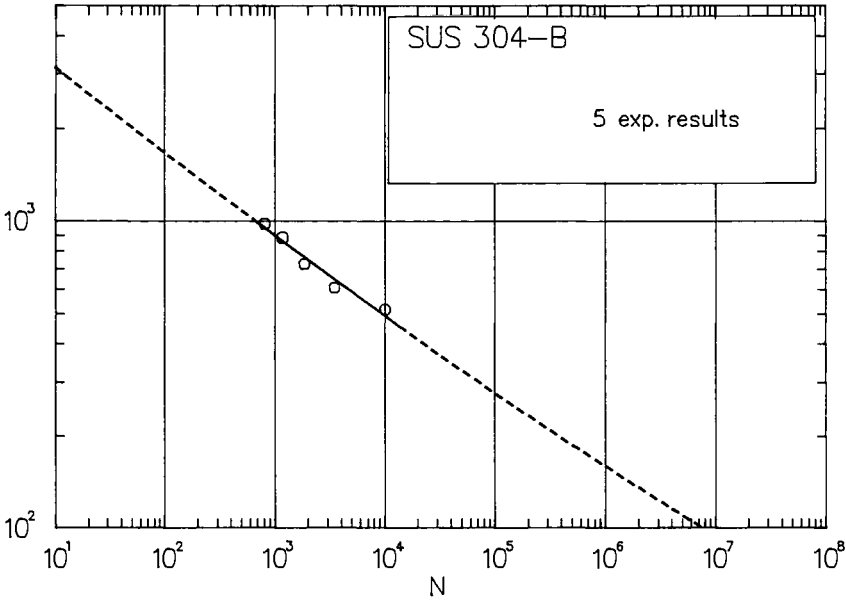
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 304-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	395.3	0.0	1.1600	810.0
2.0000	375.7	0.0	0.9900	1176.0
3.0000	340.9	0.0	0.7350	1860.0
4.0000	277.1	0.0	0.6350	3445.0
5.0000	261.0	0.0	0.4850	10048.0

X 5 CrNi 18 9	1.4301	SUS 304-B
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Heat treatment : 1075°C/30', water
Test temperature : +23°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Al
0.067	0.57	1.45	0.033	0.012	8.02	18.28	0.082	0.058	0.001	0.001

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	207	N/mm ²	K	=	N/mm ²
R _m	=	611	N/mm ²	n	=	-
A ₅	=	79	%	σ_f	=	N/mm ²
Z	=	83	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	203	N/mm ²	K'	=	3001	N/mm ²
σ'_g	=	112	N/mm ²	n'	=	0.434	-
ϵ'_g	=	0.104	%	σ'_f	=	1268	N/mm ²
N _T	=	1685501	cycles	ϵ'_f	=	0.134	-
T _σ	=	1.188	-	b	=	-0.160	-
T _{ep}	=	1.317	-	c	=	-0.366	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
σ/ε-values valid for : half failure life

Remarks : Young's modulus estimated

Hardness : HV 10 : 142

Microstructure : grain size : 3.4

Monotonic test

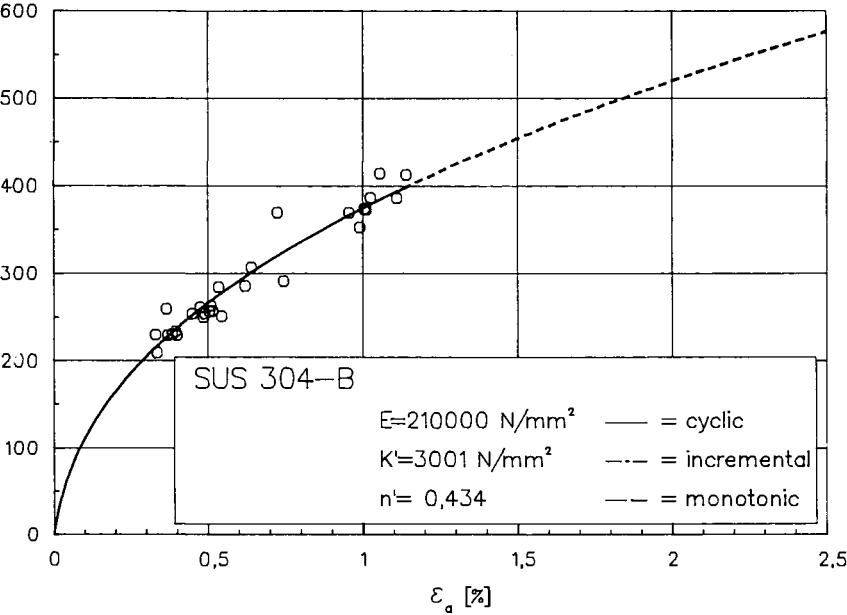
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7,5 (%/min)

Cyclic test

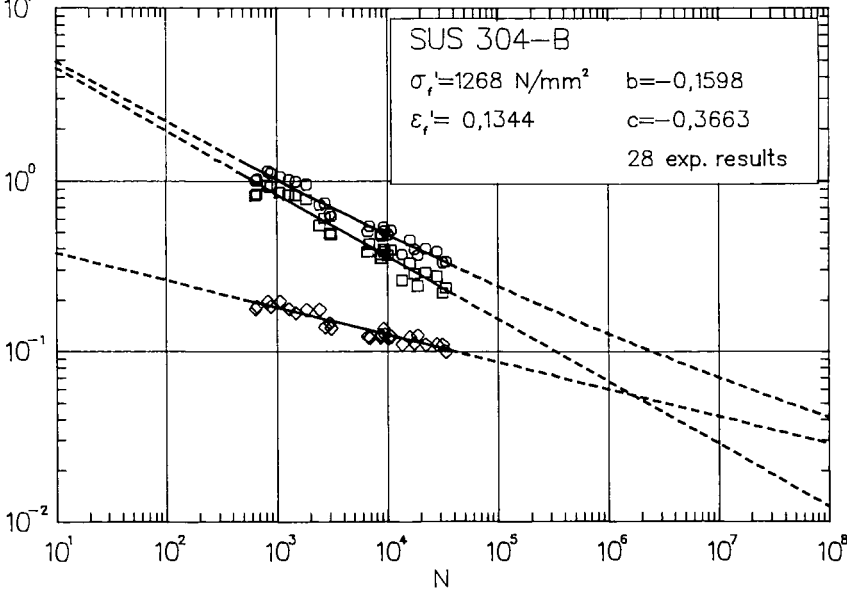
Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 4.0 (%/min)
Waveform : triangular

Remarks :

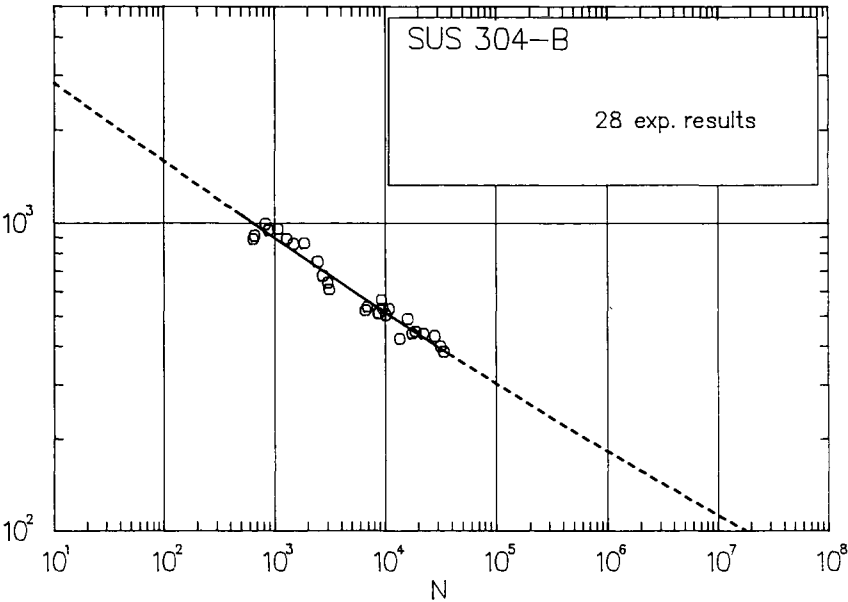
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 304-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
3.0000	374.3	0.0	1.0050	640.0
5.0000	386.5	0.0	1.0250	661.0
1.0000	413.0	0.0	1.1400	827.0
2.0000	386.0	0.0	1.1100	880.0
4.0000	414.5	0.0	1.0550	1069.0
6.0000	372.8	0.0	1.0100	1289.0
7.0000	352.7	0.0	0.9900	1484.0
8.0000	369.4	0.0	0.9550	1858.0
10.0000	369.4	0.0	0.7250	2436.0
9.0000	291.4	0.0	0.7450	2715.0
11.0000	307.0	0.0	0.6400	2997.0
12.0000	286.0	0.0	0.6200	3086.0
17.0000	256.5	0.0	0.5050	6631.0
13.0000	251.1	0.0	0.5450	6869.0
18.0000	254.1	0.0	0.4900	8638.0
20.0000	261.0	0.0	0.4750	8730.0
14.0000	284.5	0.0	0.5350	9166.0
16.0000	262.9	0.0	0.5100	9449.0
19.0000	250.2	0.0	0.4850	10133.0
15.0000	257.0	0.0	0.5150	10778.0
25.0000	229.6	0.0	0.3700	13576.0
21.0000	254.1	0.0	0.4500	15973.0
23.0000	233.5	0.0	0.3950	17508.0

continued

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
26.0000	259.5	0.0	0.3650	18801.0
22.0000	229.6	0.0	0.4000	22260.0
24.0000	230.5	0.0	0.3850	28118.0
28.0000	230.0	0.0	0.3300	31725.0
27.0000	209.4	0.0	0.3350	33872.0

X 5 CrNi 18 9	1.4301	SUS 304-B
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Heat treatment : 1075°C/30', water
 Test temperature : +450°C
 Semifinished material : bar. Ø 22 mm
 Reference : [4.1]
 Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Al
0.067	0.57	1.45	0.033	0.012	8.02	18.28	0.082	0.058	0.001	0.001

Monotonic properties

E	=	170500	N/mm ²	ν	=	-
R _{p0.2}	=	106	N/mm ²	K	=	N/mm ²
R _m	=	435	N/mm ²	n	=	-
A ₅	=	47	%	σ_f	=	N/mm ²
Z	=	71	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	184	N/mm ²	K'	=	4497	N/mm ²
σ_g	=	59	N/mm ²	n'	=	0.514	-
ϵ_g	=	0.056	%	σ'_f	=	2528	N/mm ²
N _T	=	276590	cycles	ϵ'_f	=	0.325	-
T _{σ}	=	1.093	-	b	=	-0.247	-
T _{ϵ_p}	=	1.078	-	c	=	-0.481	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

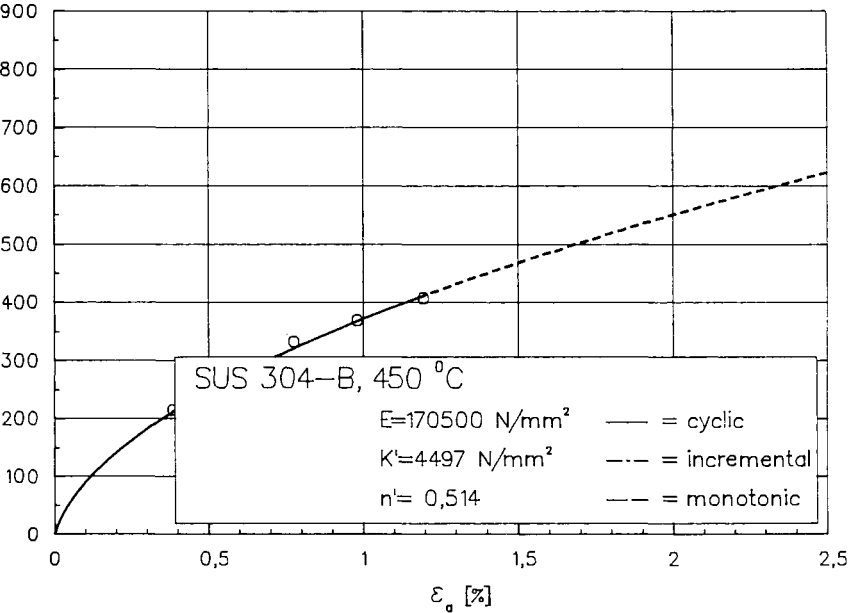
Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

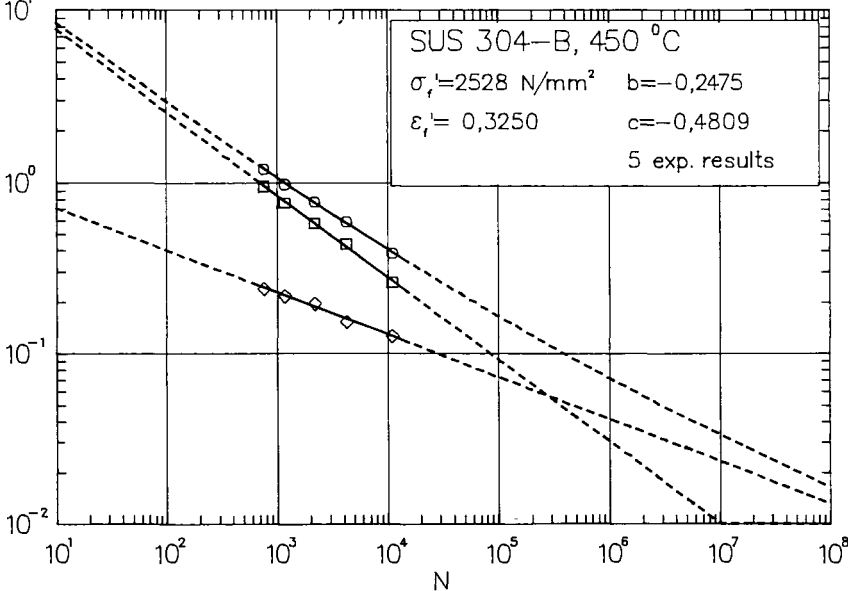
Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks :

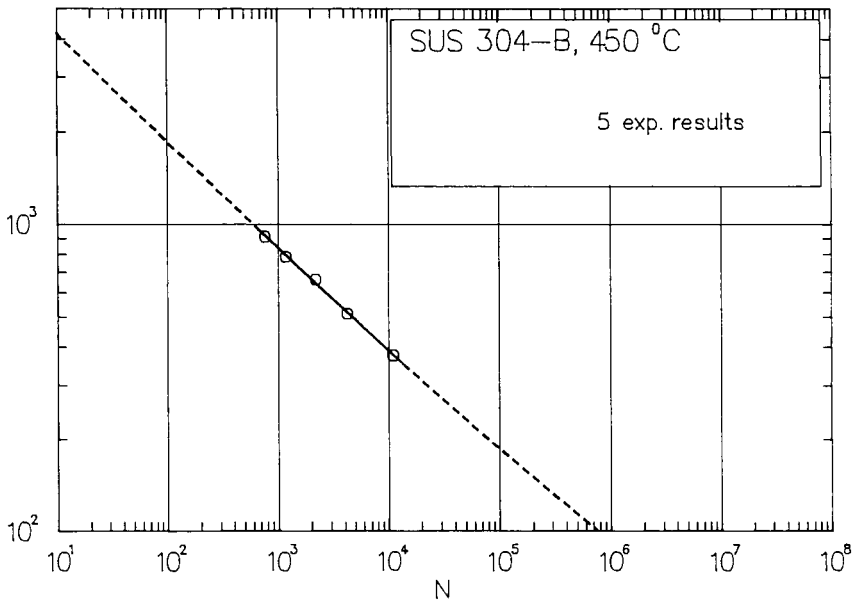
σ_a [N/mm²]



ϵ_a [%]



PSWT [N/mm²]



Material : SUS 304-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	407.6	0.0	1.1950	762.0
2.0000	368.9	0.0	0.9800	1172.0
3.0000	332.6	0.0	0.7750	2182.0
4.0000	260.5	0.0	0.5900	4220.0
5.0000	214.4	0.0	0.3850	10966.0

X 5 CrNi 18 9	1.4301	SUS 304-B
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Heat treatment : 1075°C/30', water
Test temperature : +450°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Al
0.067	0.57	1.45	0.033	0.012	8.02	18.28	0.082	0.058	0.001	0.001

Monotonic properties

E	=	170500	N/mm ²	ν	=	-
R _{p0.2}	=	106	N/mm ²	K	=	N/mm ²
R _m	=	435	N/mm ²	n	=	-
A ₅	=	47	%	σ_f	=	N/mm ²
Z	=	71	%	ϵ_f	=	-

Cyclic Properties

R' _{p0.2}	=	229	N/mm ²	K'	=	2363	N/mm ²
σ_g	=	79	N/mm ²	n'	=	0.375	-
ϵ_g	=	0.059	%	σ'_f	=	1700	N/mm ²
N _T	=	35610	cycles	ϵ'_f	=	0.386	-
T _{σ}	=	1.148	-	b	=	-0.202	-
T _{ep}	=	1.538	-	c	=	-0.529	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

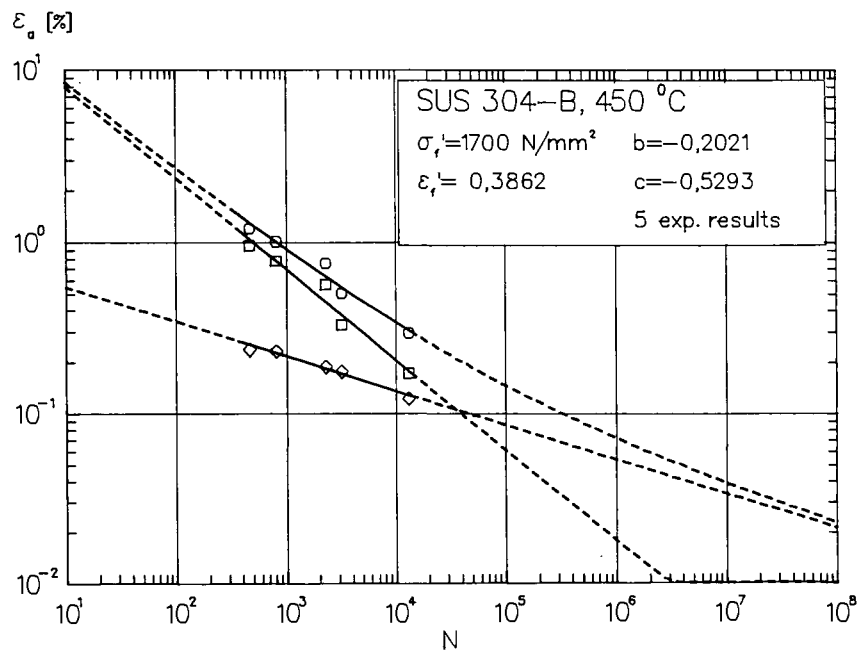
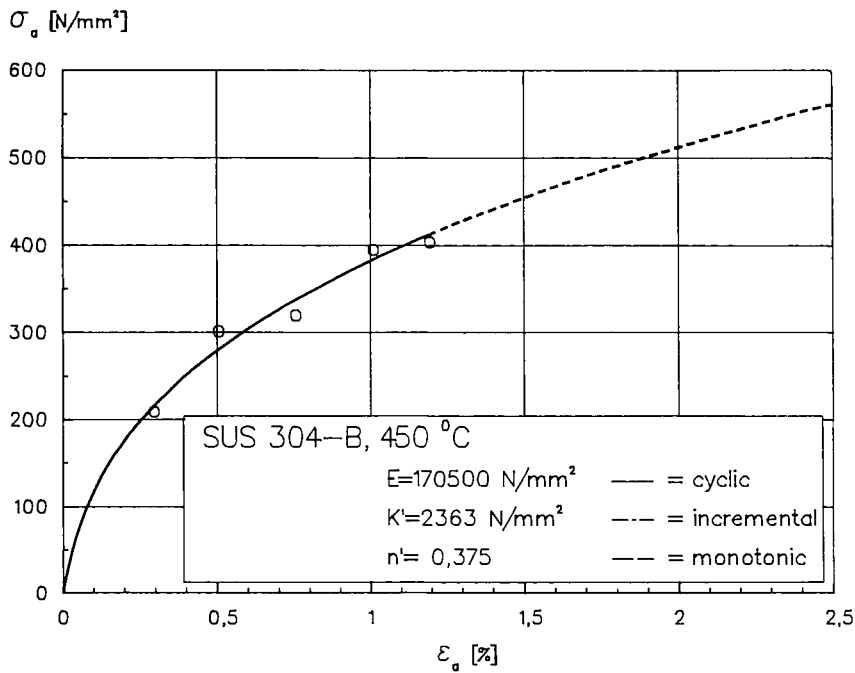
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

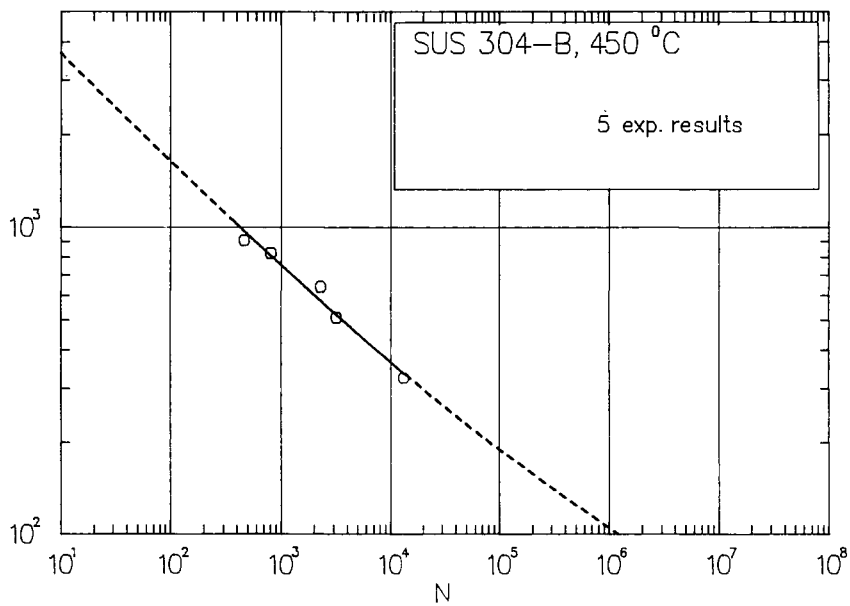
Cyclic test

Loading condition : total strain control, R_e = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 4.0 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 304-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	403.7	0.0	1.1950	462.0
2.0000	394.4	0.0	1.0100	806.0
3.0000	319.8	0.0	0.7550	2276.0
4.0000	301.2	0.0	0.5050	3167.0
5.0000	208.9	0.0	0.2950	13091.0

X 5 CrNi 18 9	1.4301	SUS 304-B
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Heat treatment : 1075°C/30', water
Test temperature : +450°C
Semifinished material : bar, Ø 22 mm
Reference : [4,11]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Al
0.067	0.57	1.45	0.033	0.012	8.02	18.28	0.082	0.058	0.001	0.001

Monotonic properties

E	=	170500	N/mm ²	ν	=	-
R _{p0.2}	=	106	N/mm ²	K	=	N/mm ²
R _m	=	435	N/mm ²	n	=	-
A ₅	=	47	%	σ_f	=	N/mm ²
Z	=	71	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	266	N/mm ²	K'	=	2193	N/mm ²
σ'_g	=	75	N/mm ²	n'	=	0.340	-
ϵ'_g	=	0.049	%	σ'_f	=	1890	N/mm ²
N _T	=	9317	cycles	ϵ'_f	=	0.653	-
T _{σ}	=	1.105	-	b	=	-0.212	-
T _{ϵp}	=	1.165	-	c	=	-0.627	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

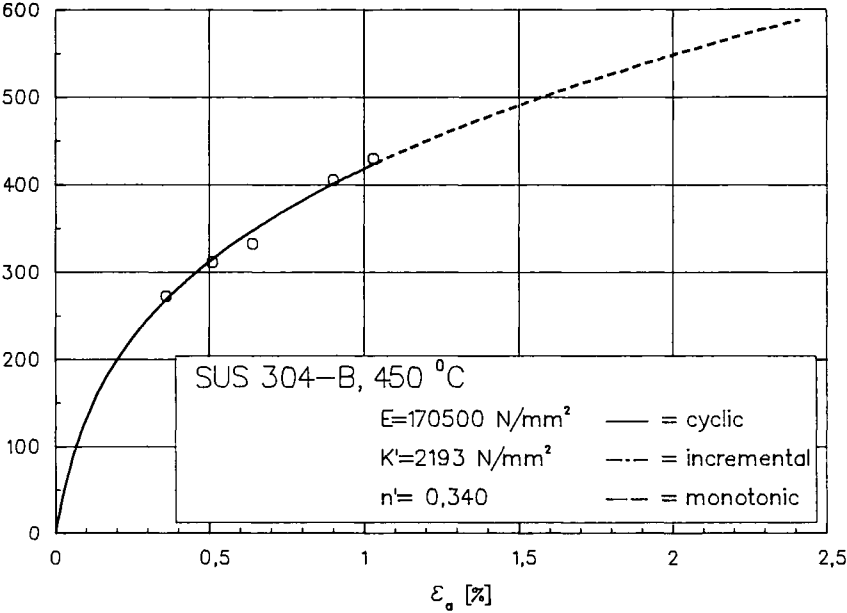
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

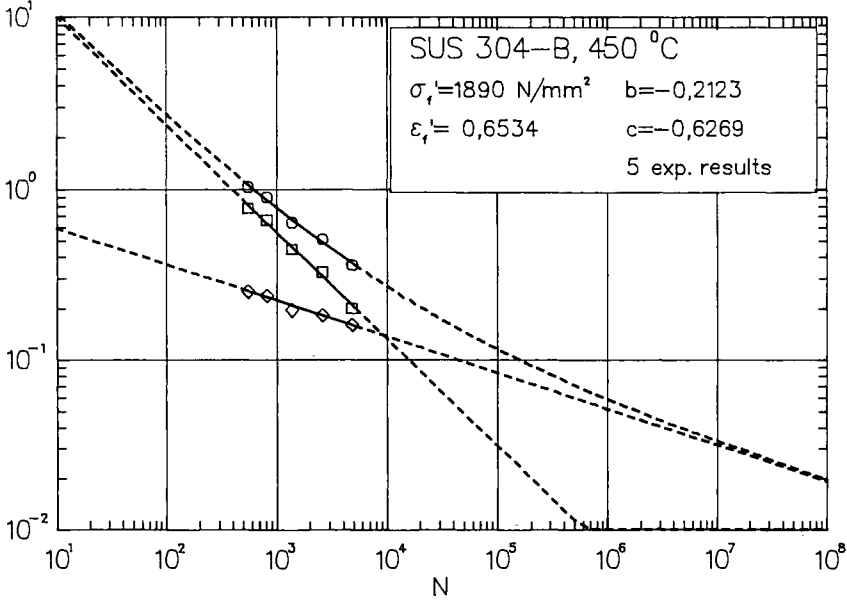
Loading condition : total strain control, R_e = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.4 (%/min)
Waveform : triangular

Remarks :

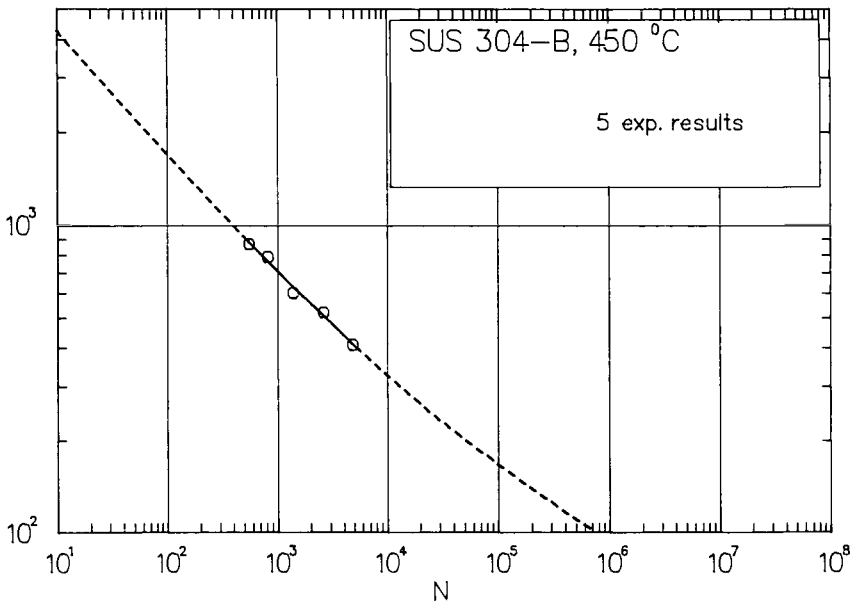
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 304-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	429.7	0.0	1.0300	549.0
2.0000	405.1	0.0	0.9000	815.0
3.0000	332.6	0.0	0.6400	1372.0
4.0000	311.5	0.0	0.5100	2590.0
5.0000	272.7	0.0	0.3600	4798.0

X 5 CrNi 18 9	1.4301	SUS 304-B
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Heat treatment : 1075°C/30', water
 Test temperature : +600°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.1]
 Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Al
0.067	0.57	1.45	0.033	0.012	8.02	18.28	0.082	0.058	0.001	0.001

Monotonic properties

E	=	158000	N/mm ²	ν	=	-
R _{p0.2}	=	92	N/mm ²	K	=	N/mm ²
R _m	=	373	N/mm ²	n	=	-
A ₅	=	42	%	σ_f	=	N/mm ²
Z	=	73	%	ϵ_f	=	-

Cyclic properties

R'p _{0.2}	=	217	N/mm ²	K'	=	1544	N/mm ²
σ'_g	=	94	N/mm ²	n'	=	0.316	-
ϵ'_g	=	0.073	%	σ'_f	=	1009	N/mm ²
N _T	=	27051	cycles	ϵ'_f	=	0.268	-
T _{σ}	=	1.100	-	b	=	-0.156	-
T _{ϵp}	=	1.130	-	c	=	-0.499	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

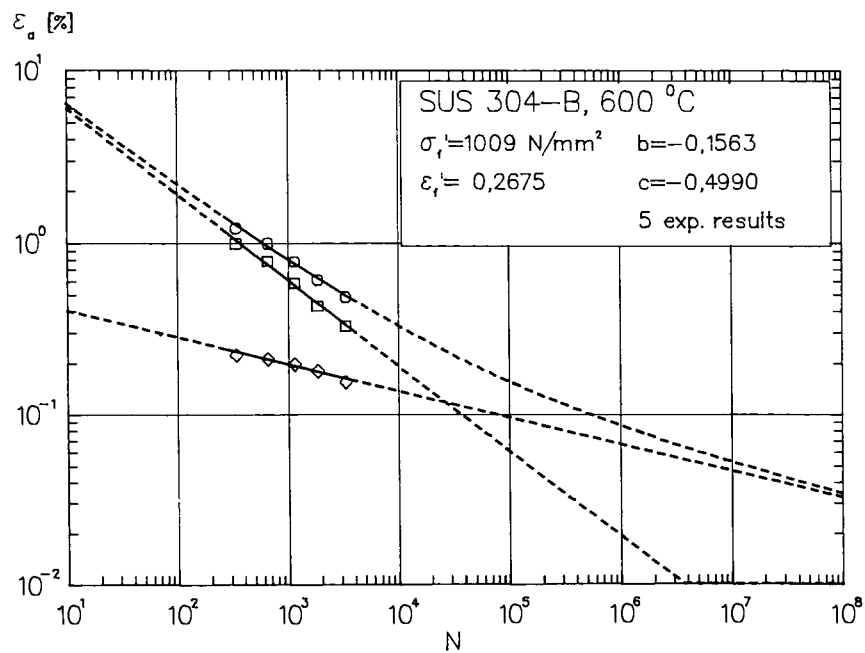
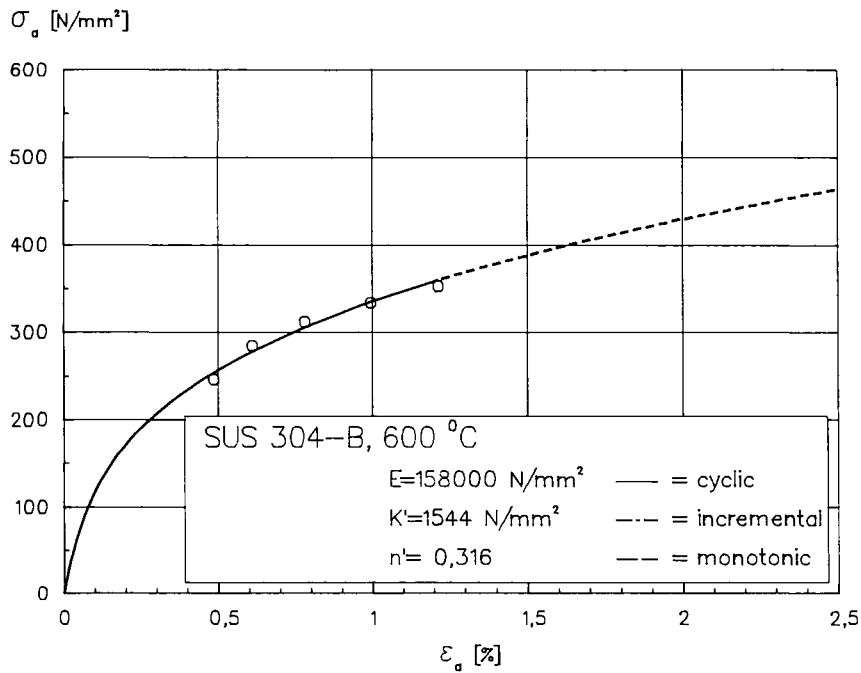
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

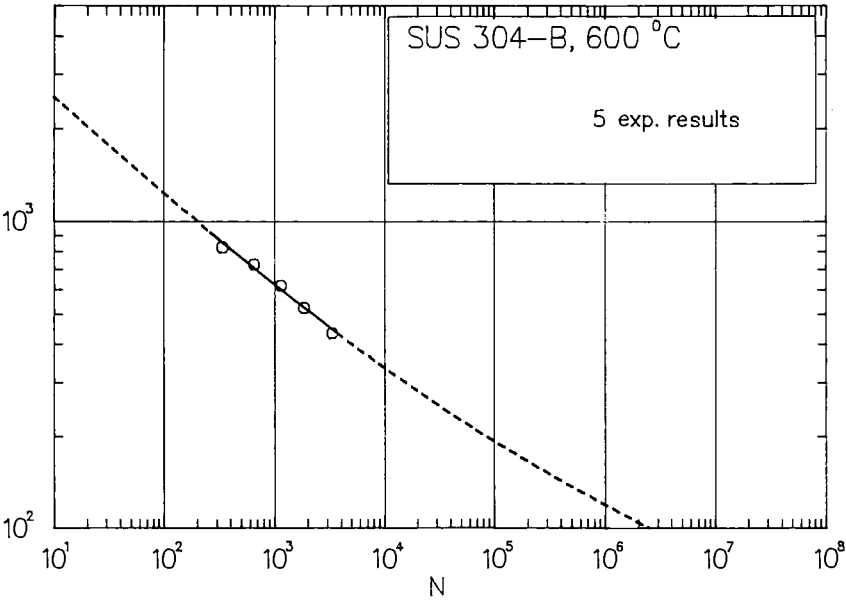
Cyclic test

Loading condition : total strain control. R _{ϵ} = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 304-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	353.2	0.0	1.2150	338.0
2.0000	334.0	0.0	0.9950	654.0
3.0000	312.0	0.0	0.7800	1144.0
4.0000	284.5	0.0	0.6100	1846.0
5.0000	246.2	0.0	0.4850	3318.0

X 5 CrNi 18 9	1.4301	SUS 304-B
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Heat treatment : 1075°C/30', water
 Test temperature : +600°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.1]
 Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Al
0.067	0.57	1.45	0.033	0.012	8.02	18.28	0.082	0.058	0.001	0.001

Monotonic properties

E	=	158000	N/mm ²	ν	=	-
R _{p0.2}	=	92	N/mm ²	K	=	N/mm ²
R _m	=	373	N/mm ²	n	=	-
A ₅	=	42	%	σ_f	=	N/mm ²
Z	=	73	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	238	N/mm ²	K'	=	1031	N/mm ²
σ_g	=	121	N/mm ²	n'	=	0.236	-
ϵ_g	=	0.088	%	σ'_f	=	728	N/mm ²
N _T	=	13427	cycles	ϵ'_f	=	0.224	-
T _{σ}	=	1.070	-	b	=	-0.118	-
T _{ep}	=	1.206	-	c	=	-0.499	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

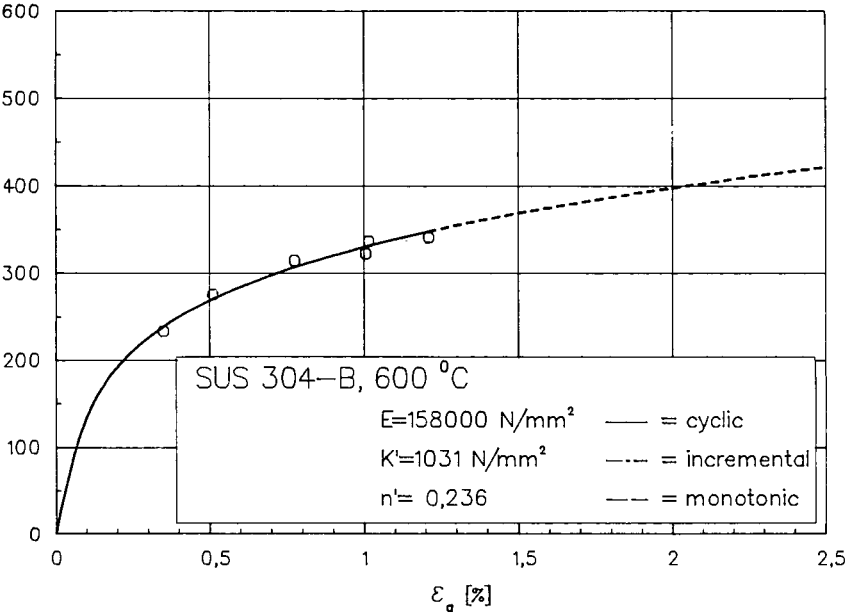
Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

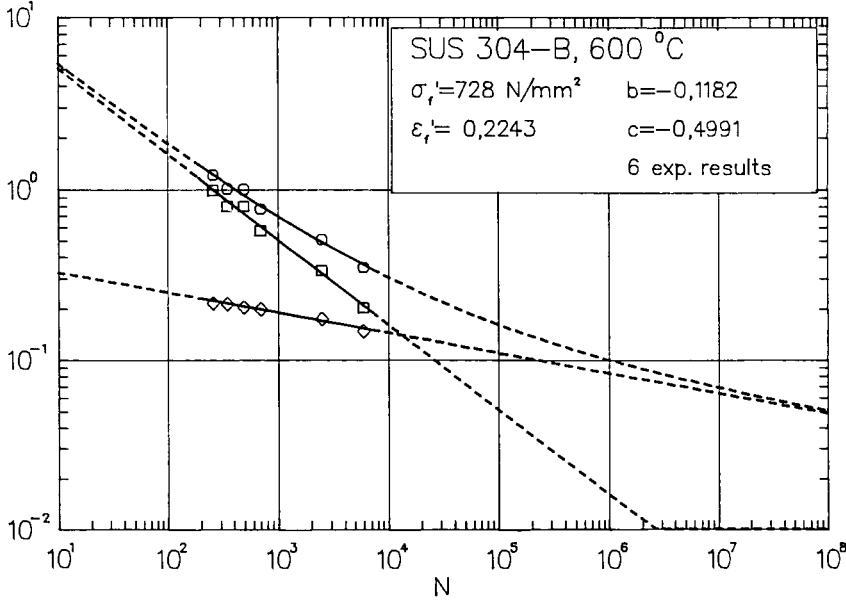
Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 4.0 (%/min)
 Waveform : triangular

Remarks :

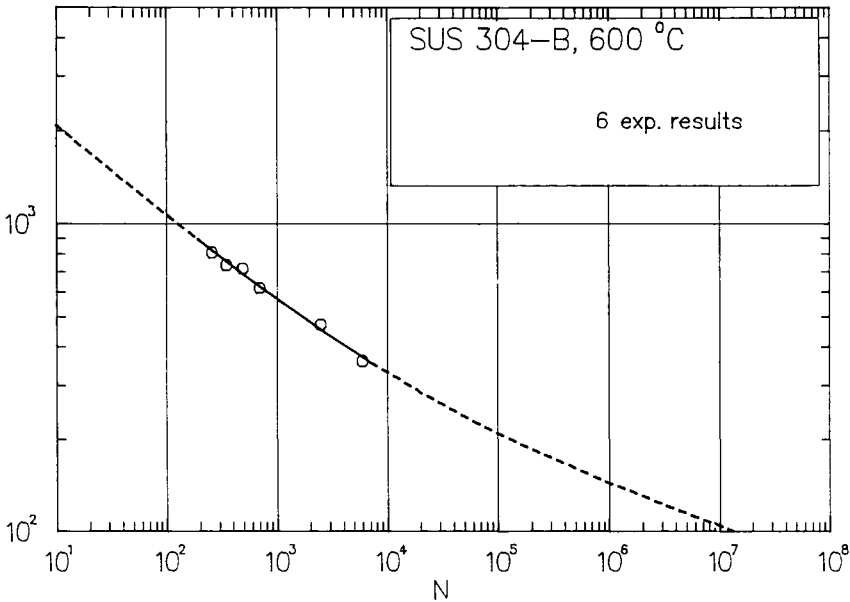
σ_a [N/mm²]



ϵ_a [%]



PSWT [N/mm²]



Material : SUS 304-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	340.9	0.0	1.2100	256.0
2.0000	337.0	0.0	1.0150	346.0
3.0000	322.8	0.0	1.0050	490.0
4.0000	314.4	0.0	0.7750	694.0
5.0000	275.7	0.0	0.5100	2471.0
6.0000	233.5	0.0	0.3500	5920.0

X 5 CrNi 18 9	1.4301	SUS 304-B
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Heat treatment : 1075°C/30', water
Test temperature : +600°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Al
0.067	0.57	1.45	0.033	0.012	8.02	18.28	0.082	0.058	0.001	0.001

Monotonic properties

E	=	158000	N/mm ²	ν	=	-
R _{p0.2}	=	92	N/mm ²	K	=	N/mm ²
R _m	=	373	N/mm ²	n	=	-
A ₅	=	42	%	σ _f	=	N/mm ²
Z	=	73	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	276	N/mm ²	K'	=	437	N/mm ²
σ _g	=	212	N/mm ²	n'	=	0.074	-
ε _g	=	0.139	%	σ' _f	=	394	N/mm ²
N _T	=	3626	cycles	ε' _f	=	0.262	-
T _σ	=	1.078	-	b	=	-0.041	-
T _{εp}	=	1.177	-	c	=	-0.564	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

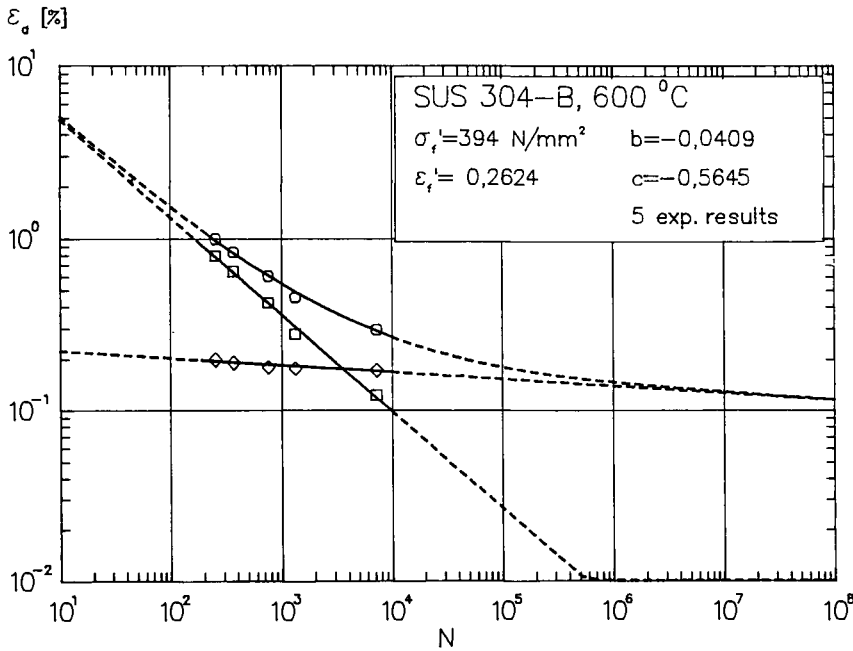
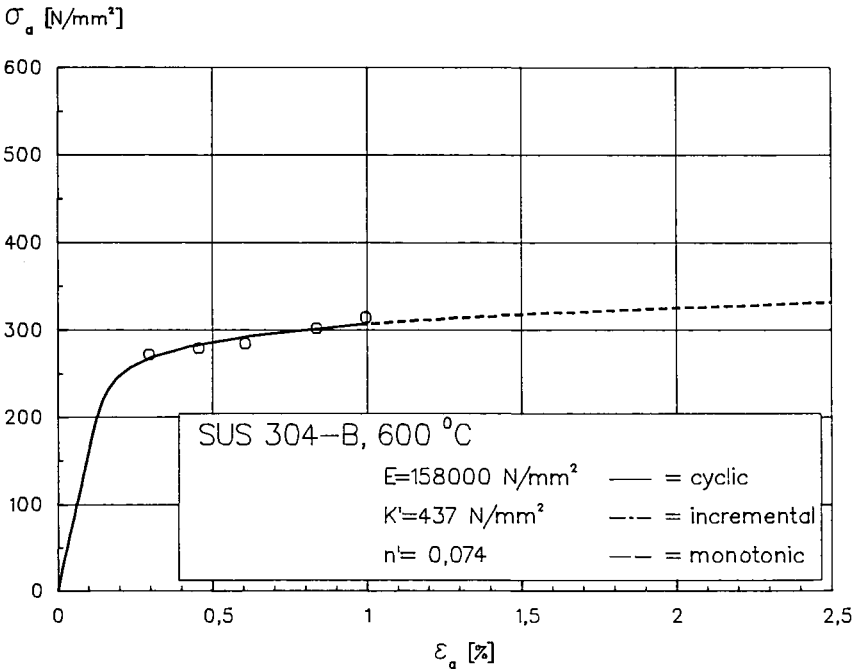
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

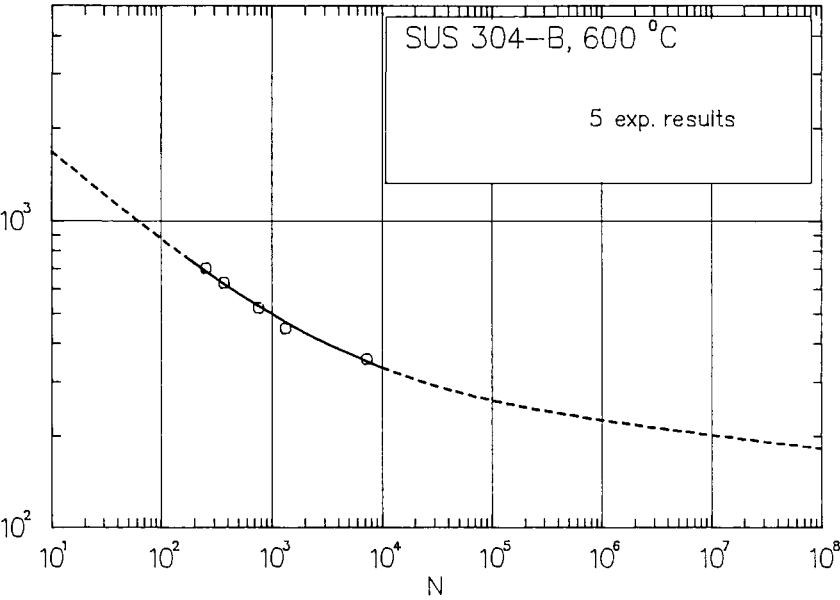
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.4 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 304-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	314.4	0.0	0.9950	253.0
2.0000	302.1	0.0	0.8350	369.0
3.0000	284.5	0.0	0.6050	761.0
4.0000	279.1	0.0	0.4550	1328.0
5.0000	272.2	0.0	0.2950	7224.0

X 5 CrNi 18 9	1.4301	SUS 304-B
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Heat treatment : 1075°C/30', water
 Test temperature : +700°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.1]
 Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Al
0.067	0.57	1.45	0.033	0.012	8.02	18.28	0.082	0.058	0.001	0.001

Monotonic properties

E	=	152000	N/mm ²	v	=	-
R _{p0.2}	=	81	N/mm ²	K	=	N/mm ²
R _m	=	278	N/mm ²	n	=	-
A ₅	=	55	%	σ _f	=	N/mm ²
Z	=	77	%	ε _f	=	-

Cyclic properties

R'p0.2	=	190	N/mm ²	K'	=	473	N/mm ²
σ _g	=	122	N/mm ²	n'	=	0.147	-
ε _g	=	0.089	%	σ'f	=	382	N/mm ²
N _T	=	14956	cycles	ε'f	=	0.255	-
T _σ	=	1.098	-	b	=	-0.075	-
T _{ep}	=	1.121	-	c	=	-0.523	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ε-values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

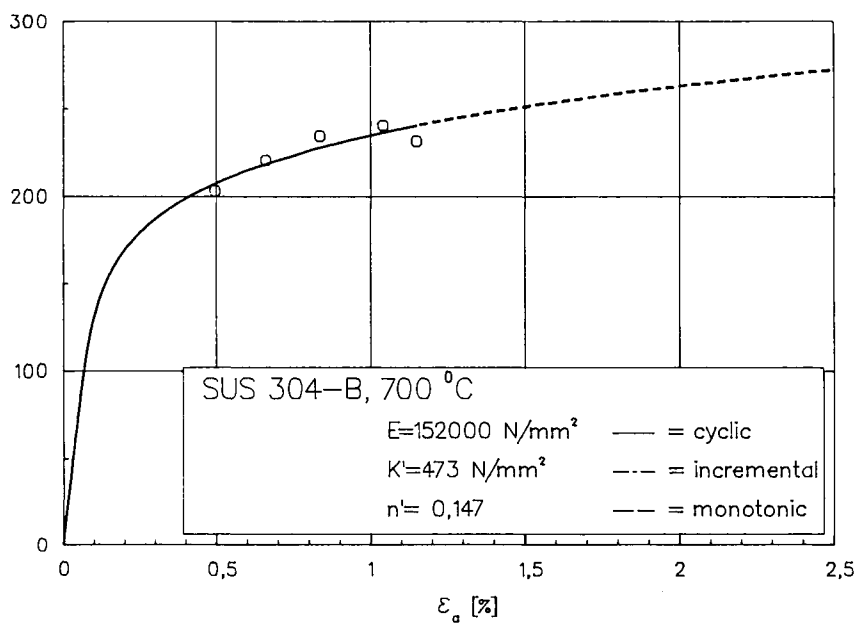
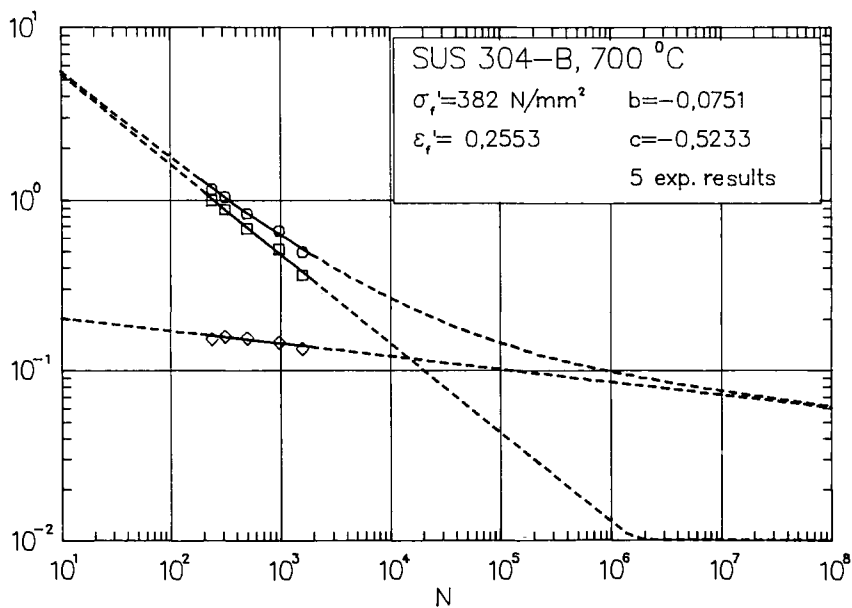
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

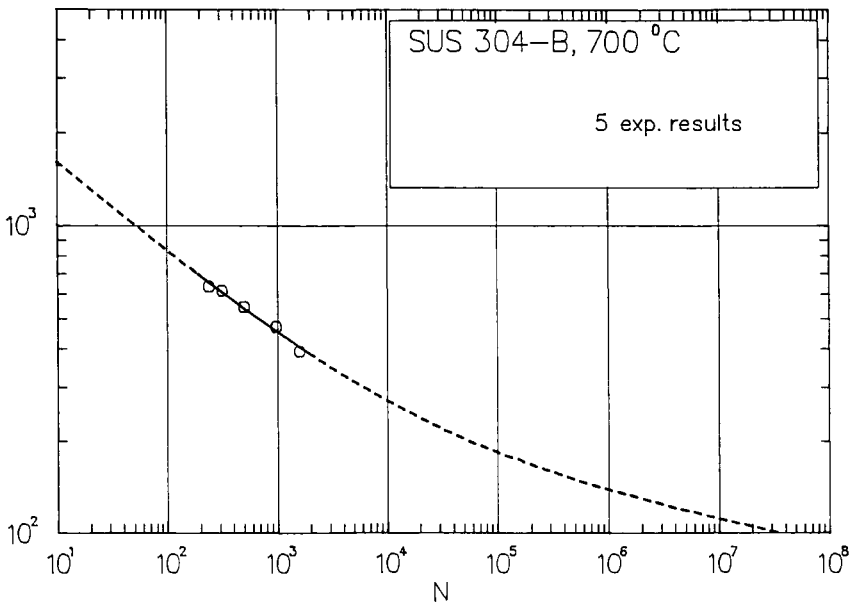
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUS 304-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	231.5	0.0	1.1500	238.0
2.0000	240.4	0.0	1.0400	315.0
3.0000	234.5	0.0	0.8350	497.0
4.0000	220.7	0.0	0.6600	975.0
5.0000	203.1	0.0	0.4950	1581.0

X 5 CrNi 18 9	1.4301	SUS 304-B
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Heat treatment : 1075^oC/30', water
Test temperature : +700^oC
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Al
0.067	0.57	1.45	0.033	0.012	8.02	18.28	0.082	0.058	0.001	0.001

Monotonic properties

E	=	152000	N/mm ²	ν	=	-
R _{p0.2}	=	81	N/mm ²	K	=	N/mm ²
R _m	=	278	N/mm ²	n	=	-
A ₅	=	55	%	σ _f	=	N/mm ²
Z	=	77	%	e _f	=	-

Cyclic properties

R' _{p0.2}	=	158	N/mm ²	K'	=	587	N/mm ²
σ _g	=	93	N/mm ²	n'	=	0.212	-
e _g	=	0.079	%	σ' _f	=	389	N/mm ²
N _T	=	51546	cycles	e' _f	=	0.138	-
T _σ	=	1.033	-	b	=	-0.094	-
T _{εp}	=	1.293	-	c	=	-0.4392	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
σ/e-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

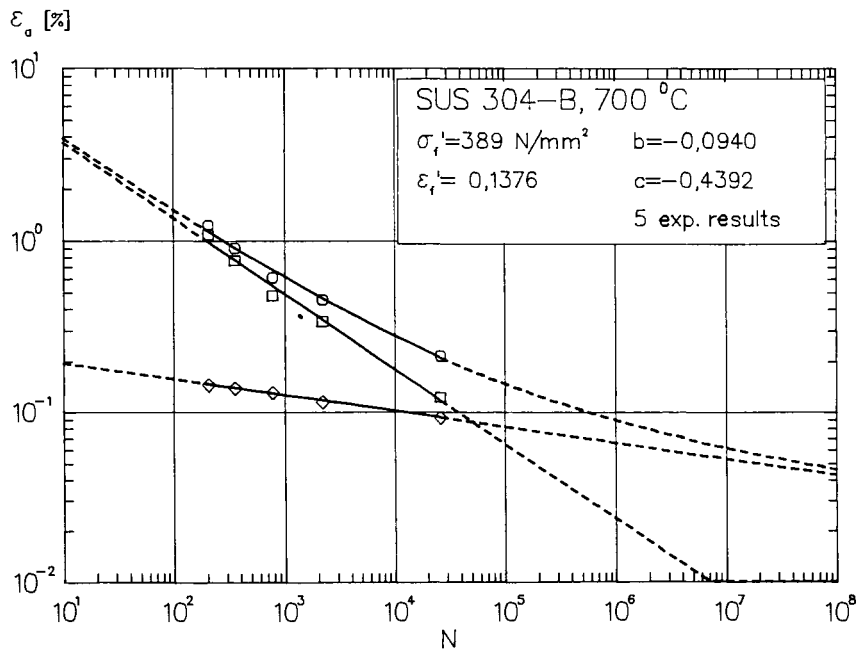
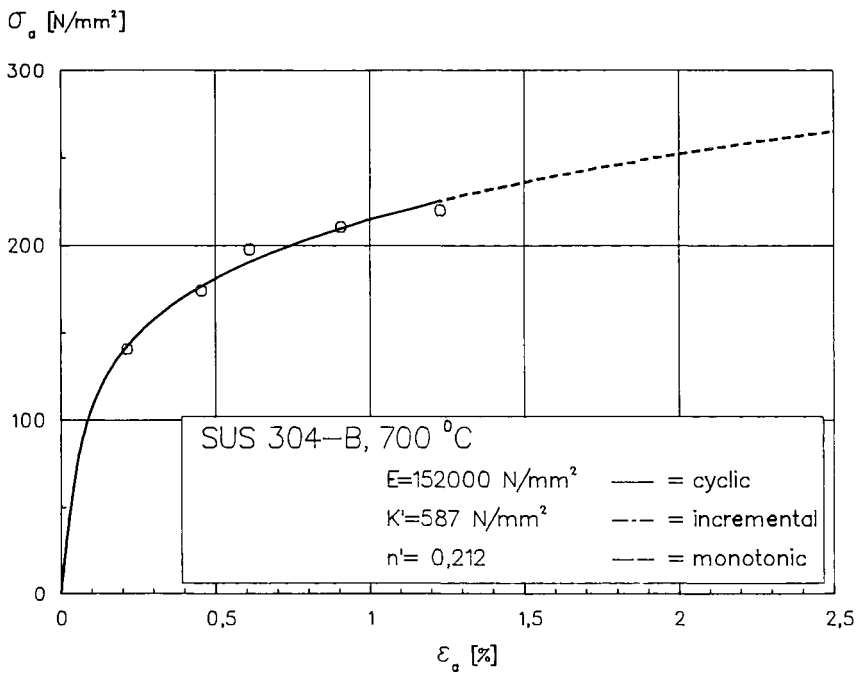
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

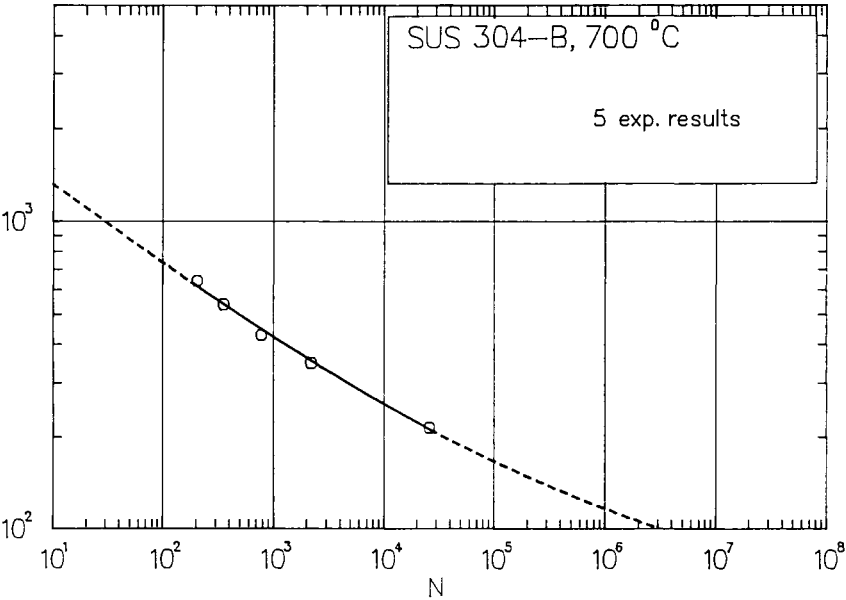
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 4.0 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 304-B, 700 °C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	220.2	0.0	1.2300	205.0
2.0000	210.4	0.0	0.9050	356.0
3.0000	197.7	0.0	0.6100	778.0
4.0000	174.1	0.0	0.4550	2191.0
5.0000	140.8	0.0	0.2150	25977.0

X 5 CrNi 18 9	1.4301	SUS 304-B
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Heat treatment : 1075°C/30', water
Test temperature : +700°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Al
0.067	0.57	1.45	0.033	0.012	8.02	18.28	0.082	0.058	0.001	0.001

Monotonic properties

E	=	152000	N/mm ²	ν	=	-
R _{p0.2}	=	81	N/mm ²	K	=	N/mm ²
R _m	=	192	N/mm ²	n	=	-
A ₅	=	76	%	σ_f	=	N/mm ²
Z	=	82	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	143	N/mm ²	K'	=	372	N/mm ²
σ_g	=	90	N/mm ²	n'	=	0.154	-
ϵ_g	=	0.070	%	σ'_f	=	286	N/mm ²
N _T	=	29102	cycles	ϵ'_f	=	0.182	-
T _{σ}	=	1.020	-	b	=	-0.076	-
T _{ϵ_p}	=	1.181	-	c	=	-0.493	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

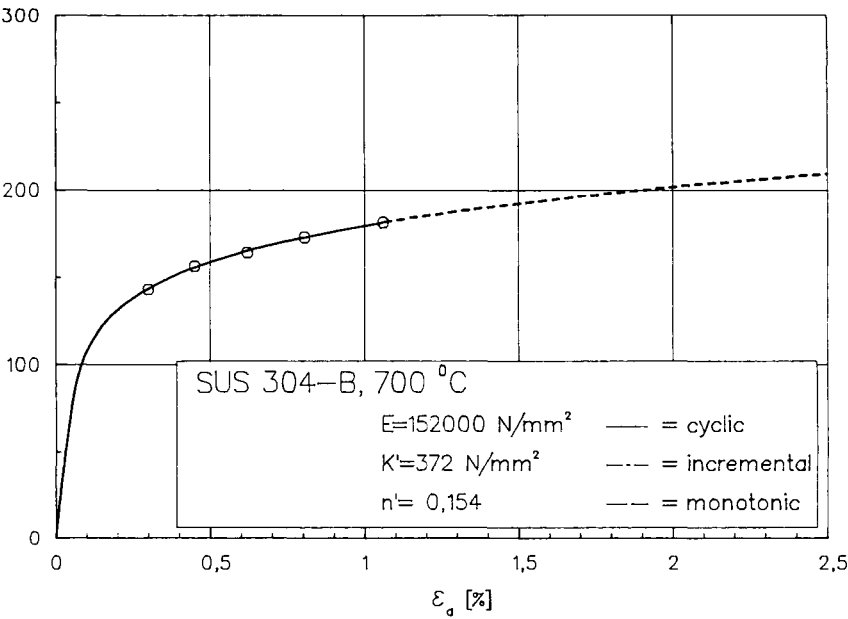
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

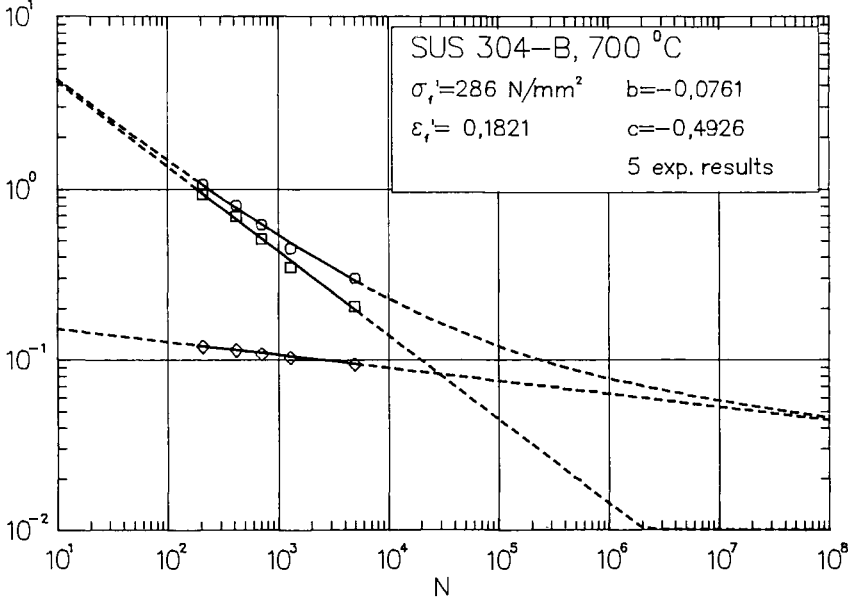
Loading condition : total strain control, R _{ϵ} = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.4 (%/min)
Waveform : triangular

Remarks :

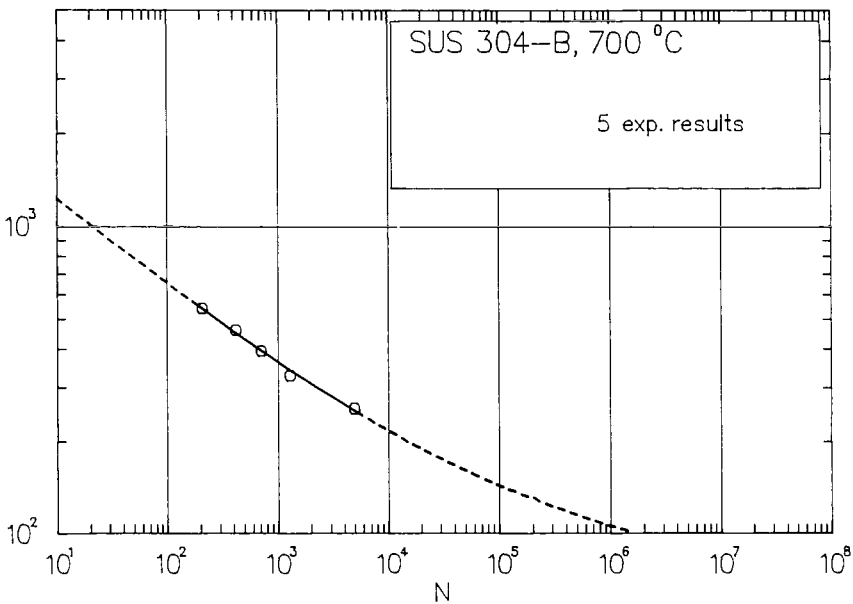
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 304-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	181.5	0.0	1.0600	207.0
2.0000	173.1	0.0	0.8050	416.0
3.0000	164.3	0.0	0.6200	707.0
4.0000	156.5	0.0	0.4500	1285.0
5.0000	143.2	0.0	0.3000	4914.0

X 5 CrNi 18 9	1.4301	SUS 304-B
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Heat treatment : 1075°C/30', water
 Test temperature : +800°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.1]
 Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Al
0.067	0.57	1.45	0.033	0.012	8.02	18.28	0.082	0.058	0.001	0.001

Monotonic properties

E	=	160000	N/mm ²	ν	=	-
R _{p0.2}	=	73	N/mm ²	K	=	N/mm ²
R _m	=	192	N/mm ²	n	=	-
A ₅	=	76	%	σ _f	=	N/mm ²
Z	=	82	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	136	N/mm ²	K'	=	365	N/mm ²
σ _g	=	88	N/mm ²	n'	=	0.159	-
ε _g	=	0.068	%	σ' _f	=	283	N/mm ²
N _T	=	55006	cycles	ε' _f	=	0.210	-
T _σ	=	1.064	-	b	=	-0.077	-
T _{εp}	=	1.052	-	c	=	-0.488	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks : Young's modulus estimated

hardness :

Microstructure :

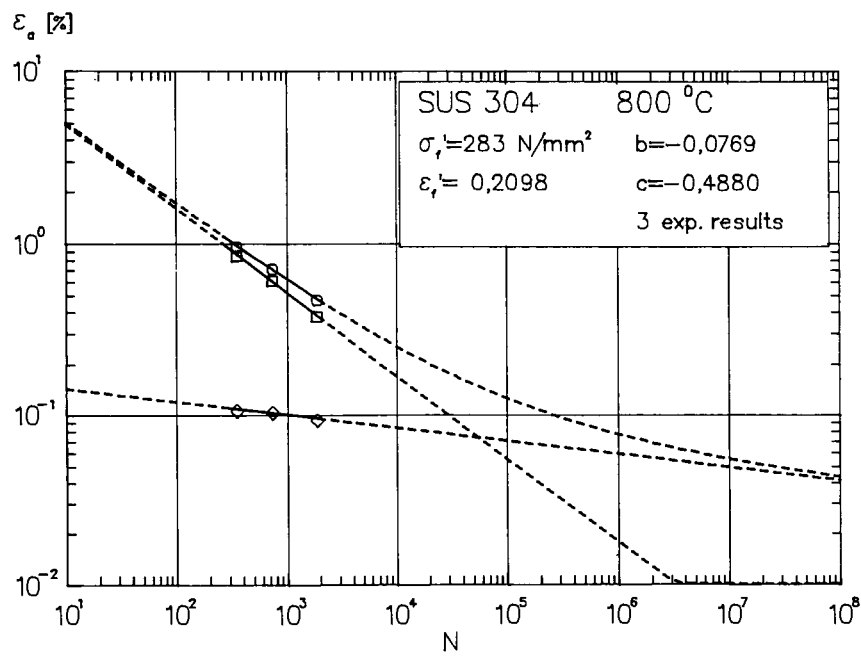
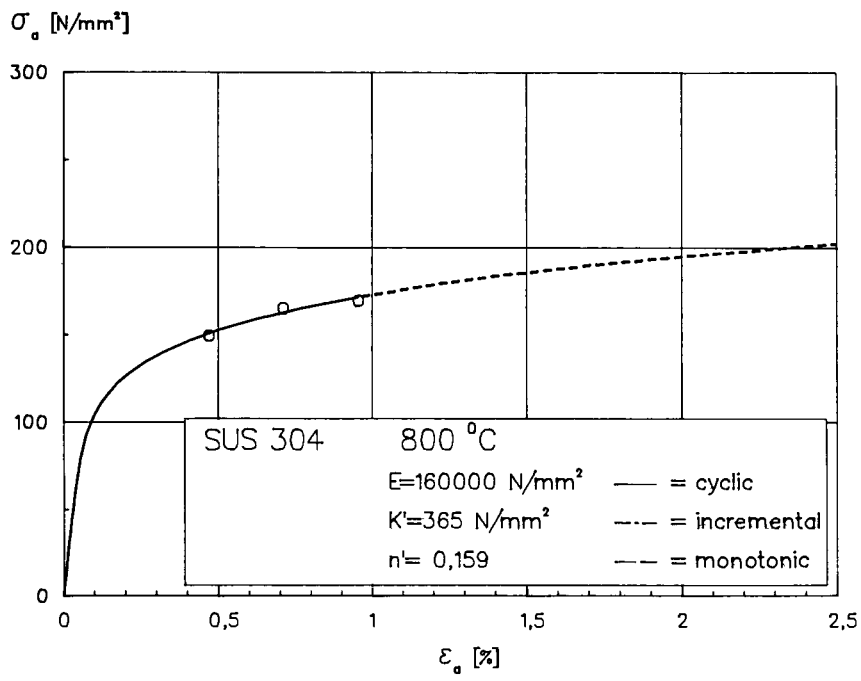
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

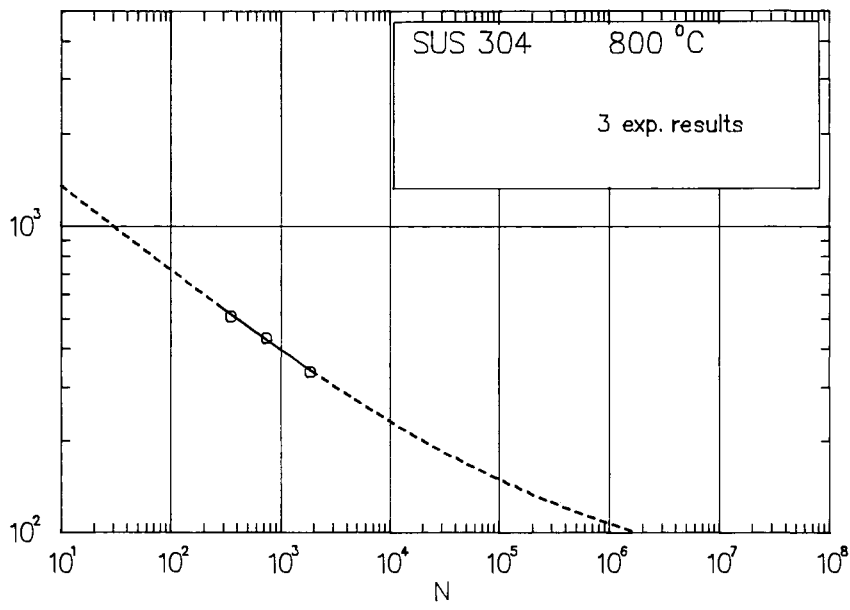
Cyclic test

Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 38 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 304-HP, 800°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	169.7	0.0	0.9550	351.0
2.0000	165.3	0.0	0.7100	735.0
3.0000	149.6	0.0	0.4700	1865.0

X 5 CrNi 18 9	1.4301	SUS 304-B
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Heat treatment : 1075°C/30', water
Test temperature : +800°C
Semifinished material : bar, Ø 22 mm
Reference : [4.11]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Al
0.067	0.57	1.45	0.033	0.012	8.02	18.28	0.082	0.058	0.001	0.001

Monotonic properties

E	=	160000	N/mm ²	v	=	-
R _{p0.2}	=	73	N/mm ²	K	=	N/mm ²
R _m	=	192	N/mm ²	n	=	-
A ₅	=	76	%	σ _f	=	N/mm ²
Z	=	82	%	ε _f	=	-

Cyclic properties

R _{p0.2}	=	100	N/mm ²	K'	=	146	N/mm ²
σ _g	=	74	N/mm ²	n'	=	0.063	-
ε _g	=	0.048	%	σ' _f	=	141	N/mm ²
N _T	=	13607	cycles	ε' _f	=	0.451	-
T _σ	=	1.066	-	b	=	-0.043	-
T _{εp}	=	1.086	-	c	=	-0.653	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

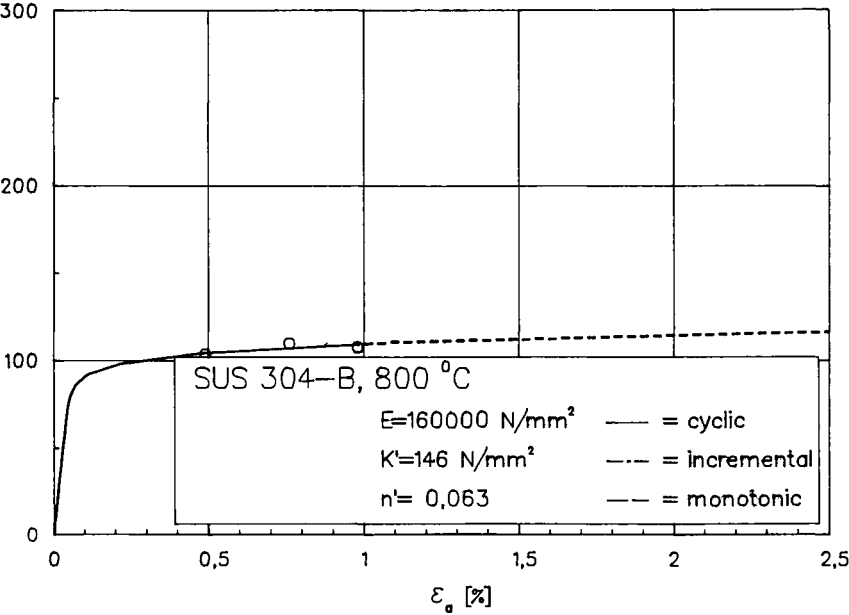
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

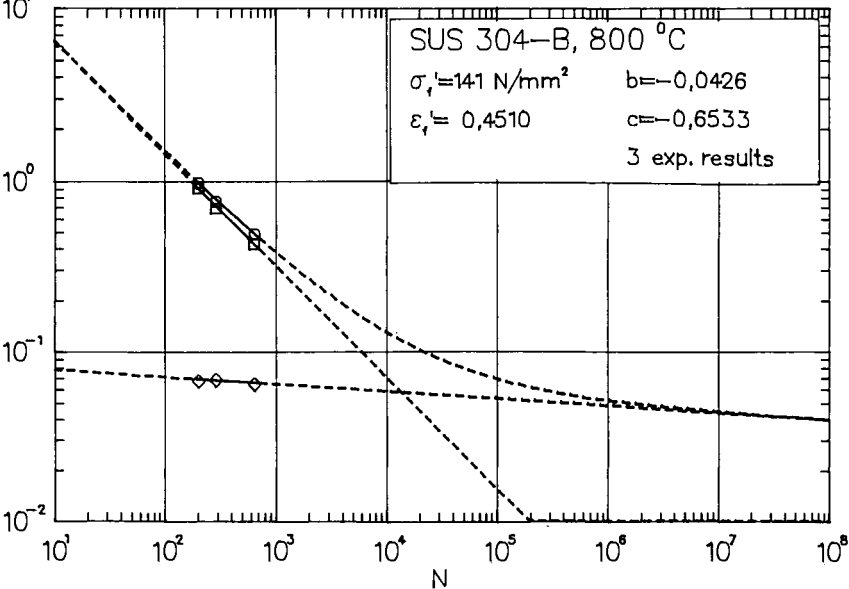
Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.39 (%/min)
Waveform : triangular

Remarks :

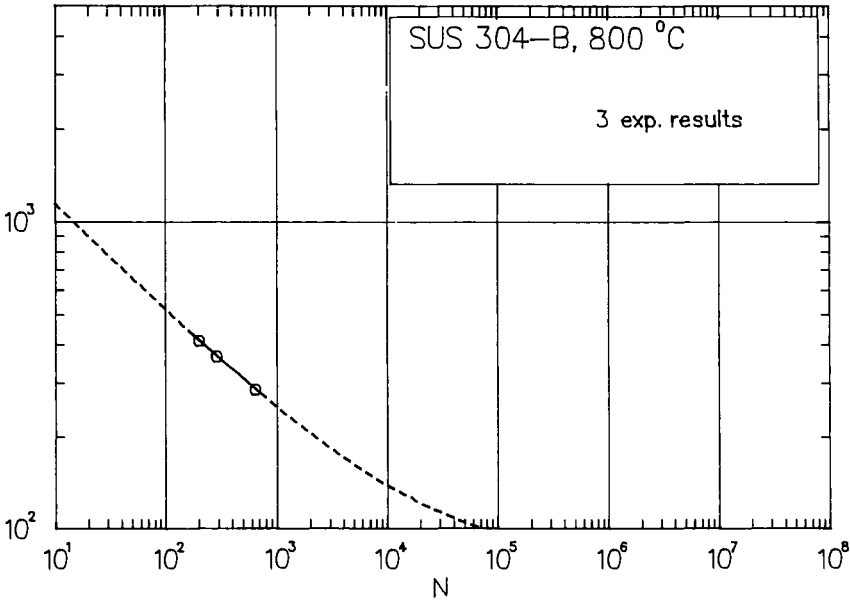
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 304-B, 800°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	107.9	0.0	0.9800	201.0
2.0000	109.9	0.0	0.7600	288.0
3.0000	103.5	0.0	0.4900	638.0

X 5 CrNiMo 18 10	1.4401	Type 316
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Heat treatment : 1066°C/30' argon, air cooling 82°C/min
Test temperature : +21°C
Semifinished material : plate, 25.4 mm thick
Reference : [4.6]
Year : 1982

Chemical composition

Hardness : Rockwell B: 71 - 77

Microstructure : ASTM grain size: 3.5

Monotonic properties

E	=	205000	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=		%	σ _f	=	N/mm ²
Z	=		%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	266	N/mm ²	K'	=	691	N/mm ²
σ _g	=	199	N/mm ²	n'	=	0.154	-
ε _g	=	0.132	%	σ' _f	=	660	N/mm ²
N _T	=	3220072	cycles	ε' _f	=	0.341	-
T _σ	=	1.109	-	b	=	-0.079	-
T _{εp}	=	1.562	-	c	=	-0.453	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete fracture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

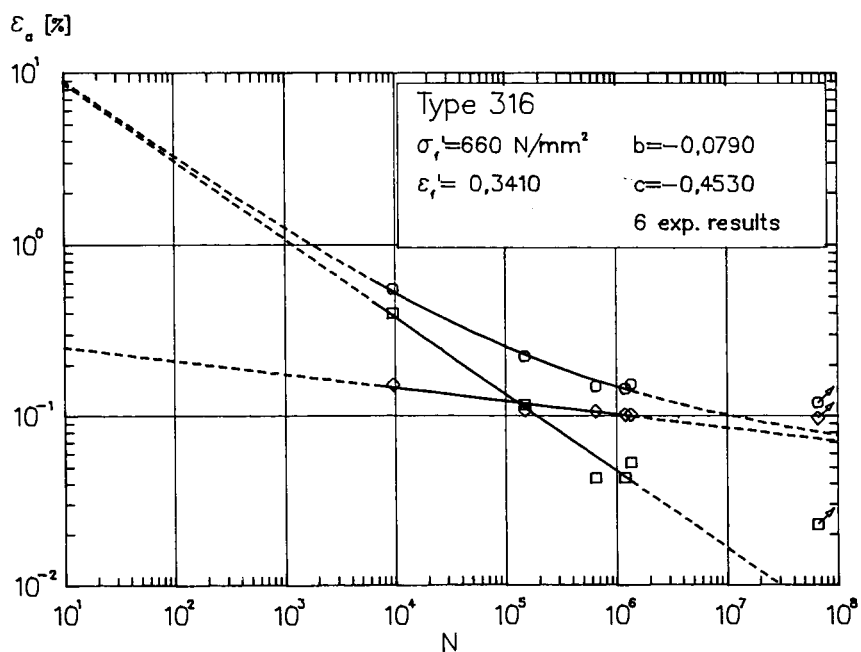
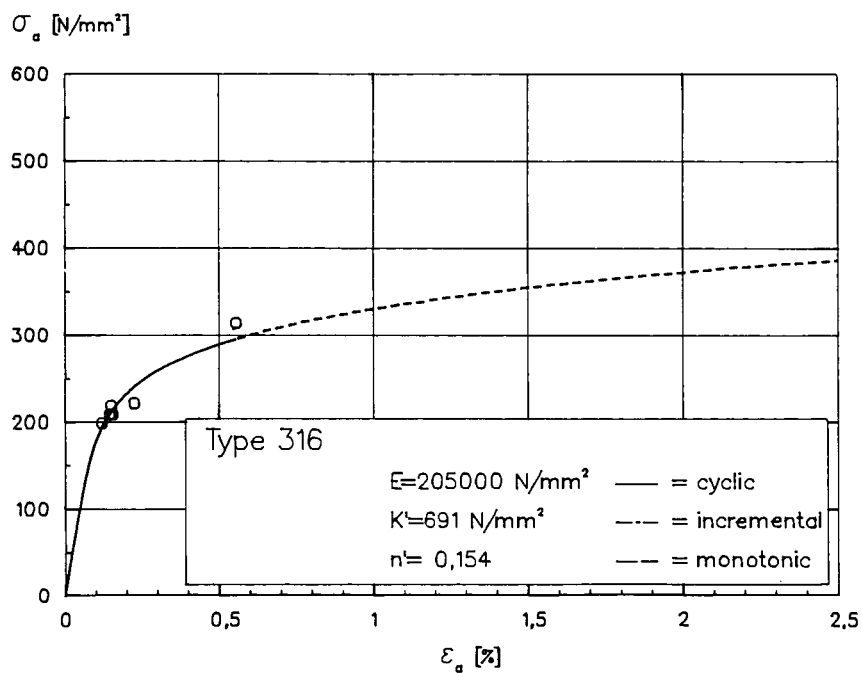
Monotonic test

Loading condition :
Specimen :
Specimen location :
Gauge length :
Testing machine :
Strain rate :

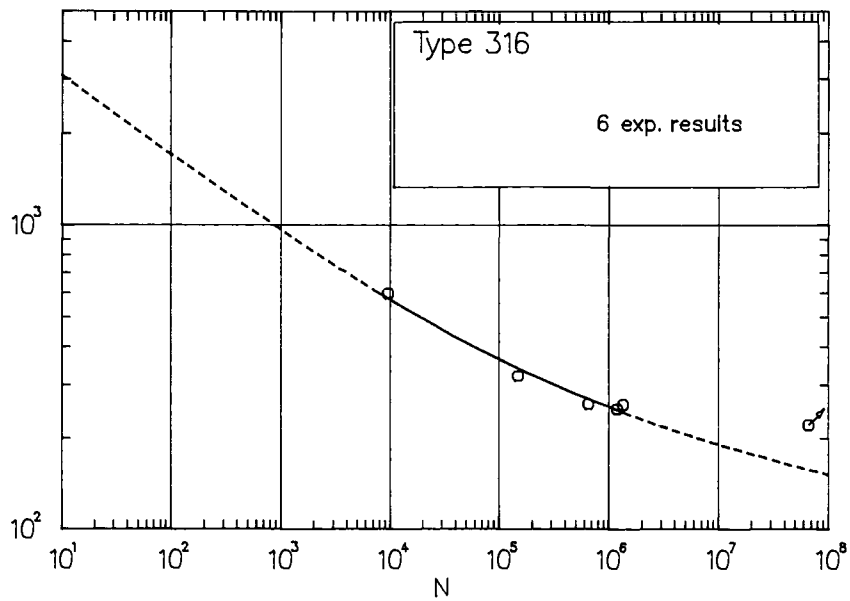
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6.35 mm
Surface :
Specimen location :
Gauge length : 12.7 mm
Testing machine :
Frequency :
Strain rate : 24 (%/min)
Waveform :

Remarks :



PSWT [N/mm²]



Material : Type 316

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	314.0	0.0	0.5550	9543.0
2.0000	222.0	0.0	0.2250	147900.0
5.0000	219.0	0.0	0.1500	647400.0
6.0000	209.0	0.0	0.1450	1190000.0
3.0000	209.0	0.0	0.1550	1340000.0
4.0000	199.0	0.0	0.1200	>66000000.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1075°C/30' water, 1100°C/1h water
 Test temperature : +23°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.1]
 Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.075	0.77	1.49	0.030	0.009	10.02	16.45	2.09	0.18	0.040	0.098

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	231	N/mm ²	K	=	N/mm ²
R _m	=	587	N/mm ²	n	=	-
A ₅	=	68	%	σ_f	=	N/mm ²
Z	=	78	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	247	N/mm ²	K'	=	2755	N/mm ²
σ_g	=	79	N/mm ²	n'	=	0.388	-
ϵ_g	=	0.049	%	σ'_f	=	2508	N/mm ²
N _T	=	59769	cycles	ϵ'_f	=	0.758	-
T _{σ}	=	1.087	-	b	=	-0.227	-
T _{ep}	=	1.376	-	c	=	-0.582	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness : HV 10 : 138

Microstructure : grain size : 1.9

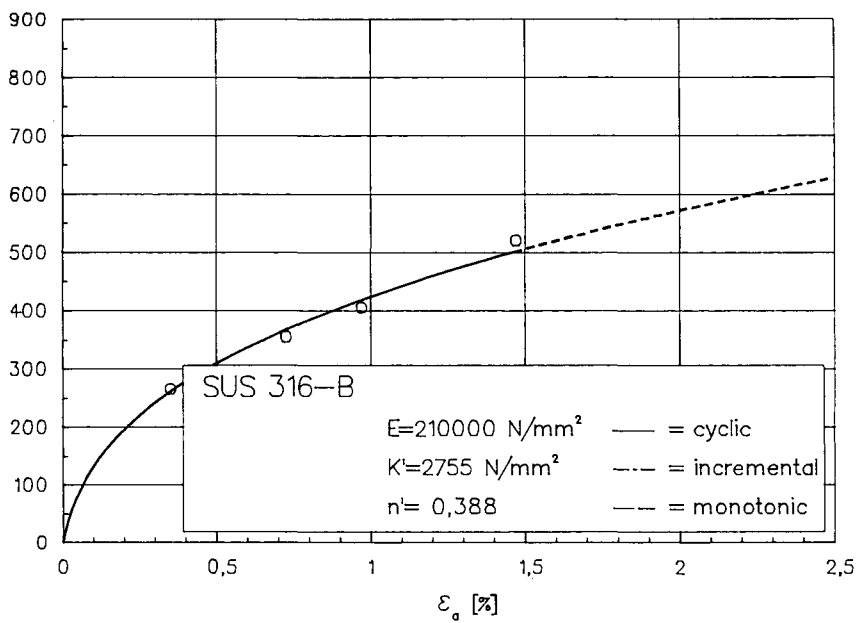
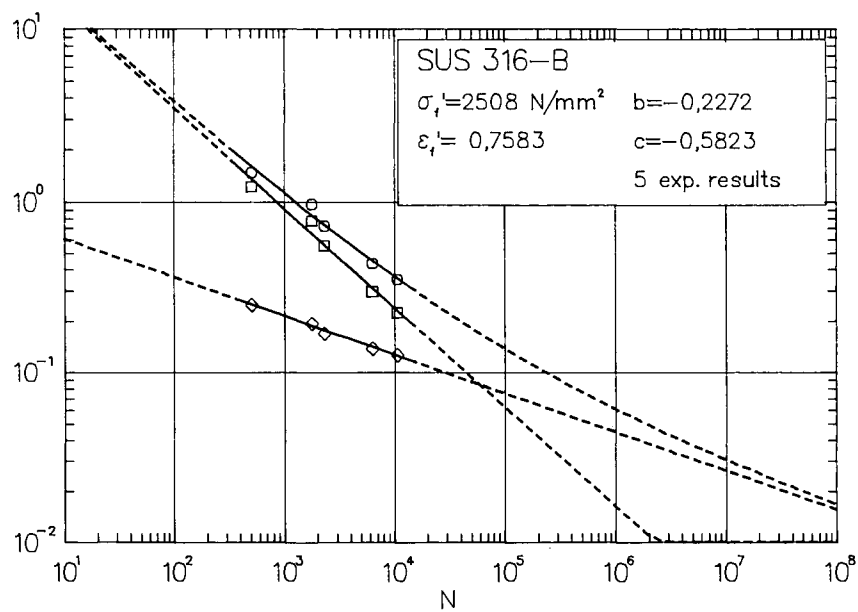
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

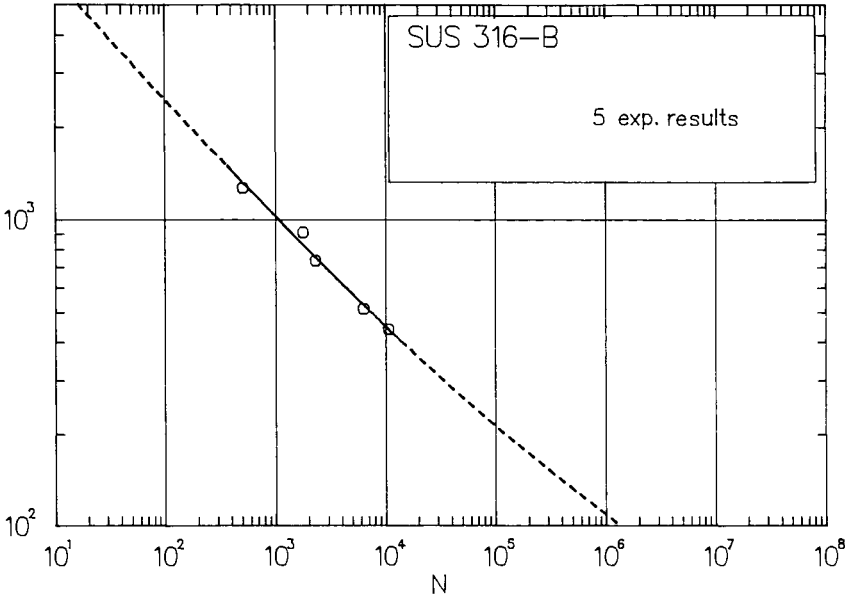
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 39 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²] ϵ_a [%]

PSWT [N/mm²]



Material : SUS 316-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	520.9	0.0	1.4700	505.0
2.0000	405.6	0.0	0.9700	1777.0
3.0000	355.6	0.0	0.7250	2296.0
4.0000	289.9	0.0	0.4350	6276.0
5.0000	264.9	0.0	0.3500	10598.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1050°C/30' water
Test temperature : +23°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.081	0.52	1.60	0.027	0.006	10.15	16.73	2.18	0.088	0.033	0.032

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	228	N/mm ²	K	=	N/mm ²
R _m	=	665	N/mm ²	n	=	-
A ₅	=	67	%	σ _f	=	N/mm ²
Z	=	81	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	259	N/mm ²	K'	=	2674	N/mm ²
σ' _g	=	134	N/mm ²	n'	=	0.376	-
ε' _g	=	0.098	%	σ' _f	=	1595	N/mm ²
N _T	=	211542	cycles	ε' _f	=	0.252	-
T _σ	=	1.149	-	b	=	-0.163	-
T _{εp}	=	1.103	-	c	=	-0.433	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness : HV 10 : 149

Microstructure :

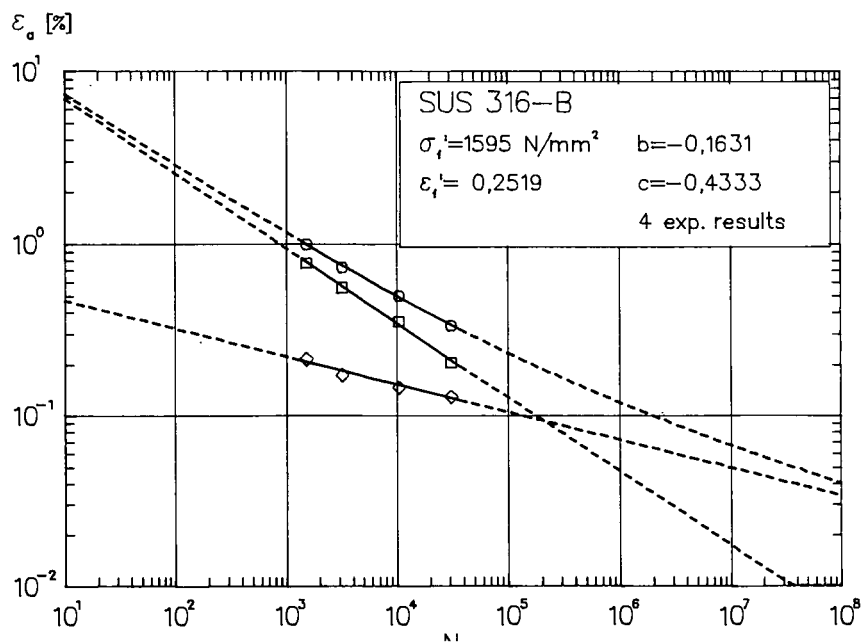
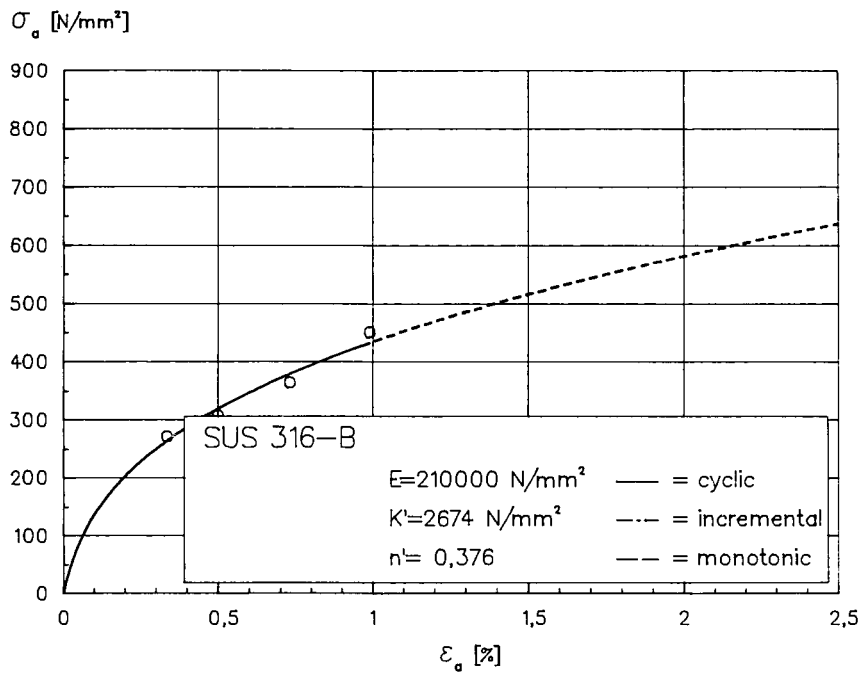
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 6 mm
Specimen location : in rolling direction
Gauge length : 30 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

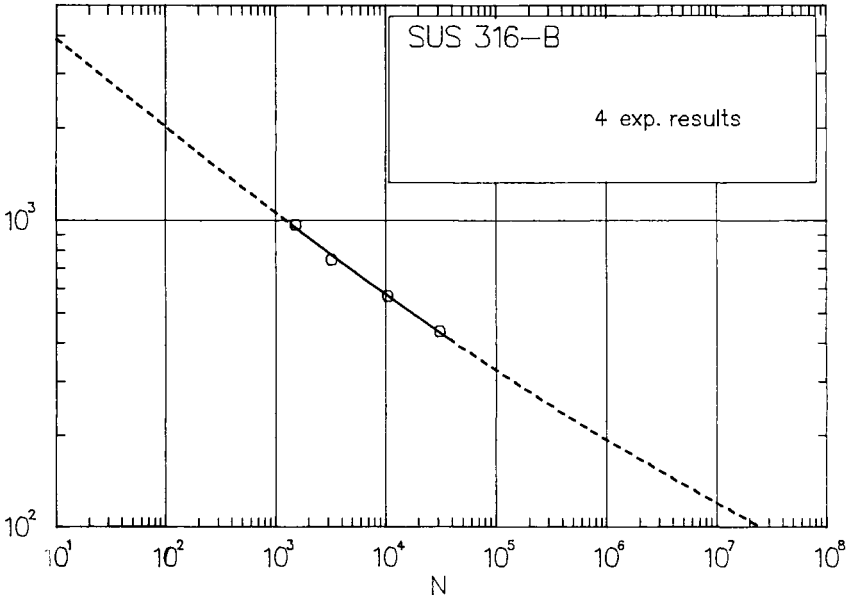
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	451.3	0.0	0.9900	1519.0
2.0000	364.0	0.0	0.7300	3210.0
3.0000	307.5	0.0	0.5000	10462.0
4.0000	271.3	0.0	0.3350	31047.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1075°C/30' water, 1100°C/1h water
Test temperature : +23°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.075	0.77	1.49	0.030	0.009	10.02	16.45	2.09	0.18	0.040	0.098

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	230	N/mm ²	K	=	N/mm ²
R _m	=	587	N/mm ²	n	=	-
A ₅	=	68	%	σ_f	=	N/mm ²
Z	=	78	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	256	N/mm ²	K'	=	1644	N/mm ²
σ_g	=	112	N/mm ²	n'	=	0.299	-
ϵ_g	=	0.066	%	σ'_f	=	1491	N/mm ²
N _T	=	53723	cycles	ϵ'_f	=	0.708	-
T _{σ}	=	1.081	-	b	=	-0.170	-
T _{ϵ_p}	=	1.275	-	c	=	-0.568	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

c/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness : HV 10 : 138

Microstructure : grain size : 1.9

Monotonic test

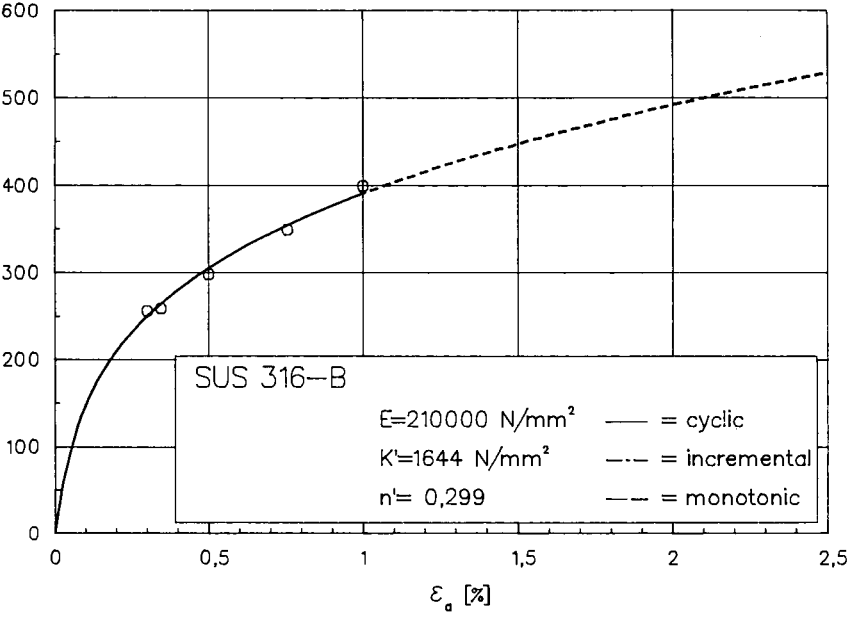
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

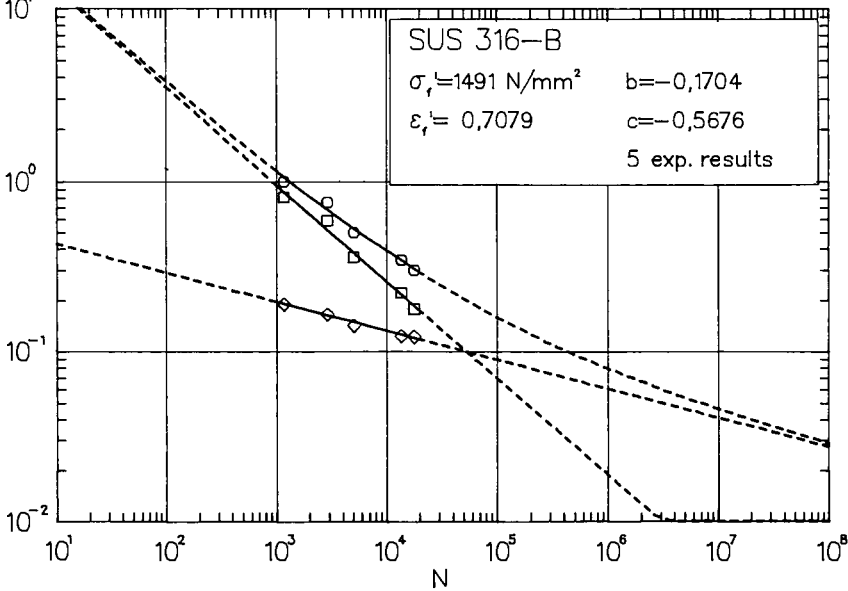
Loading condition : total strain control, R _{ϵ} = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 4.0 (%/min)
Waveform : triangular

Remarks :

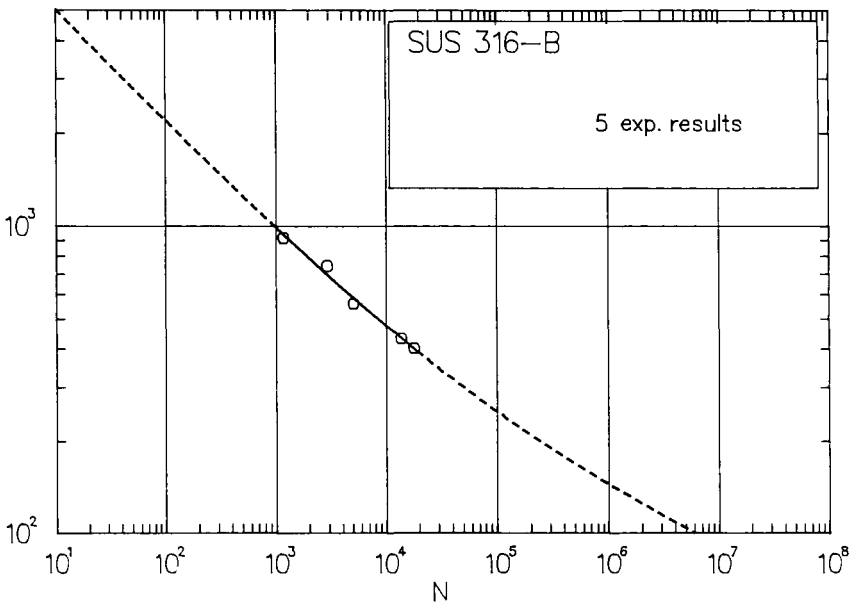
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 316-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	399.3	0.0	1.0000	1168.0
2.0000	348.8	0.0	0.7550	2893.0
3.0000	298.2	0.0	0.5000	5053.0
4.0000	259.0	0.0	0.3450	13603.0
5.0000	256.0	0.0	0.3000	17790.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1050°C/30' water
Test temperature : +23°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.081	0.52	1.60	0.027	0.006	10.15	16.73	2.18	0.088	0.033	0.032

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	228	N/mm ²	K	=	N/mm ²
R _m	=	665	N/mm ²	n	=	-
A ₅	=	67	%	σ _f	=	N/mm ²
Z	=	81	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	259	N/mm ²	K'	=	2081	N/mm ²
σ _g	=	111	N/mm ²	n'	=	0.336	-
ε _g	=	0.068	%	σ' _f	=	1999	N/mm ²
N _T	=	80528	cycles	ε' _f	=	0.928	-
T _σ	=	1.101	-	b	=	-0.190	-
T _{εp}	=	1.156	-	c	=	-0.572	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness : HV 10 : 149

Microstructure :

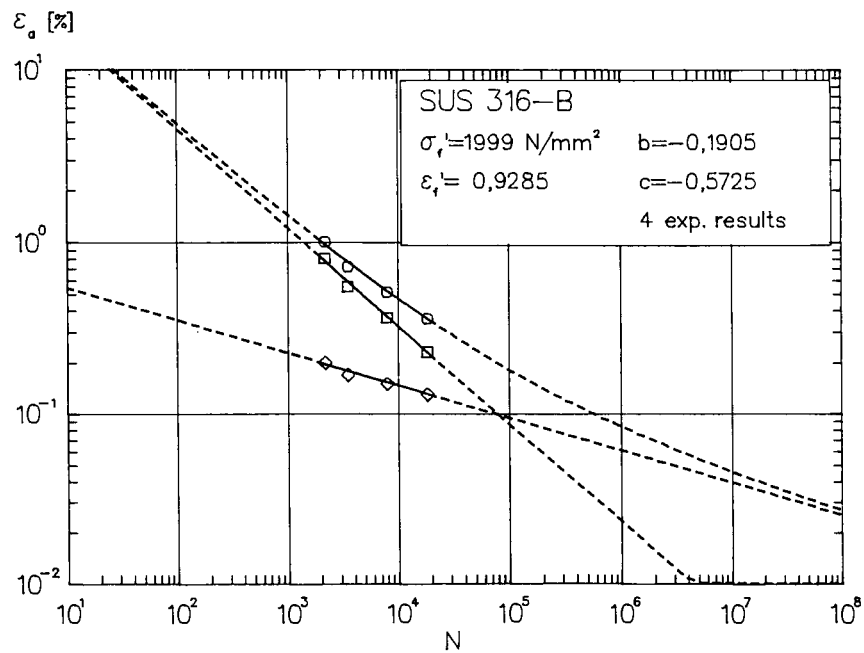
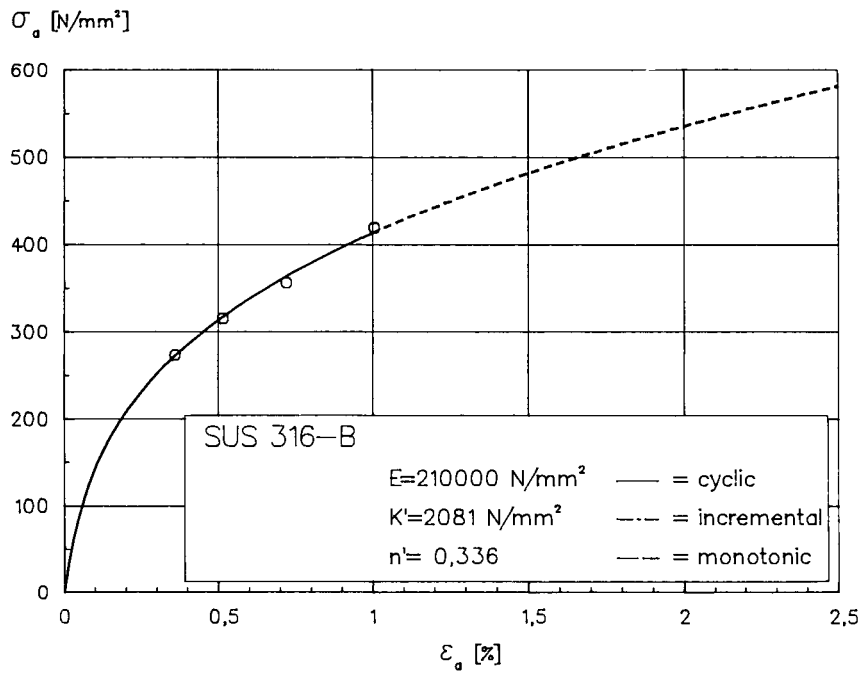
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 6 mm
Specimen location : in rolling direction
Gauge length : 30 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

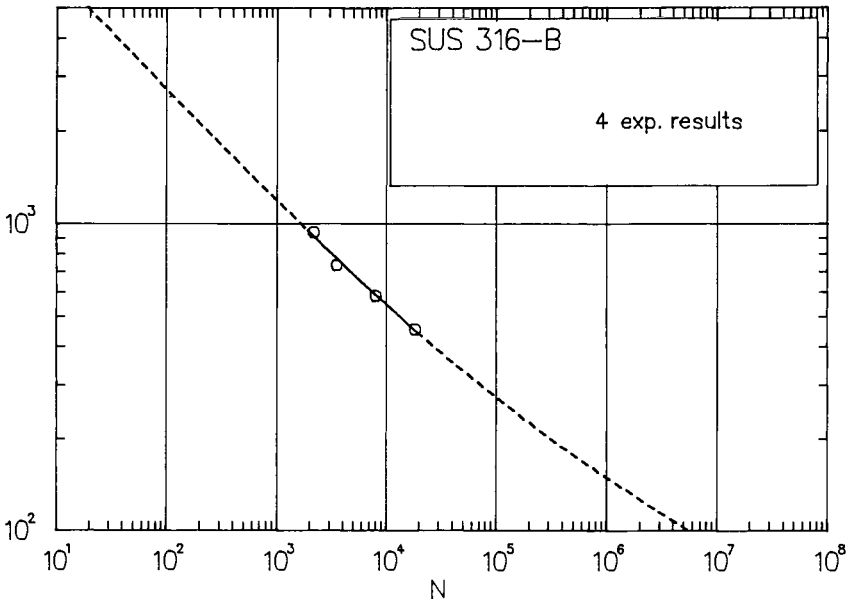
Cyclic test

Loading condition : total strain control, R_e = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 4.0 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	418.9	0.0	1.0050	2168.0
2.0000	356.1	0.0	0.7200	3488.0
3.0000	315.4	0.0	0.5150	7941.0
4.0000	273.2	0.0	0.3600	18348.0

X 5 CrNiMo 18 10	1.4401	SUS 316-RP
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Heat treatment : hot rolled, 1100°C/30' water
Test temperature : +23°C
Semifinished material : plate, 24x2300x5600 mm
Reference : [4.2]
Year : 1979

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.05	0.70	1.10	0.034	0.003	12.60	17.05	2.24	0.31	0.03	0.001

Monotonic properties

E	=	210000	N/mm ²	v	=	-
R _{p0.2}	=	257	N/mm ²	K	=	N/mm ²
R _m	=	606	N/mm ²	n	=	-
A ₅	=	57	%	σ _f	=	1830 N/mm ²
Z	=	79	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	313	N/mm ²	K'	=	2000	N/mm ²
σ' _g	=	176	N/mm ²	n'	=	0.298	-
ε' _g	=	0.113	%	σ' _f	=	1314	N/mm ²
N _T	=	65234	cycles	ε' _f	=	0.249	-
T _σ	=	1.123	-	b	=	-0.132	-
T _{εP}	=	1.422	-	c	=	-0.445	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : 25% decrease in the max. tensile load of N/2
σ/ε-values valid for : half life until complete spec. rupture
Remarks : Young's modulus estimated

Hardness : HV 10 : 149

Microstructure : Austenite grain size acc. to JIS G 0551 : 5.5

Monotonic test

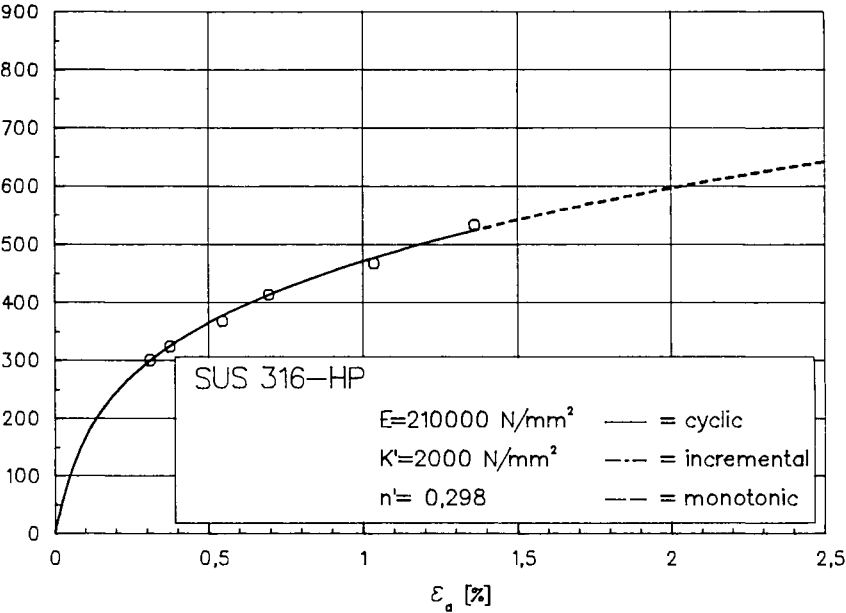
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate :

Cyclic test

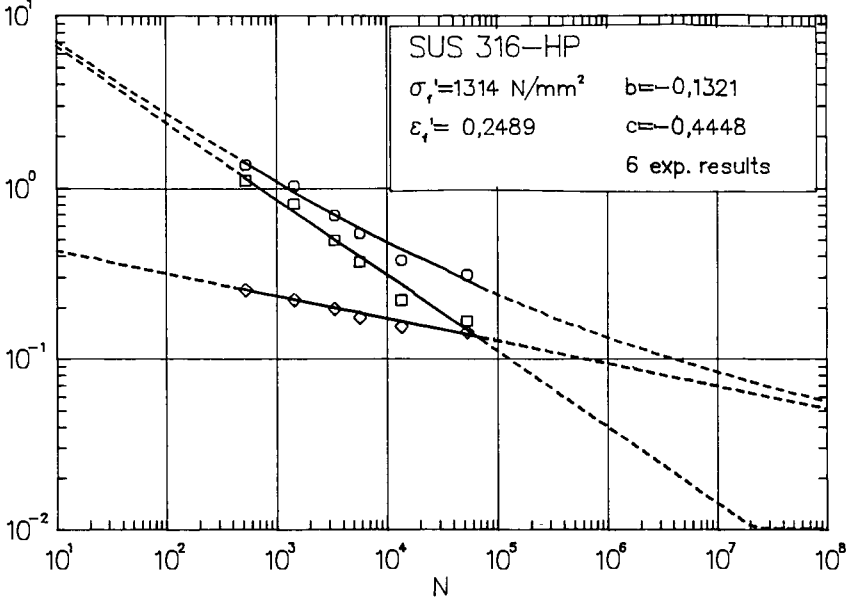
Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 13 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 6 (%/min)
Waveform : triangular

Remarks :

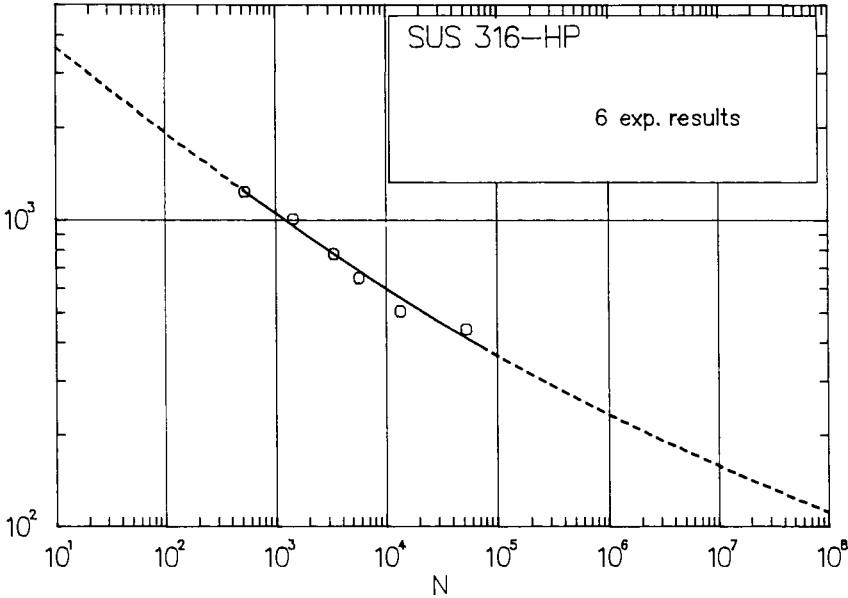
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 316-HP

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	533.5	0.0	1.3600	524.0
2.0000	467.5	0.0	1.0350	1442.0
3.0000	413.5	0.0	0.6950	3343.0
4.0000	367.5	0.0	0.5450	5654.0
5.0000	324.0	0.0	0.3750	13456.0
6.0000	300.5	0.0	0.3100	52686.0

X 5 CrNiMo 18 10	1.4401	SUS 316-HP
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Heat treatment : hot rolled, 1100°C/30' water
 Test temperature : +400°C
 Semifinished material : plate, 24x2300x5600 mm
 Reference : [4.2]
 Year : 1979

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.05	0.70	1.10	0.034	0.003	12.60	17.05	2.24	0.31	0.03	0.001

Monotonic Properties

E	=	171500	N/mm ²	ν	=	-
R _{p0.2}	=	184	N/mm ²	K	=	N/mm ²
R _m	=	513	N/mm ²	n	=	-
A ₅	=	40	%	σ_f	=	1020 N/mm ²
Z	=	62	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	287	N/mm ²	K'	=	2204	N/mm ²
σ'_g	=	169	N/mm ²	n'	=	0.328	-
ϵ'_g	=	0.134	%	σ'_f	=	975	N/mm ²
N _T	=	35881	cycles	ϵ'_f	=	0.096	-
T _{σ}	=	1.369	-	b	=	-0.115	-
T _{ep}	=	1.381	-	c	=	-0.368	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : 25% decrease in the max. tensile load of N/2
 σ/ϵ -values valid for : half life until complete spec. rupture
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

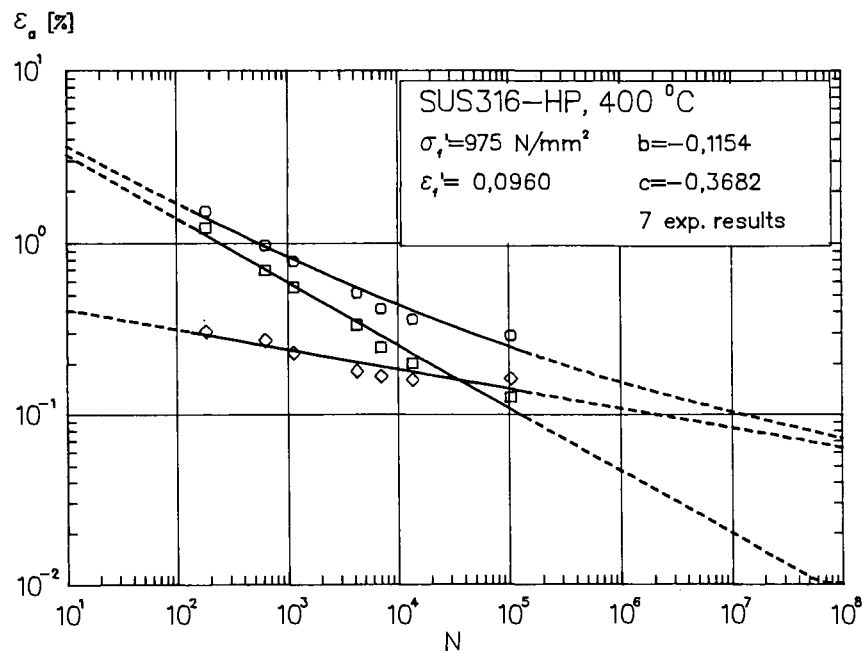
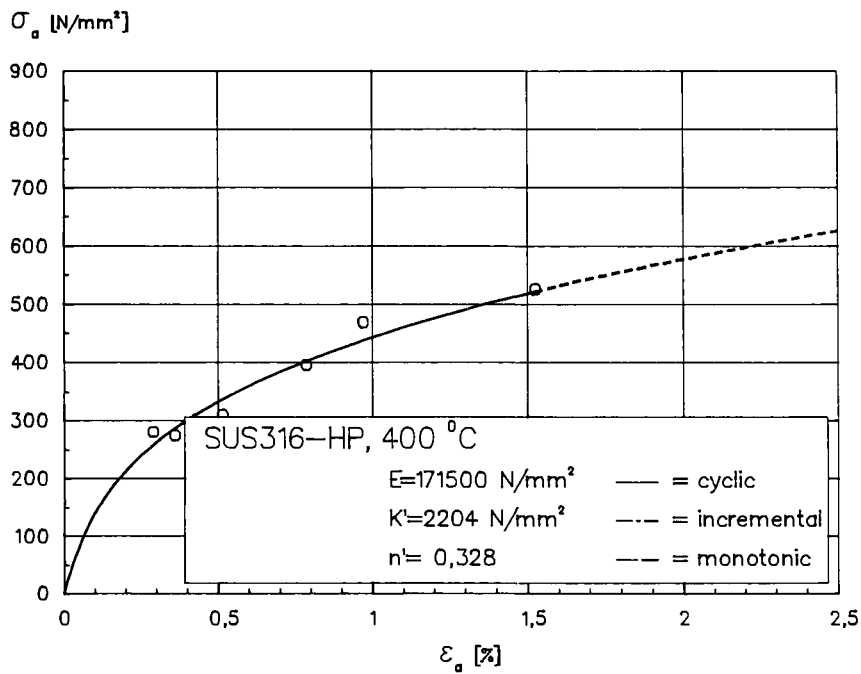
Monotonic test

Loading condition :
 Specimen : cylindrical, $\emptyset$ 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate :

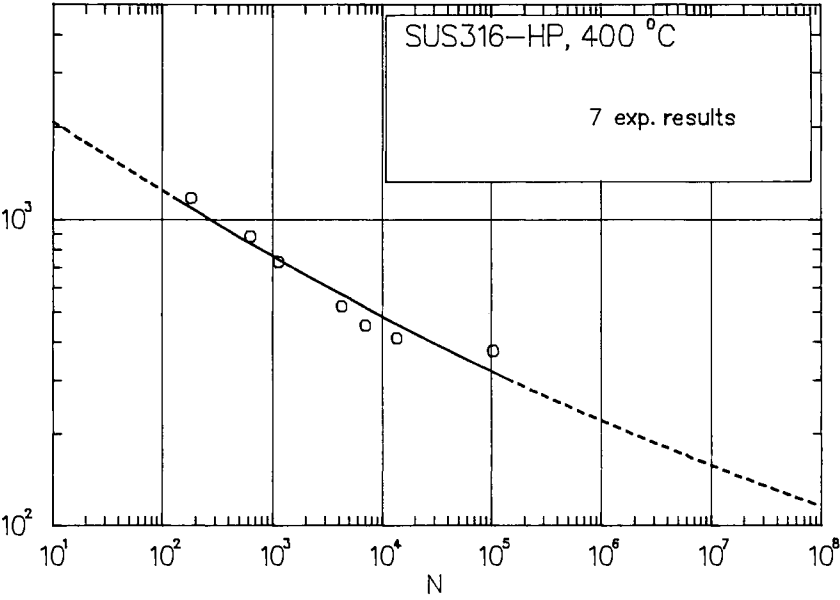
Cyclic test

Loading condition : total strain control, $R_\epsilon = -1$
 Specimen : cylindrical, $\emptyset$ 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 13 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 6 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-HP, 400°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	526.0	0.0	1.5250	183.0
2.0000	469.0	0.0	0.9700	629.0
3.0000	395.5	0.0	0.7850	1129.0
4.0000	309.5	0.0	0.5150	4241.0
5.0000	288.0	0.0	0.4150	7050.0
6.0000	274.5	0.0	0.3600	13574.0
7.0000	280.5	0.0	0.2900	103667.0

X 5 CrNiMo 18 10	1.4401	SUS 316-HP
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Heat treatment : hot rolled, 1100°C/30' water
Test temperature : +400°C
Semifinished material : plate, 24x2300x5600 mm
Reference : [4.2]
Year : 1979

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.05	0.70	1.10	0.034	0.003	12.60	17.05	2.24	0.31	0.03	0.001

Monotonic Properties

E	=	171500	N/mm ²	ν	=	-
R _{p0.2}	=	184	N/mm ²	K	=	N/mm ²
R _m	=	513	N/mm ²	n	=	-
A ₅	=	40	%	σ_f	=	990 N/mm ²
Z	=	62	%	ϵ_f	=	-

Cyclic Properties

R' _{p0.2}	=	332	N/mm ²	K'	=	1789	N/mm ²
σ_g	=	188	N/mm ²	n'	=	0.271	-
ϵ_g	=	0.133	%	σ'_f	=	973	N/mm ²
N _T	=	11125	cycles	ϵ'_f	=	0.113	-
T _{σ}	=	1.312	-	b	=	-0.108	-
T _{ep}	=	1.275	-	c	=	-0.407	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : 25% decrease in the max. tensile load of N/2
 σ/ϵ -values valid for : half life until complete spec. rupture
Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

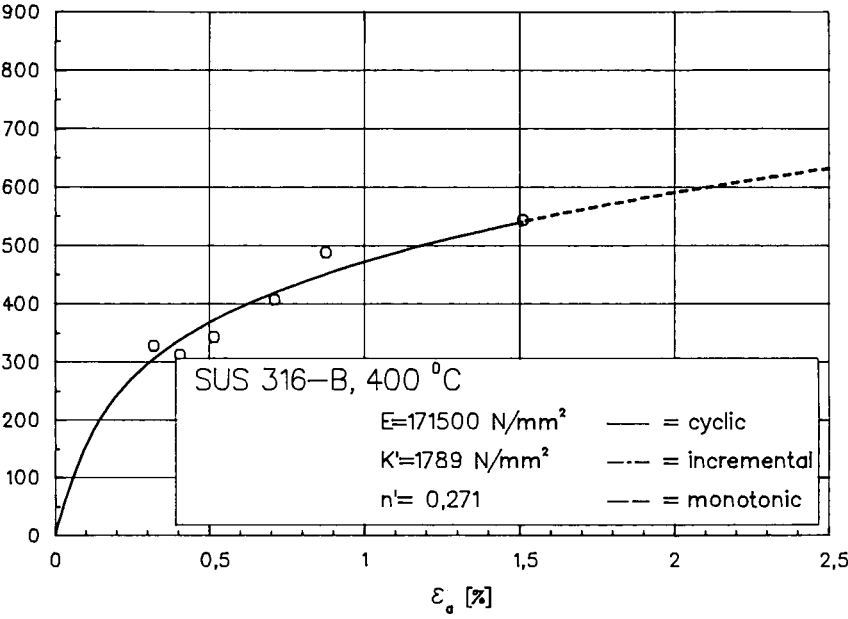
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate :

Cyclic test

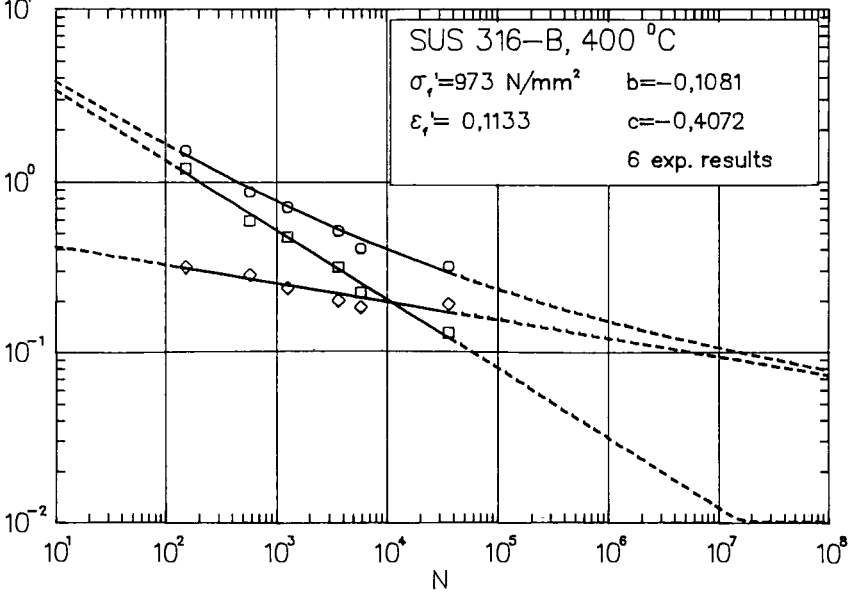
Loading condition : total strain control, R _{ϵ} = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 13 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.6 (%/min)
Waveform : triangular

Remarks :

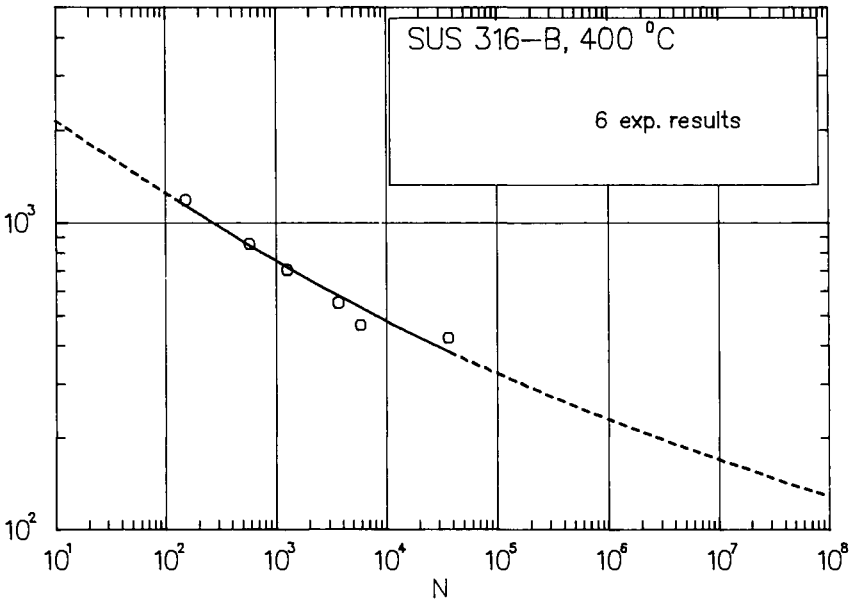
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 316-B, 400°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	543.0	0.0	1.5100	152.0
2.0000	488.0	0.0	0.8750	576.0
3.0000	407.0	0.0	0.7100	1259.0
4.0000	343.0	0.0	0.5150	3623.0
5.0000	313.0	0.0	0.4050	5778.0
6.0000	328.0	0.0	0.3200	35889.0

X 5 CrNiMo 18 10	1.4401	SUS 316-HP
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Heat treatment : hot rolled, 1100°C/30' water
 Test temperature : +400°C
 Semifinished material : plate, 24x2300x5600 mm
 Reference : [4.2]
 Year : 1979

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.05	0.70	1.10	0.034	0.003	12.60	17.05	2.24	0.31	0.03	0.001

Monotonic properties

E	=	171500	N/mm ²	ν	=	-
R _{p0.2}	=	184	N/mm ²	K	=	N/mm ²
R _m	=	513	N/mm ²	n	=	-
A ₅	=	40	%	σ_f	=	1020 N/mm ²
Z	=	62	%	ϵ_f	=	-

Cyclic Properties

R' _{p0.2}	=	395	N/mm ²	K'	=	1504	N/mm ²
σ'_g	=	157	N/mm ²	n'	=	0.215	-
ϵ'_g	=	0.094	%	σ'_f	=	1190	N/mm ²
N _T	=	1448	cycles	ϵ'_f	=	0.341	-
T _{σ}	=	1.109	-	b	=	-0.133	-
T _{ep}	=	1.065	-	c	=	-0.622	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : 25% decrease in the max. tensile load of N/2
 σ/ϵ -values valid for : half life until complete spec. rupture
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

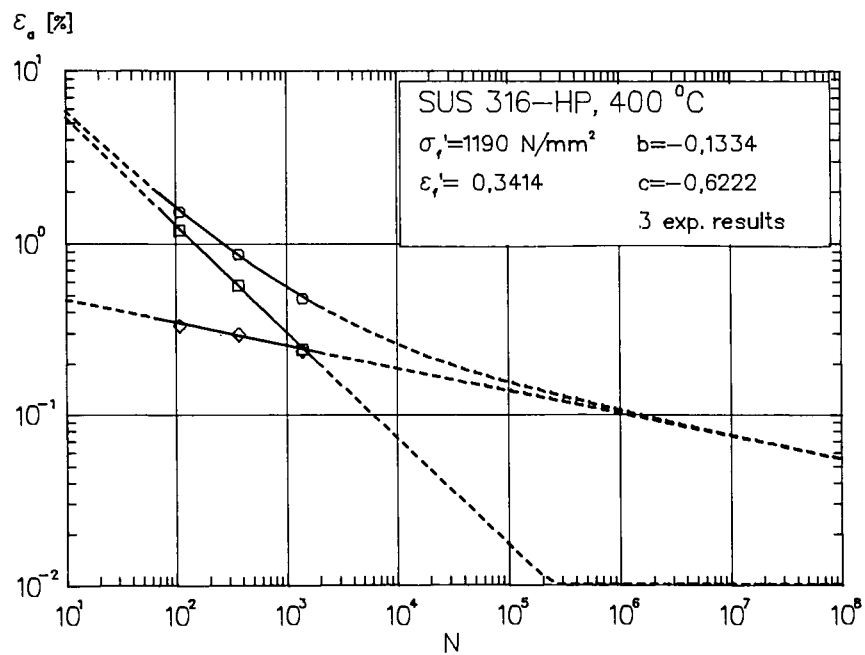
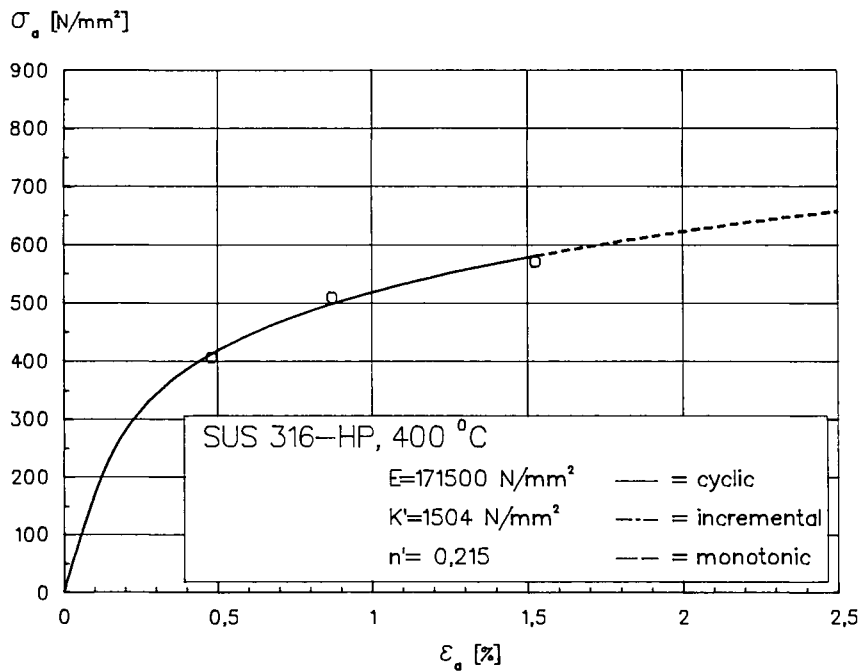
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate :

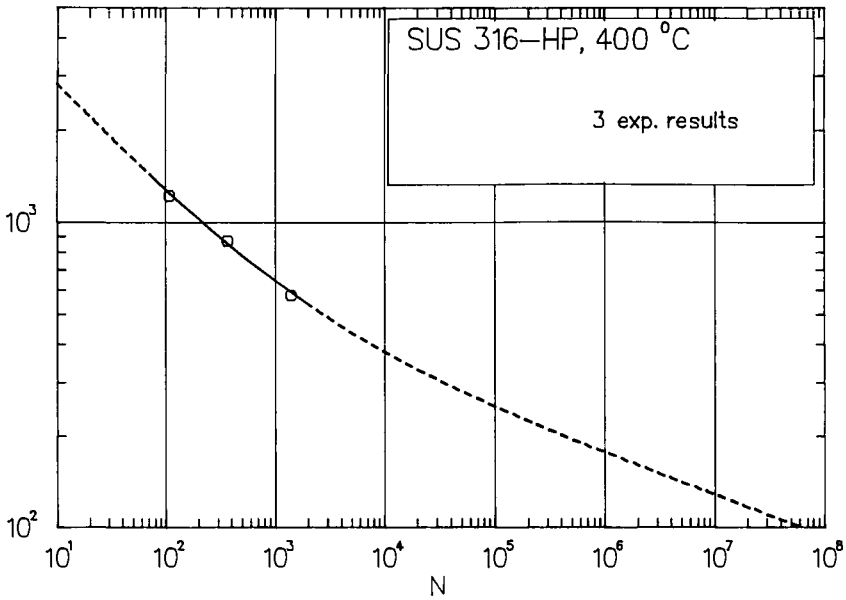
Cyclic test

Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 13 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.06 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-HP, 400°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	571.0	0.0	1.5250	108.0
2.0000	509.5	0.0	0.8700	368.0
3.0000	406.5	0.0	0.4800	1394.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1075°C/30' water, 1100°C/1h water
Test temperature : +450°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.075	0.77	1.49	0.030	0.009	10.02	16.45	2.09	0.18	0.040	0.098

Monotonic properties

E	=	170000	N/mm ²	ν	=	-
R _{p0.2}	=	128	N/mm ²	K	=	N/mm ²
R _m	=	465	N/mm ²	n	=	-
A ₅	=	47	%	σ _f	=	N/mm ²
Z	=	70	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	214	N/mm ²	K'	=	5290	N/mm ²
σ _g	=	84	N/mm ²	n'	=	0.516	-
ε _g	=	0.083	%	σ' _f	=	1947	N/mm ²
N _T	=	25030	cycles	ε' _f	=	0.143	-
T _σ	=	1.058	-	b	=	-0.207	-
T _{εp}	=	1.130	-	c	=	-0.399	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ε-values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

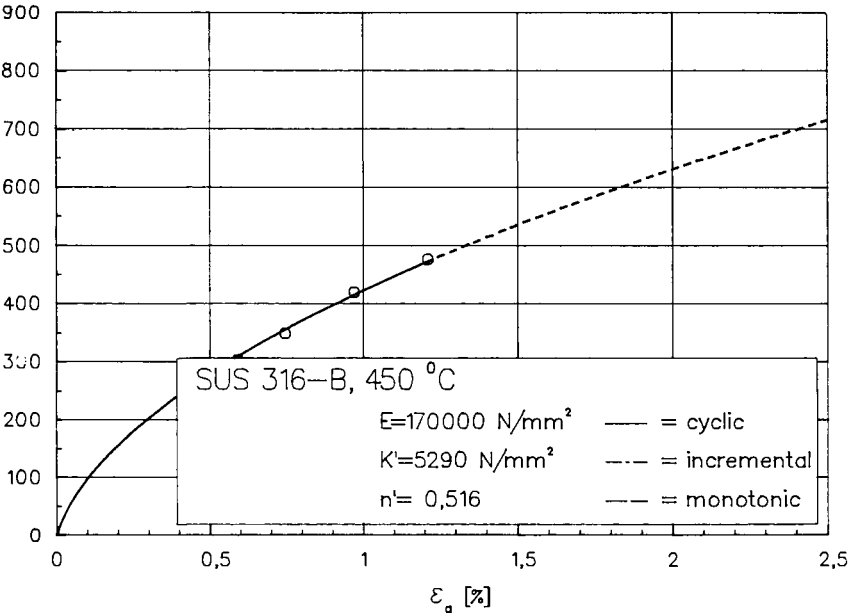
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

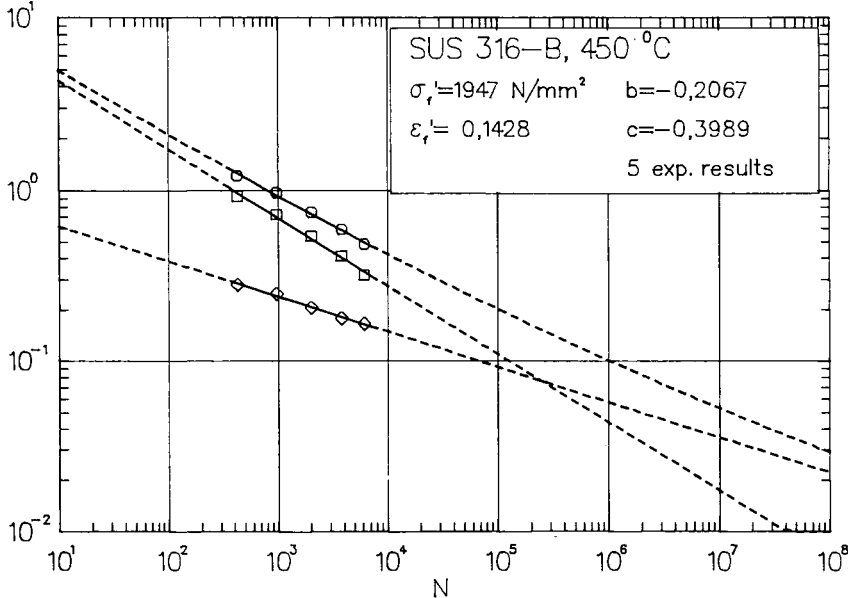
Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 39 (%/min)
Waveform : triangular

Remarks :

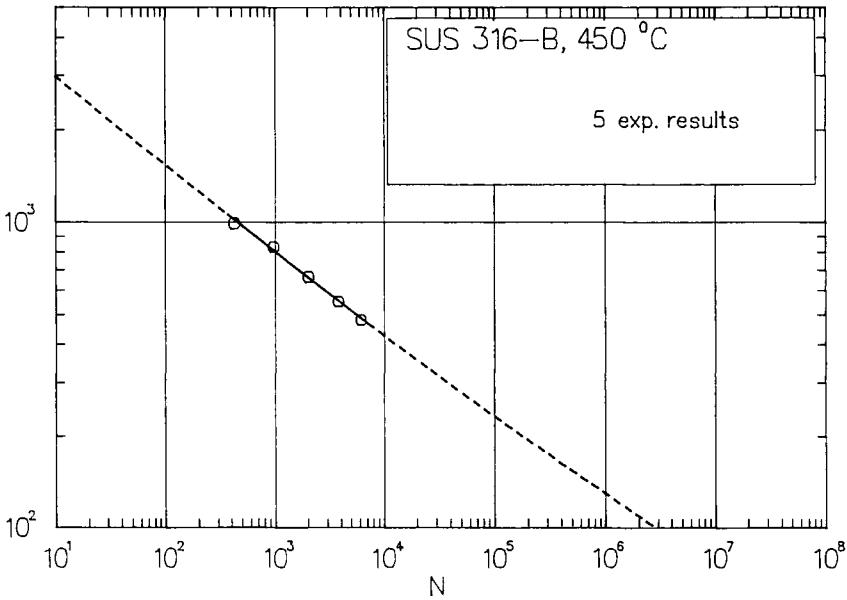
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 316-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	476.3	0.0	1.2100	423.0
2.0000	419.9	0.0	0.9700	966.0
3.0000	348.8	0.0	0.7450	2008.0
4.0000	302.6	0.0	0.5900	3787.0
5.0000	280.6	0.0	0.4850	6102.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1050°C/30' water
 Test temperature : +450°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.1]
 Year : 1977

Hardness :

Chemical composition

Microstructure :

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.081	0.52	1.60	0.027	0.006	10.15	16.73	2.18	0.088	0.033	0.032

Monotonic properties

Monotonic test

E	=	135300	N/mm ²	ν	=	-
R _{p0.2}	=	145	N/mm ²	K	=	N/mm ²
R _m	=	529	N/mm ²	n	=	-
A ₅	=	46	%	σ_f	=	N/mm ²
Z	=	69	%	ε_f	=	-

Loading condition :
 Specimen : cylindrical, Ø 6 mm
 Specimen location : in rolling direction
 Gauge length : 30 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

Cyclic properties

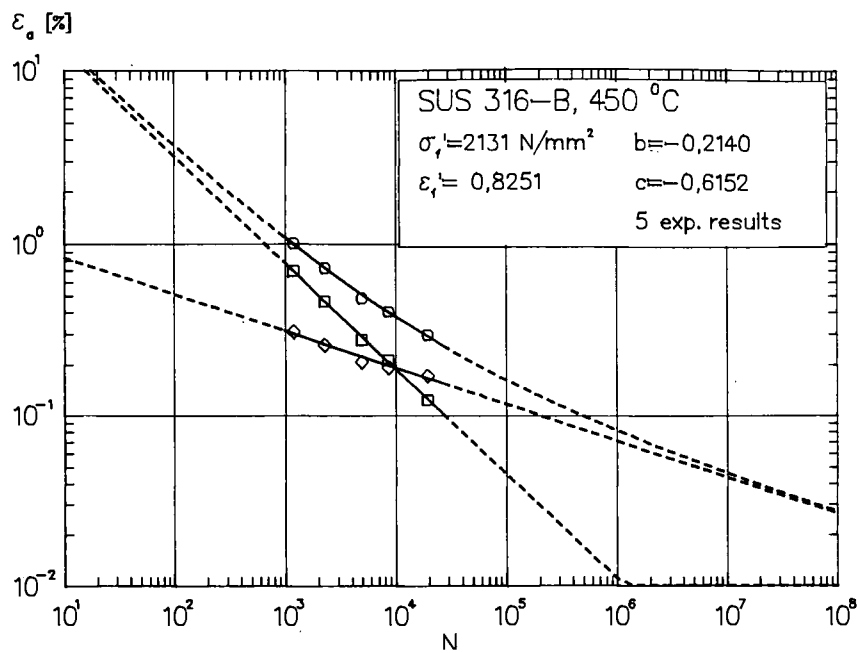
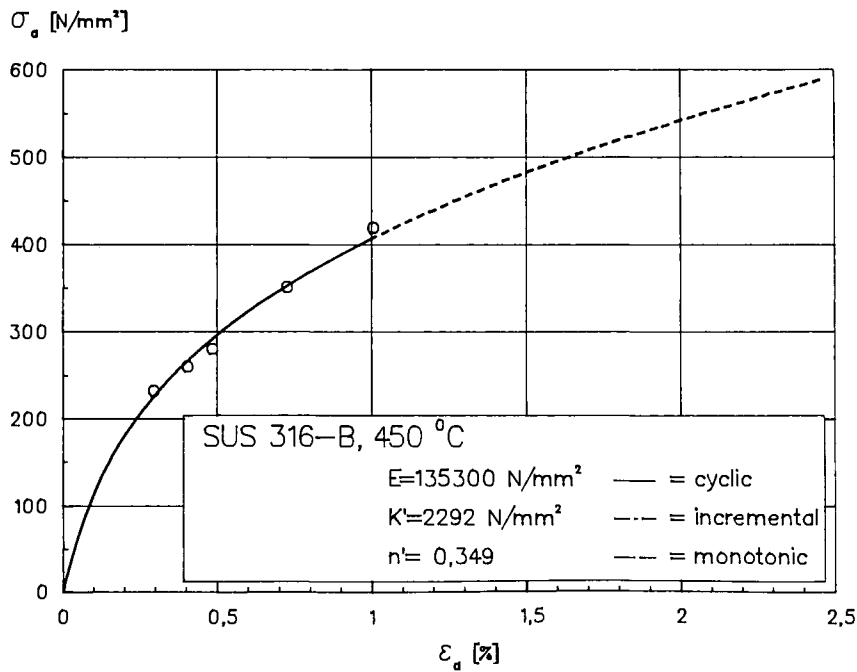
Cyclic test

R _{p0.2}	=	262	N/mm ²	K'	=	2292	N/mm ²
σ_g	=	82	N/mm ²	n'	=	0.349	-
ε_g	=	0.068	%	σ'_f	=	2131	N/mm ²
N _T	=	9625	cycles	ε'_f	=	0.825	-
T _{σ}	=	1.136	-	b	=	-0.214	-
T _{ep}	=	1.084	-	c	=	-0.615	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

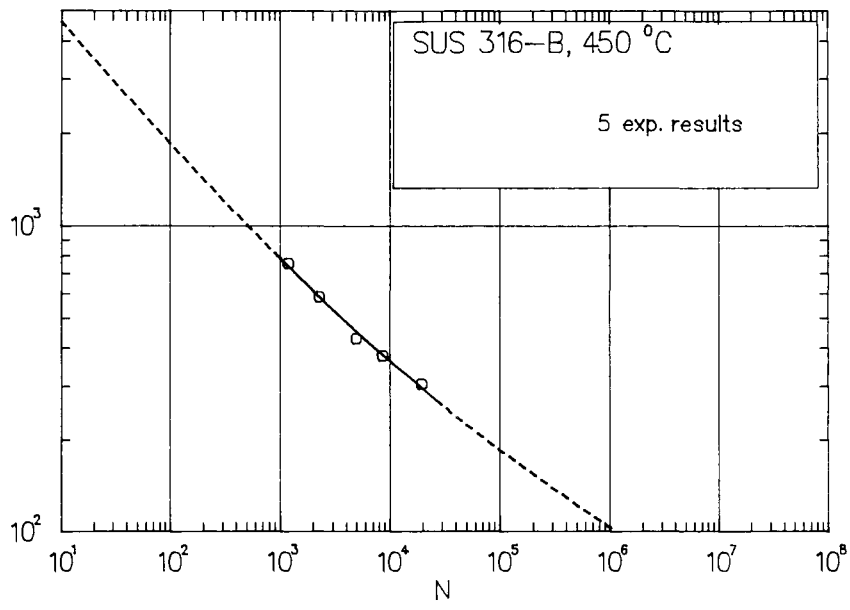
Loading condition : total strain control, R _{ε} = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Failure criterion : complete rupture
 σ/ε -values valid for : half failure life
 Remarks : Young's modulus estimated

Remarks :



PSWT [N/mm²]



Material : SUS 316-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	418.9	0.0	1.0050	1187.0
2.0000	351.2	0.0	0.7250	2266.0
3.0000	280.6	0.0	0.4850	4932.0
4.0000	260.0	0.0	0.4050	8577.0
5.0000	232.5	0.0	0.2950	19365.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1075°C/30' water, 1100°C/1h water
 Test temperature : +450°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.1]
 Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.075	0.77	1.49	0.030	0.009	10.02	16.45	2.09	0.18	0.040	0.098

Monotonic properties

E	=	170000	N/mm ²	v	=	-
R _{p0.2}	=	128	N/mm ²	K	=	N/mm ²
R _m	=	465	N/mm ²	n	=	-
A ₅	=	47	%	σ _f	=	N/mm ²
Z	=	70	%	ε _f	=	-

Cyclic properties

R'p0.2	=	283	N/mm ²	K'	=	2994	N/mm ²
σ _g	=	96	N/mm ²	n'	=	0.380	-
ε _g	=	0.068	%	σ' _f	=	1774	N/mm ²
N _T	=	13064	cycles	ε' _f	=	0.250	-
T _σ	=	1.052	-	b	=	-0.192	-
T _{εp}	=	1.194	-	c	=	-0.504	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

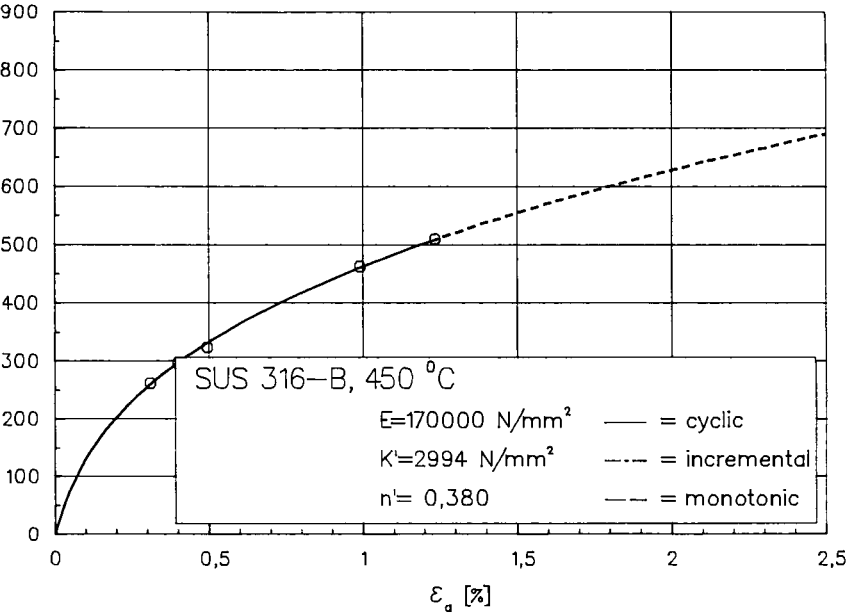
Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

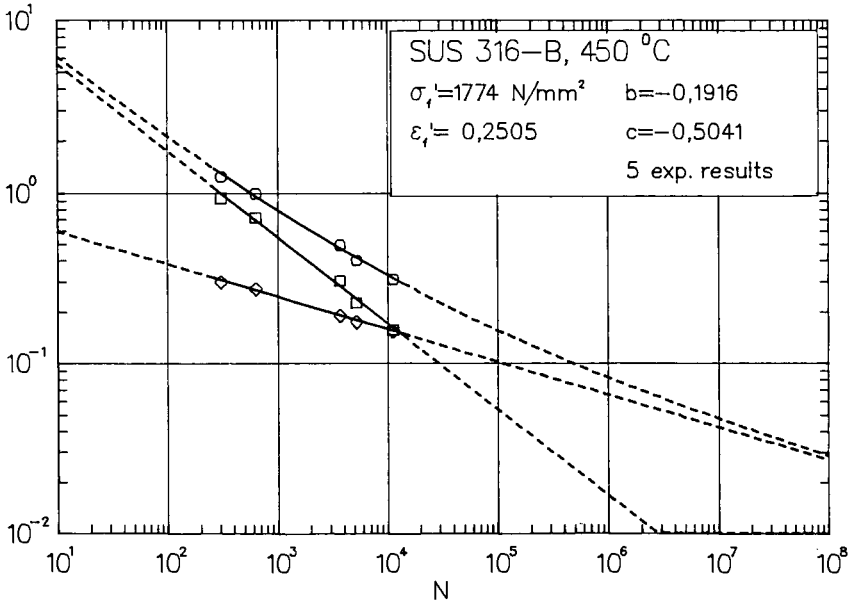
Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 4.0 (%/min)
 Waveform : triangular

Remarks :

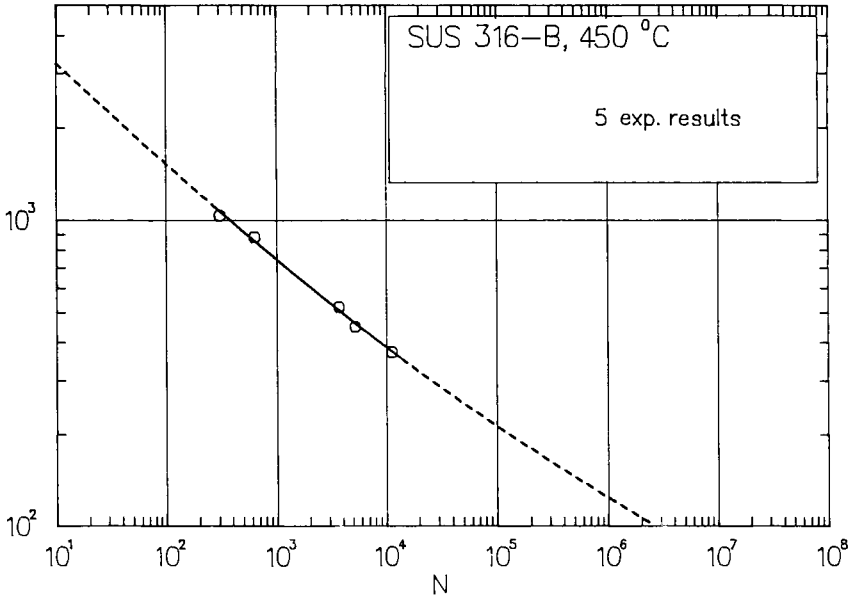
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 316-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	510.1	0.0	1.2350	306.0
2.0000	462.5	0.0	0.9900	630.0
3.0000	323.7	0.0	0.4950	3684.0
4.0000	296.8	0.0	0.4010	5192.0
5.0000	261.4	0.0	0.3100	11212.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1075°C/30' water, 1100°C/1h water
Test temperature : +450°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.075	0.77	1.49	0.030	0.009	10.02	16.45	2.09	0.18	0.040	0.098

Monotonic properties

E	=	170000	N/mm ²	ν	=	-
R _{p0.2}	=	128	N/mm ²	K	=	N/mm ²
R _m	=	465	N/mm ²	n	=	-
A ₅	=	47	%	σ_f	=	N/mm ²
Z	=	70	%	ϵ_f	=	-

Cyclic Properties

R' _{p0.2}	=	322	N/mm ²	K'	=	2909	N/mm ²
σ'_g	=	113	N/mm ²	n'	=	0.354	-
ϵ'_g	=	0.076	%	σ'_f	=	1546	N/mm ²
N _T	=	5240	cycles	ϵ'_f	=	0.178	-
T _σ	=	1.112	-	b	=	-0.172	-
T _{ep}	=	1.174	-	c	=	-0.493	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

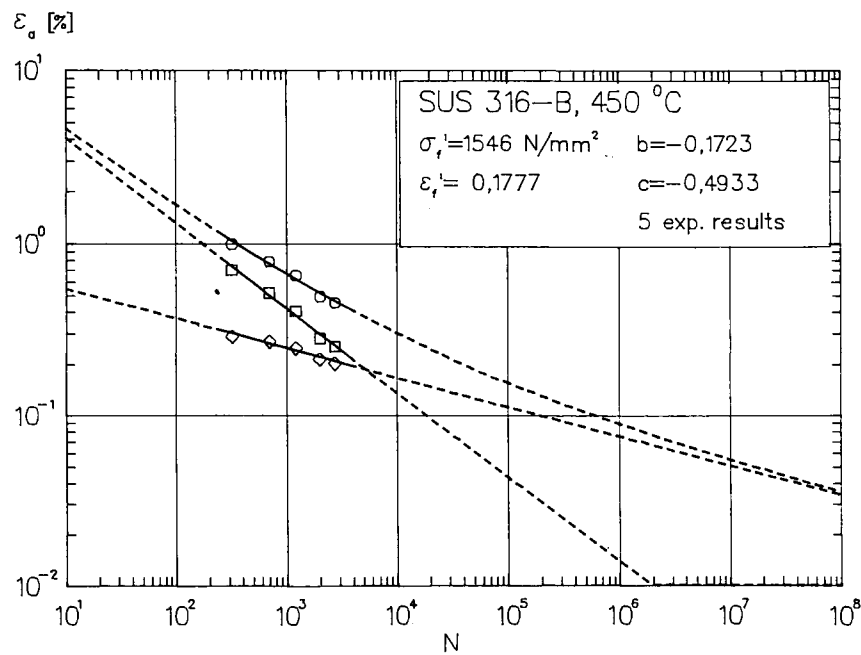
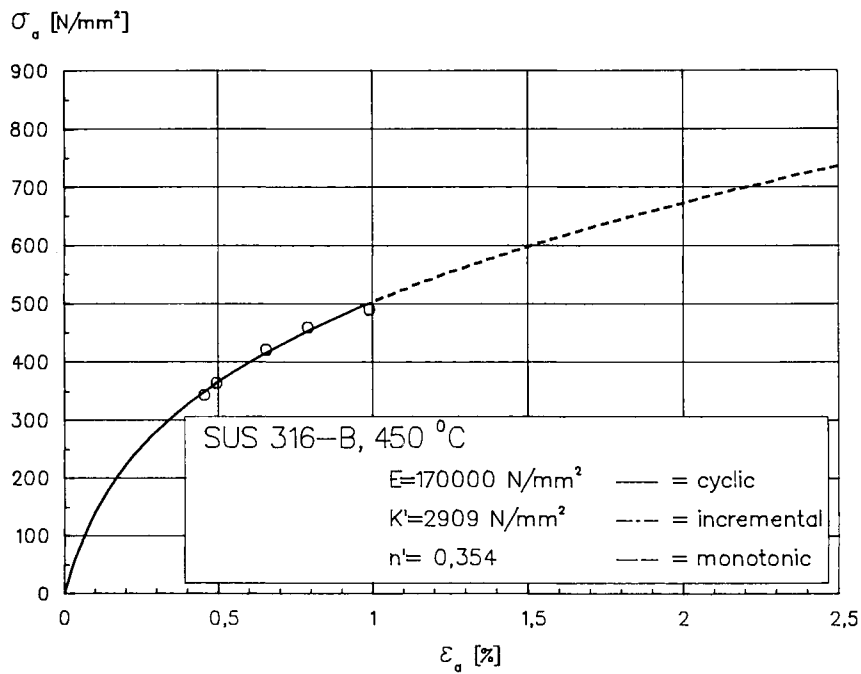
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

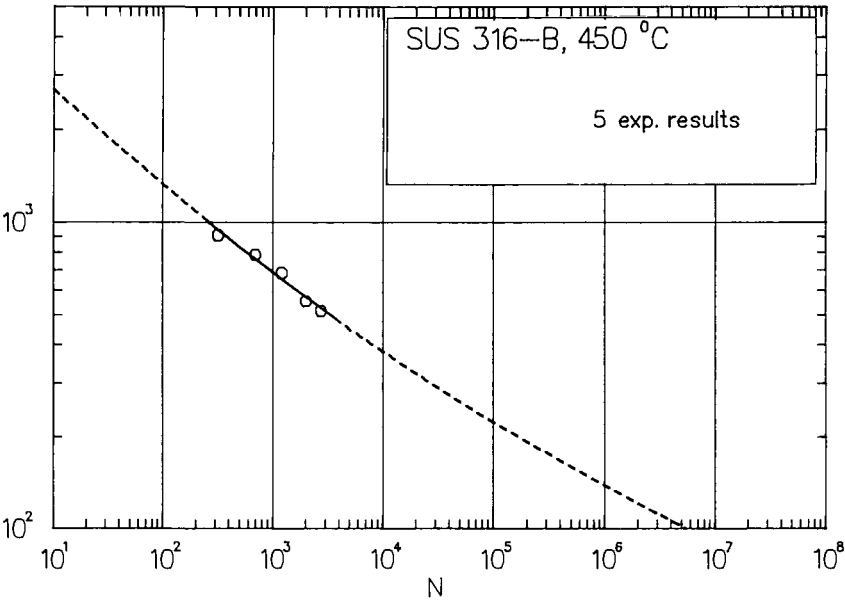
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-B, 450 °C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	490.5	0.0	0.9900	320.0
2.0000	459.6	0.0	0.7900	696.0
3.0000	421.3	0.0	0.6550	1211.0
4.0000	364.0	0.0	0.4950	1992.0
5.0000	343.4	0.0	0.4550	2736.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1050°C/30' water
 Test temperature : +450°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.1]
 Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.081	0.52	1.60	0.027	0.006	10.15	16.73	2.18	0.088	0.033	0.032

Monotonic properties

E	=	135300	N/mm ²	ν	=	-
R _{p0.2}	=	145	N/mm ²	K	=	N/mm ²
R _m	=	529	N/mm ²	n	=	-
A ₅	=	46	%	σ_f	=	N/mm ²
Z	=	69	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	335	N/mm ²	K'	=	2541	N/mm ²
σ_g	=	93	N/mm ²	n'	=	0.326	-
ϵ_g	=	0.074	%	σ'_f	=	1881	N/mm ²
N _r	=	1904	cycles	ϵ'_f	=	0.321	-
T _{σ}	=	1.073	-	b	=	-0.198	-
T _{ϵ_p}	=	1.869	-	c	=	-0.579	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

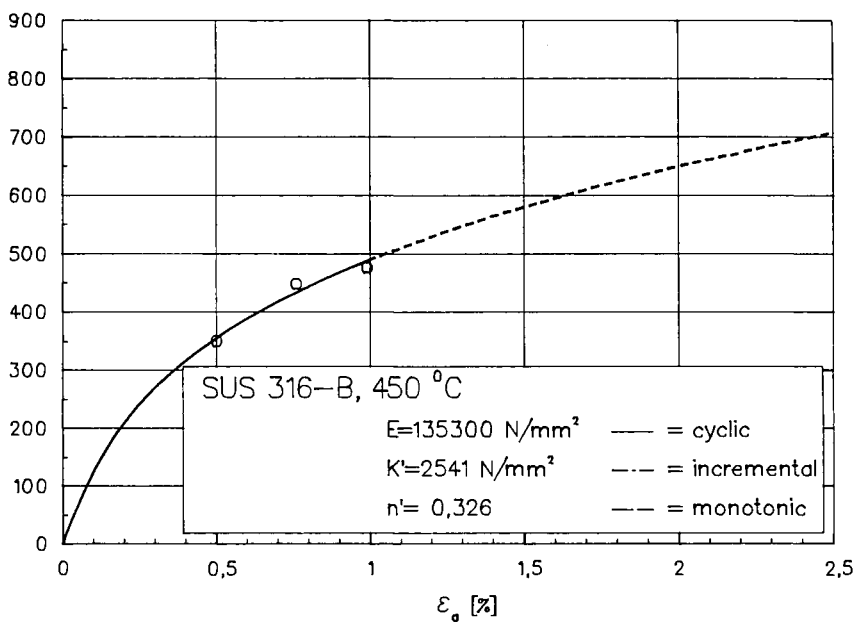
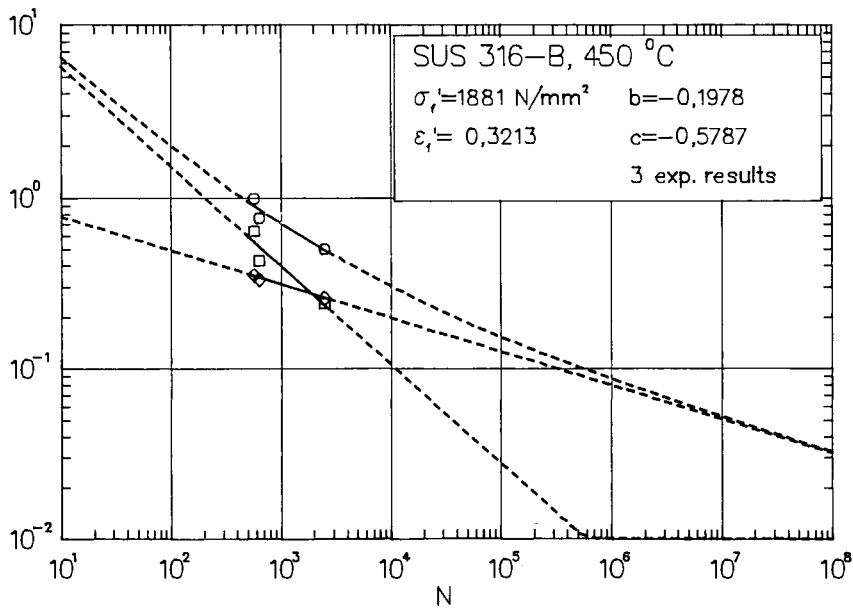
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 6 mm
 Specimen location : in rolling direction
 Gauge length : 30 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

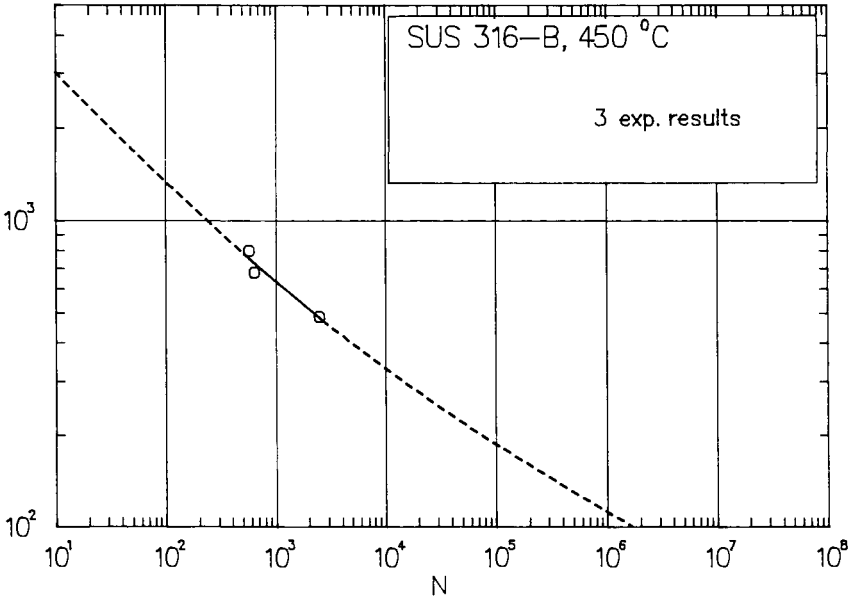
Cyclic test

Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.40 (%/min)
 Waveform : triangular

Remarks :

σ_e [N/mm²] ϵ_e [%]

PSWT [N/mm²]



Material : SUS 316-B, 450 °C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	476.3	0.0	0.9900	569.0
2.0000	448.8	0.0	0.7600	634.0
3.0000	350.2	0.0	0.5000	2475.0

X 5 CrNiMo 18 10	1.4401	SUS 316-HP
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Heat treatment : hot rolled, 1100°C/30' water
 Test temperature : +500°C
 Semifinished material : plate, 24x2300x5600 mm
 Reference : [4.2]
 Year : 1979

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.05	0.70	1.10	0.034	0.003	12.60	17.05	2.24	0.31	0.03	0.001

Monotonic properties

E	=	178000	N/mm ²	ν	=	-
R _{p0.2}	=	178	N/mm ²	K	=	N/mm ²
R _m	=	493	N/mm ²	n	=	-
A ₅	=	41	%	σ_f	=	990 N/mm ²
Z	=	62	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	349	N/mm ²	K'	=	1406 N/mm ²
σ'_g	=	192	N/mm ²	n'	=	0.224 -
ϵ'_g	=	0.122	%	σ'_f	=	891 N/mm ²
N _T	=	5895	cycles	ϵ'_f	=	0.127 -
T _{σ}	=	1.116	-	b	=	-0.101 -
T _{ep}	=	1.295	-	c	=	-0.446 -
Incremental step test :				K'	=	N/mm ²
				n'	=	-

Failure criterion : 25% decrease in the max. tensile load of N/2
 σ/ϵ -values valid for : half life until complete spec. rupture
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

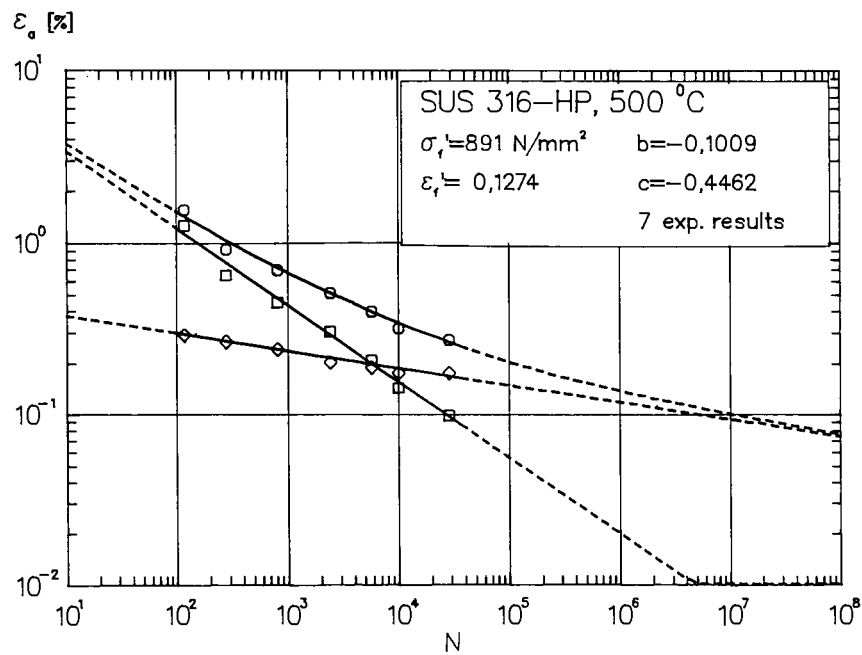
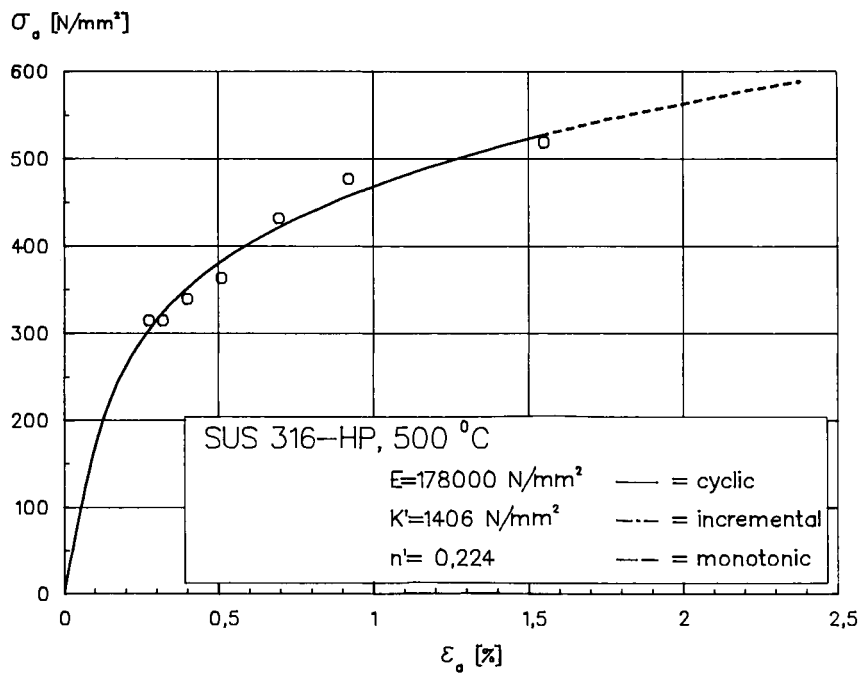
Monotonic test

Loading condition :
 Specimen : cylindrical, $\emptyset$ 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate :

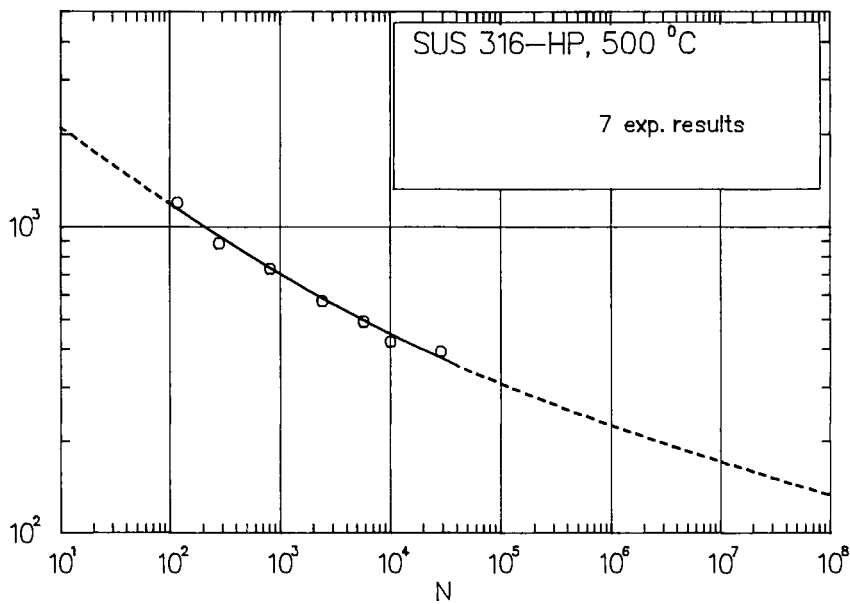
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, $\emptyset$ 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 13 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 6 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-HP, 500°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	519.0	0.0	1.5500	117.0
2.0000	476.5	0.0	0.9200	280.0
3.0000	431.5	0.0	0.6950	812.0
4.0000	363.0	0.0	0.5100	2400.0
5.0000	339.5	0.0	0.4000	5720.0
6.0000	314.5	0.0	0.3200	10041.0
7.0000	314.5	0.0	0.2750	28662.0

X 5 CrNiMo 18 10	1.4401	SUS 316-HP
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Heat treatment : hot rolled, 1100°C/30' water
Test temperature : +500°C
Semifinished material : plate, 24x2300x5600 mm
Reference : [4.2]
Year : 1979

Hardness :

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.05	0.70	1.10	0.034	0.003	12.60	17.05	2.24	0.31	0.03	0.001

Microstructure :

Monotonic properties

E	=	178000	N/mm ²	ν	=	-
R _{P0.2}	=	178	N/mm ²	K	=	N/mm ²
R _m	=	493	N/mm ²	n	=	-
A ₅	=	41	%	σ_f	=	990 N/mm ²
Z	=	62	%	ε_f	=	-

Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate :

Cyclic properties

R' _{P0.2}	=	390	N/mm ²	K'	=	1155	N/mm ²
σ'_g	=	260	N/mm ²	n'	=	0.175	-
ε'_g	=	0.161	%	σ'_f	=	696	N/mm ²
N _T	=	2733	cycles	ε'_f	=	0.078	-
T _{σ}	=	1.279	-	b	=	-0.065	-
T _{ε_p}	=	1.722	-	c	=	-0.413	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

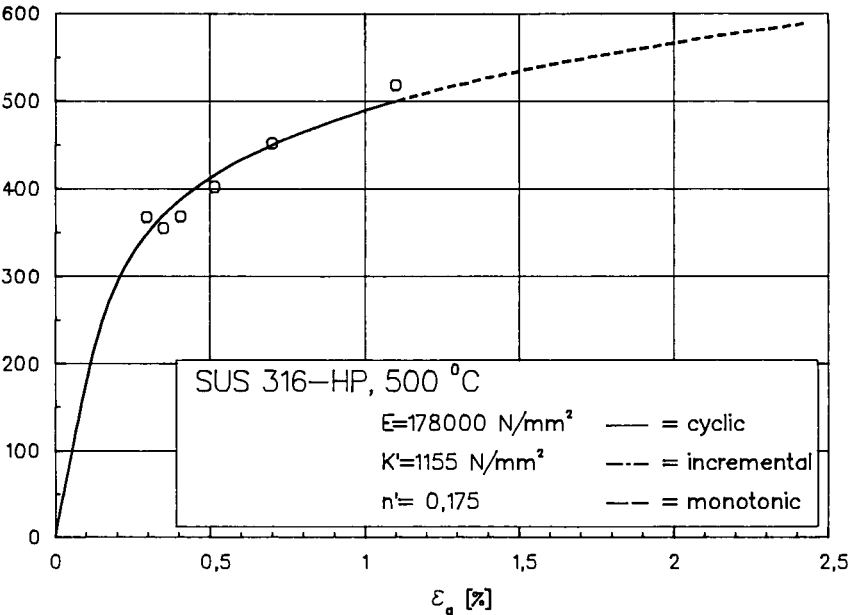
Cyclic test

Loading condition : total strain control, R_e = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 13 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.6 (%/min)
Waveform : triangular

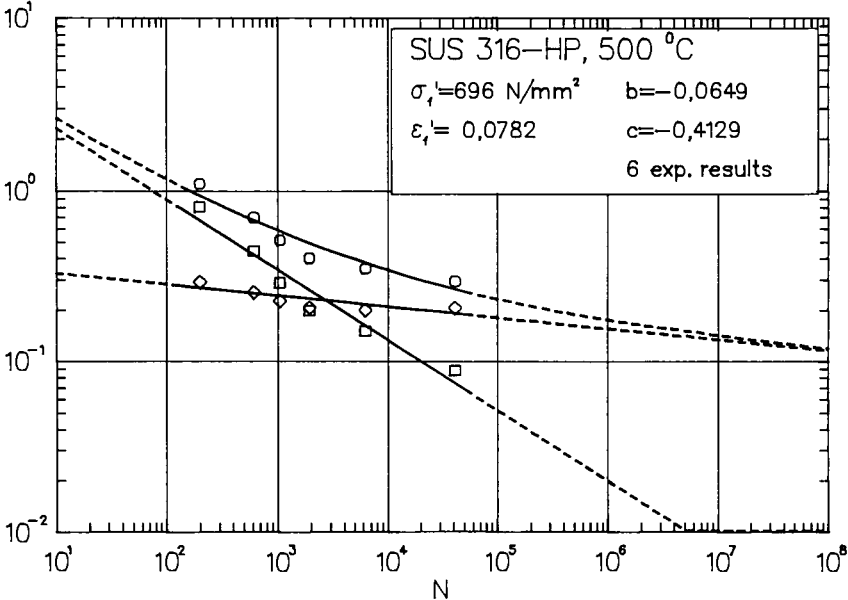
Failure criterion : 25% decrease in the max. tensile load of N/2
 σ/ε -values valid for : half life until complete spec. rupture
Remarks : Young's modulus estimated

Remarks :

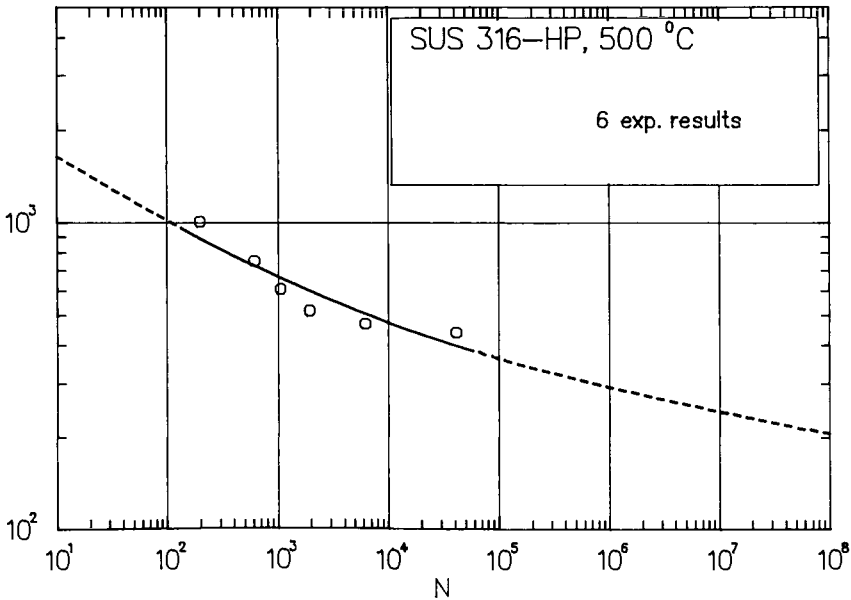
σ_e [N/mm²]



ϵ_e [%]



PSWT [N/mm²]



Material : SUS 316-HP, 500°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	519.0	0.0	1.1000	199.0
2.0000	452.0	0.0	0.7000	609.0
3.0000	402.0	0.0	0.5150	1045.0
4.0000	368.0	0.0	0.4050	1940.0
5.0000	355.0	0.0	0.3500	6198.0
6.0000	367.5	0.0	0.2950	41083.0

X 5 CrNiMo 18 10	1.4401	SUS 316-HP
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Heat treatment : hot rolled, 1100°C/30' water
Test temperature : +500°C
Semifinished material : plate, 24x2300x5600 mm
Reference : [4.2]
Year : 1979

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.05	0.70	1.10	0.034	0.003	12.60	17.05	2.24	0.31	0.03	0.001

Monotonic Properties

E	=	178000	N/mm ²	ν	=	-
R _{p0.2}	=	178	N/mm ²	K	=	N/mm ²
R _m	=	493	N/mm ²	n	=	-
A ₅	=	41	%	σ_f	=	990 N/mm ²
Z	=	62	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	436	N/mm ²	K'	=	1409	N/mm ²
σ_g	=	234	N/mm ²	n'	=	0.189	-
ϵ_g	=	0.138	%	σ'_f	=	811	N/mm ²
N _T	=	555	cycles	ϵ'_f	=	0.062	-
T _{σ}	=	1.227	-	b	=	-0.082	-
T _{ϵ_p}	=	1.696	-	c	=	-0.454	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : 25% decrease in the max. tensile load of N/2
 σ/ϵ -values valid for : half life until complete spec. rupture
Remarks : Young's modulus estimated

Hardness :

Microstructure :

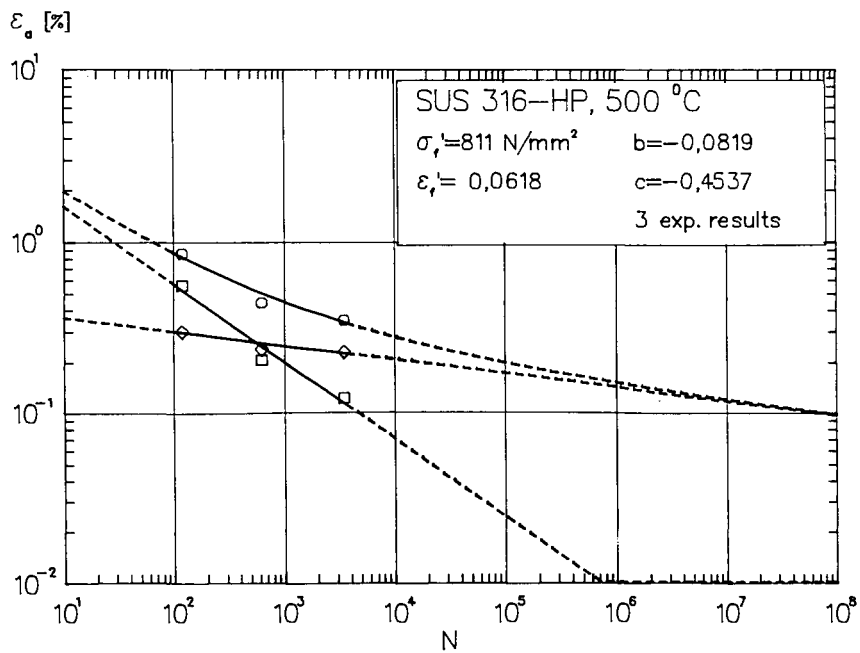
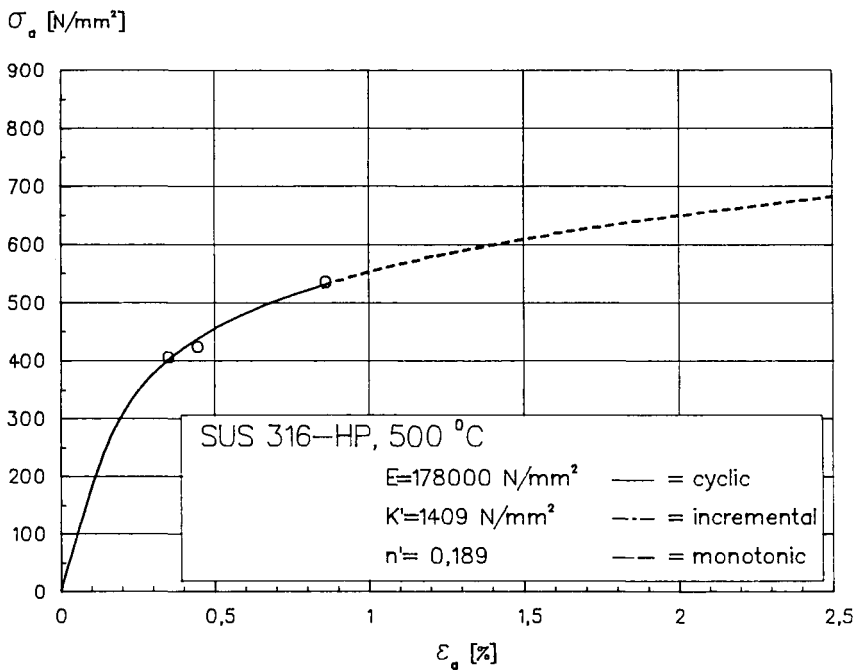
Monotonic test

Loading condition :
Specimen : cylindrical, $\varnothing$ 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate :

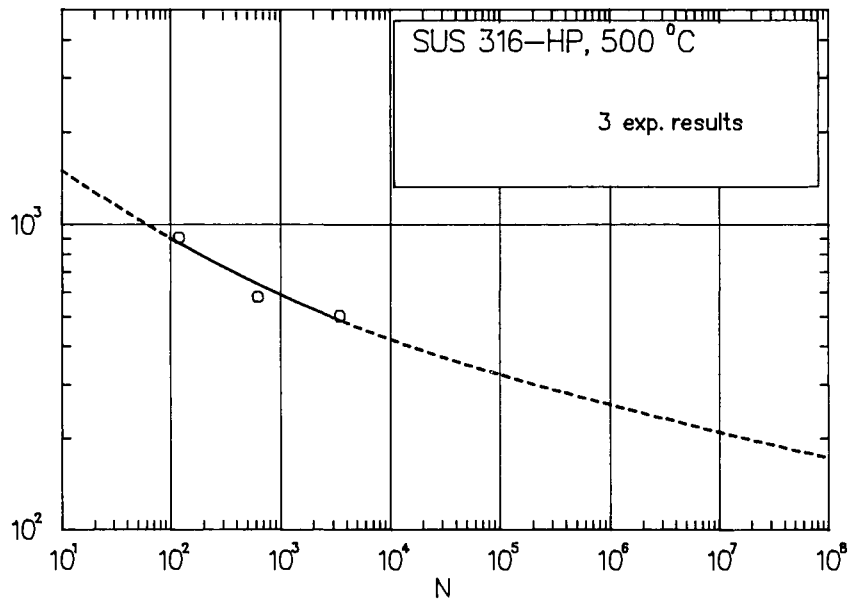
Cyclic test

Loading condition : total strain control, R_e = -1
Specimen : cylindrical, $\varnothing$ 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 13 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.06 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-HP, 500°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	535.5	0.0	0.8600	119.0
2.0000	424.5	0.0	0.4450	622.0
3.0000	406.0	0.0	0.3500	3463.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1075°C/30' water, 1100°C/1h water
 Test temperature : +600°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.1]
 Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.075	0.77	1.49	0.030	0.009	10.02	16.45	2.09	0.18	0.040	0.098

Monotonic properties

E	=	167000	N/mm ²	ν	=	-
R _{p0.2}	=	114	N/mm ²	K	=	N/mm ²
R _m	=	405	N/mm ²	n	=	-
A ₅	=	48	%	σ_f	=	N/mm ²
Z	=	71	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	307	N/mm ²	K'	=	1104	N/mm ²
σ_g	=	153	N/mm ²	n'	=	0.206	-
ϵ_g	=	0.099	%	σ'_f	=	850	N/mm ²
N _r	=	5111	cycles	ϵ'_f	=	0.282	-
T _σ	=	1.091	-	b	=	-0.113	-
T _{εp}	=	1.187	-	c	=	-0.548	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

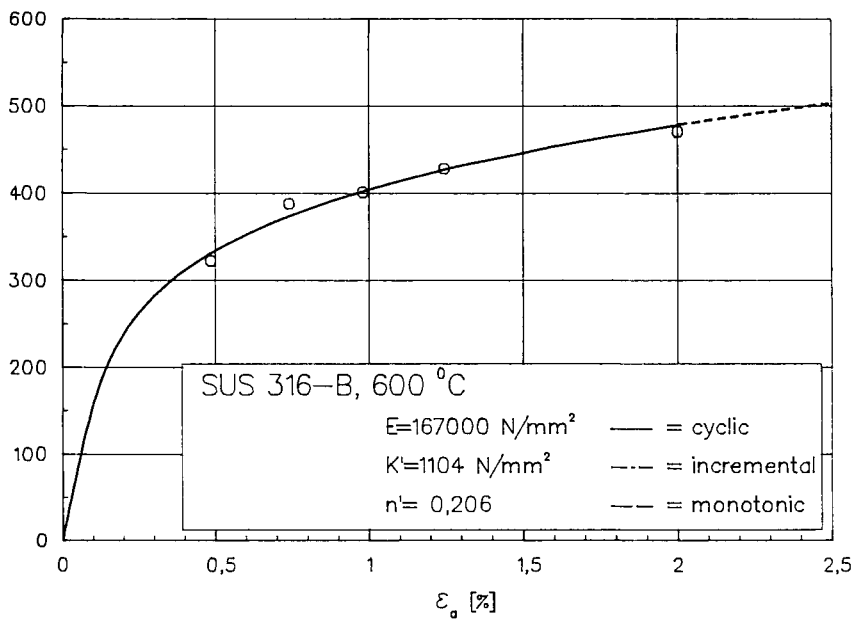
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

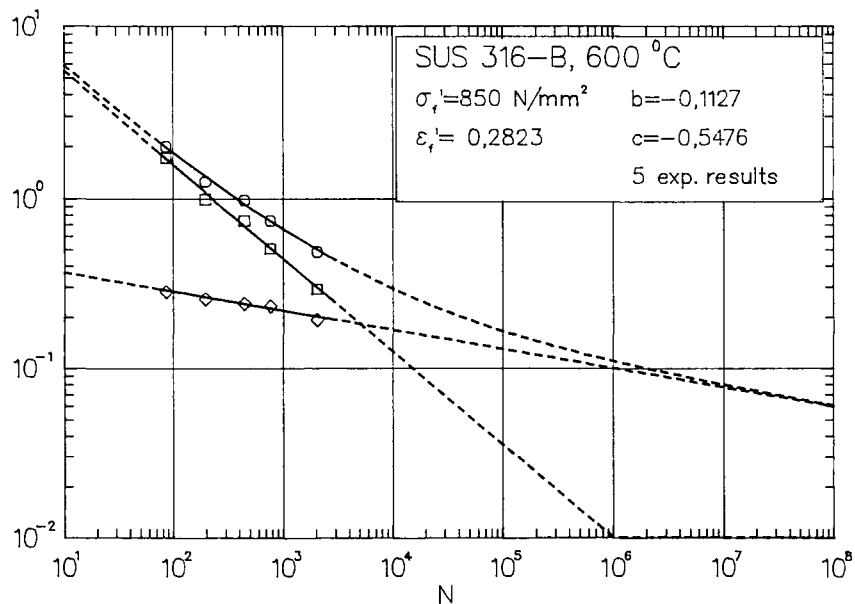
Remarks :

190

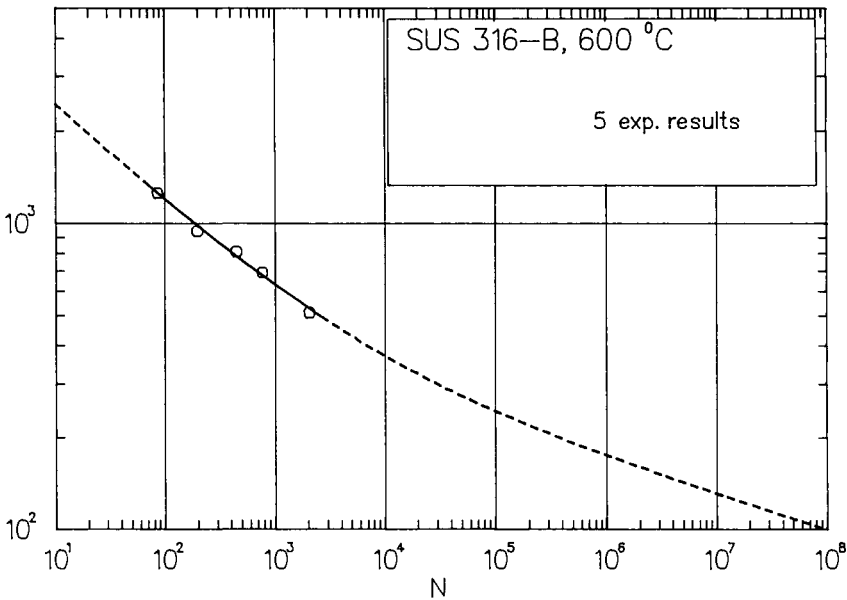
σ_a [N/mm²]



ϵ_a [%]



PSWT [N/mm²]



Material : SUS 316-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	470.9	0.0	2.0000	86.0
2.0000	428.2	0.0	1.2450	197.0
3.0000	401.2	0.0	0.9800	446.0
4.0000	388.0	0.0	0.7400	767.0
5.0000	322.3	0.0	0.4850	2045.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1050°C/30' water
Test temperature : +600°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.081	0.52	1.60	0.027	0.006	10.15	16.73	2.18	0.088	0.033	0.032

Monotonic properties

E	=	170000	N/mm ²	ν	=	-
R _{p0.2}	=	135	N/mm ²	K	=	N/mm ²
R _m	=	481	N/mm ²	n	=	-
A ₅	=	44	%	σ_f	=	N/mm ²
Z	=	70	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	287	N/mm ²	K'	=	1995	N/mm ²
σ'_g	=	103	N/mm ²	n'	=	0.312	-
ϵ'_g	=	0.069	%	σ'_f	=	1396	N/mm ²
N _T	=	8265	cycles	ϵ'_f	=	0.280	-
T _σ	=	1.037	-	b	=	-0.172	-
T _{ep}	=	1.175	-	c	=	-0.535	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

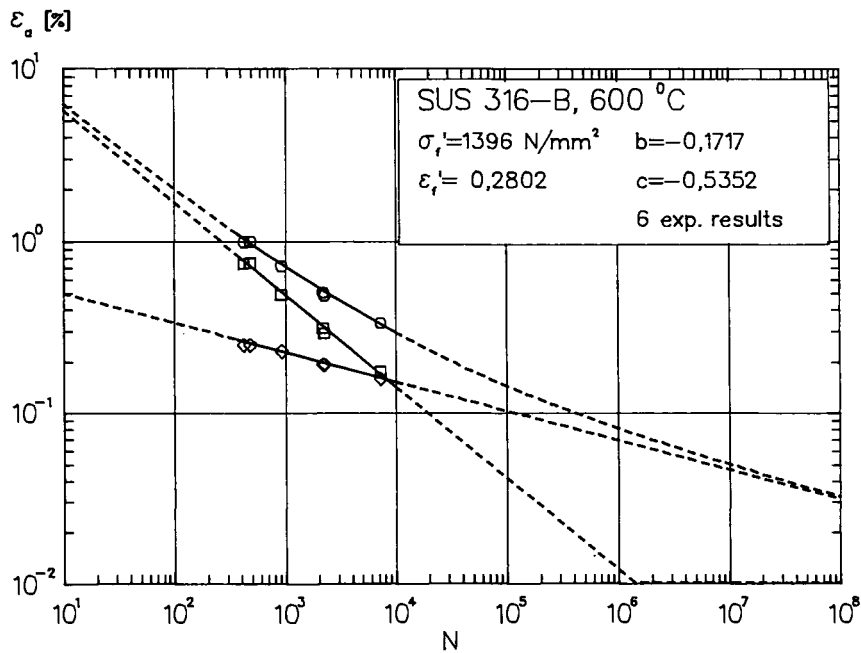
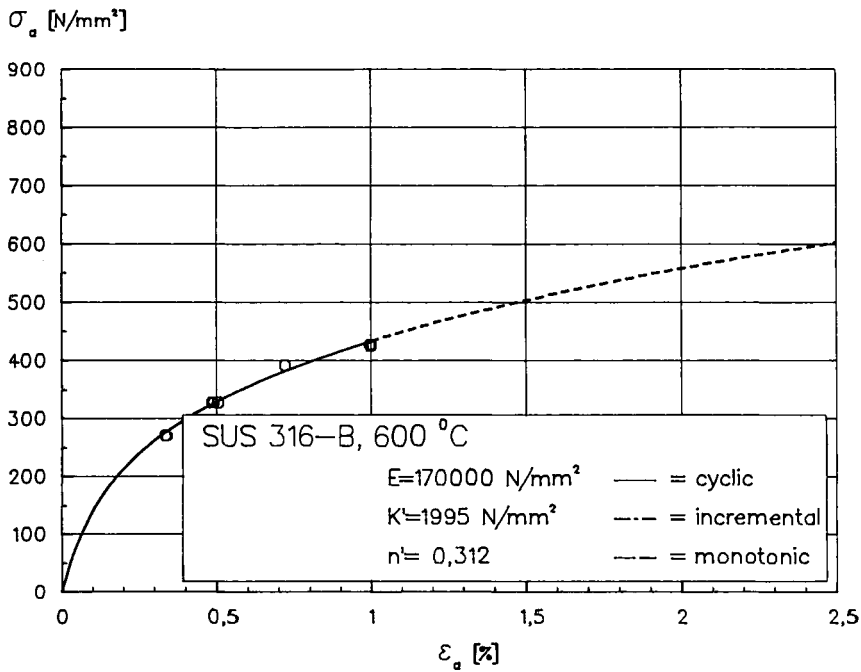
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 6 mm
Specimen location : in rolling direction
Gauge length : 30 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

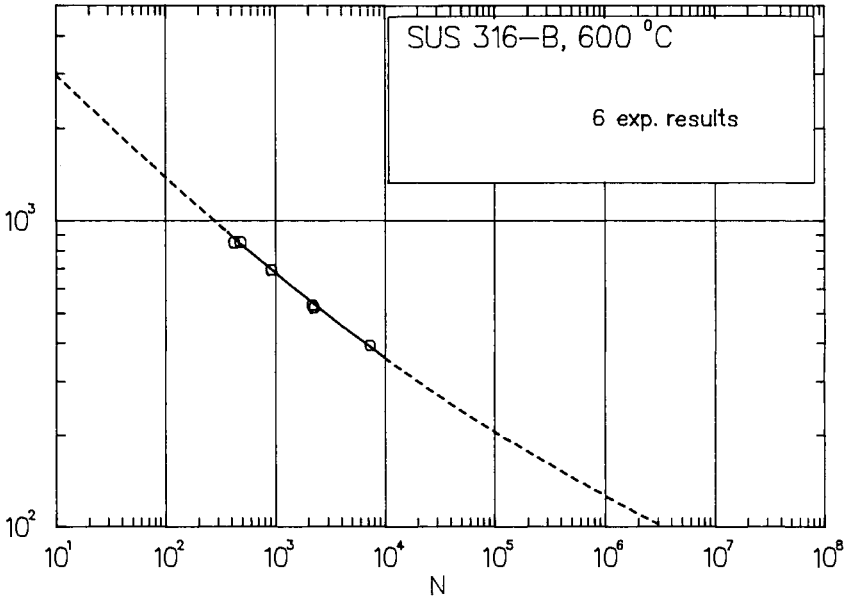
Cyclic test

Loading condition : total strain control, $R_g = -1$
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
2.0000	427.2	0.0	0.9950	422.0
1.0000	426.2	0.0	1.0000	481.0
3.0000	391.4	0.0	0.7200	917.0
4.0000	327.6	0.0	0.5050	2168.0
5.0000	328.1	0.0	0.4850	2224.0
6.0000	270.8	0.0	0.3350	7237.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1075°C/30' water, 1100°C/1h water
 Test temperature : +600°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.1]
 Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.075	0.77	1.49	0.030	0.009	10.02	16.45	2.09	0.18	0.040	0.098

Monotonic properties

E	=	167000	N/mm ²	ν	=	-
R _{p0.2}	=	114	N/mm ²	K	=	N/mm ²
R _m	=	405	N/mm ²	n	=	-
A ₅	=	48	%	σ_f	=	N/mm ²
Z	=	71	%	ε_f	=	-

Cyclic properties

R' _{p0.2}	=	318	N/mm ²	K'	=	1063	N/mm ²
σ_g	=	168	N/mm ²	n'	=	0.194	-
ε_g	=	0.108	%	σ'_f	=	755	N/mm ²
N _T	=	3611	cycles	ε'_f	=	0.179	-
T _{σ}	=	1.096	-	b	=	-0.099	-
T _{ε_p}	=	1.252	-	c	=	-0.513	-
Incremental step test :				K'	=		N/mm ²
				n'	=	-	-

Failure criterion : complete rupture

σ/ε -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

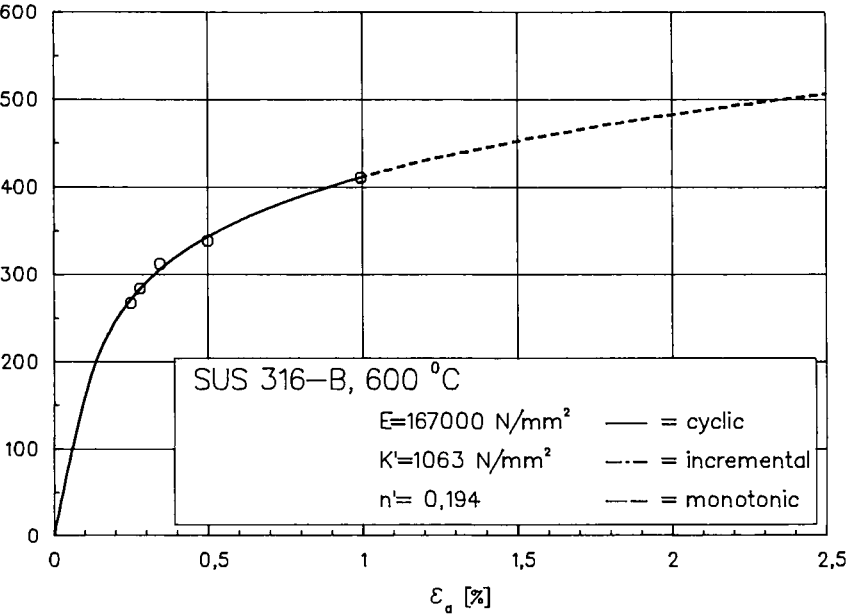
Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

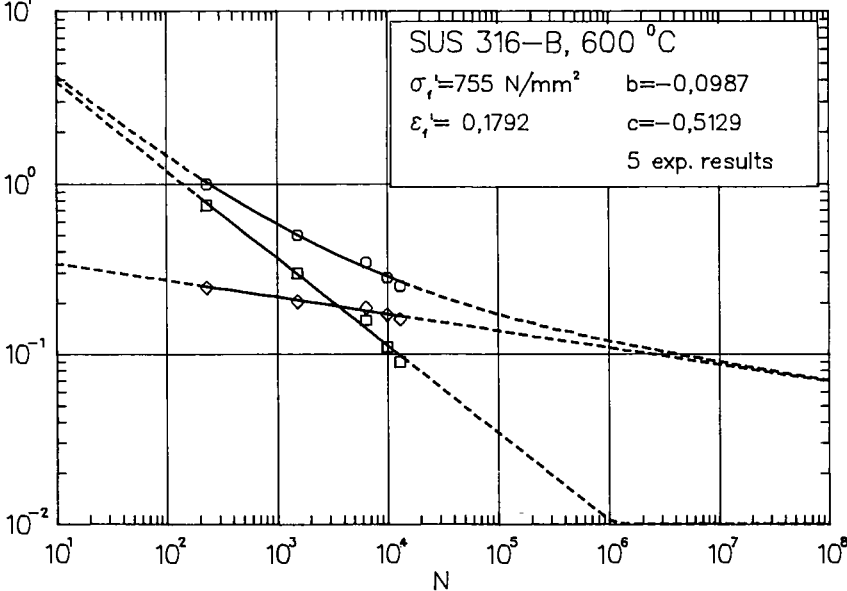
Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 4.0 (%/min)
 Waveform : triangular

Remarks :

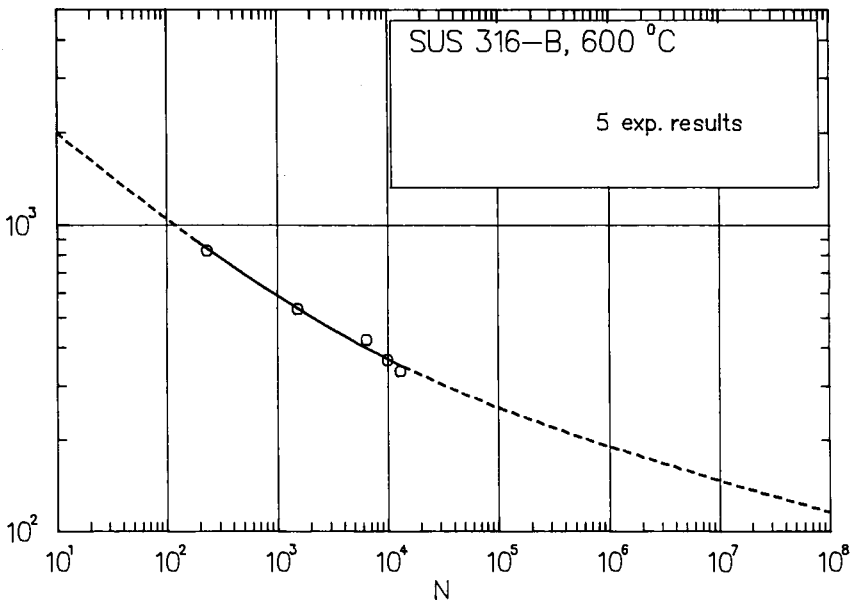
σ_a [N/mm²]



ϵ_a [%]



PSWT [N/mm²]



Material : SUS 316-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	410.5	0.0	0.9950	230.0
2.0000	338.9	0.0	0.5000	1528.0
3.0000	312.0	0.0	0.3450	6369.0
4.0000	284.0	0.0	0.2800	9888.0
5.0000	267.3	0.0	0.2500	12933.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1050°C/30' water
 Test temperature : +600°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.1]
 Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.081	0.52	1.60	0.027	0.006	10.15	16.73	2.18	0.088	0.033	0.032

Monotonic properties

E	=	170000	N/mm ²	ν	=	-
R _{p0.2}	=	135	N/mm ²	K	=	N/mm ²
R _m	=	481	N/mm ²	n	=	-
A ₅	=	44	%	σ _f	=	N/mm ²
Z	=	70	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	328	N/mm ²	K'	=	1147	N/mm ²
σ _g	=	146	N/mm ²	n'	=	0.202	-
ε _g	=	0.089	%	σ' _f	=	925	N/mm ²
N _T	=	2760	cycles	ε' _f	=	0.345	-
T _σ	=	1.038	-	b	=	-0.122	-
T _{εp}	=	1.091	-	c	=	-0.603	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture

σ/ε-values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

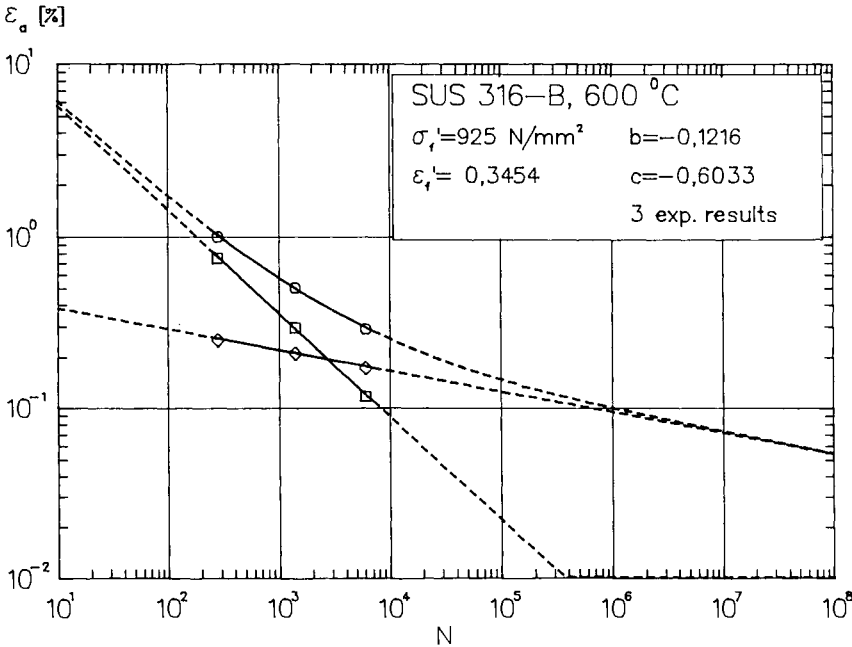
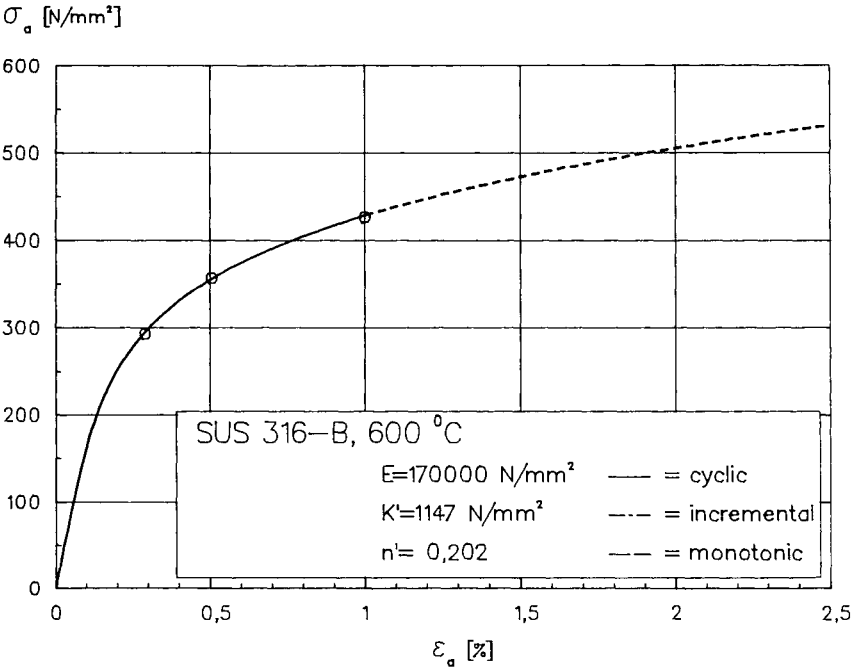
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 6 mm
 Specimen location : in rolling direction
 Gauge length : 30 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

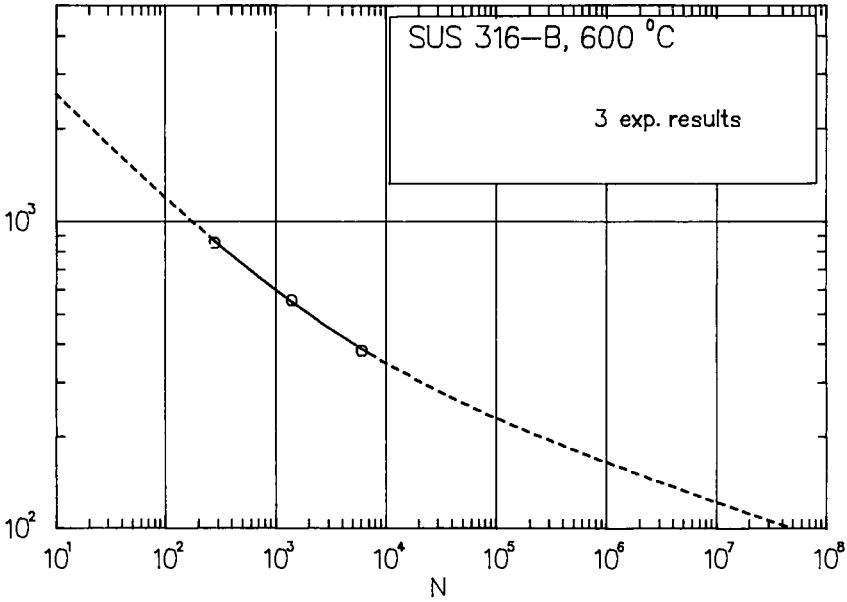
Cyclic test

Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 4.0 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	426.2	0.0	1.0000	280.0
2.0000	356.6	0.0	0.5050	1402.0
3.0000	293.3	0.0	0.2900	6030.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1075°C/30' water, 1100°C/1h water
 Test temperature : +600°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.1]
 Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.075	0.77	1.49	0.030	0.009	10.02	16.45	2.09	0.18	0.040	0.098

Monotonic properties

E	=	167000	N/mm ²	v	=	-
R _{p0.2}	=	114	N/mm ²	K	=	N/mm ²
R _m	=	405	N/mm ²	n	=	-
A ₅	=	48	%	σ _f	=	N/mm ²
Z	=	71	%	ε _f	=	-

Cyclic properties

R _{p0.2}	=	323	N/mm ²	K'	=	799	N/mm ²
σ _g	=	183	N/mm ²	n'	=	0.146	-
ε _g	=	0.113	%	σ' _f	=	601	N/mm ²
N _r	=	1524	cycles	ε' _f	=	0.139	-
T _σ	=	1.023	-	b	=	-0.078	-
T _{εp}	=	1.209	-	c	=	-0.534	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

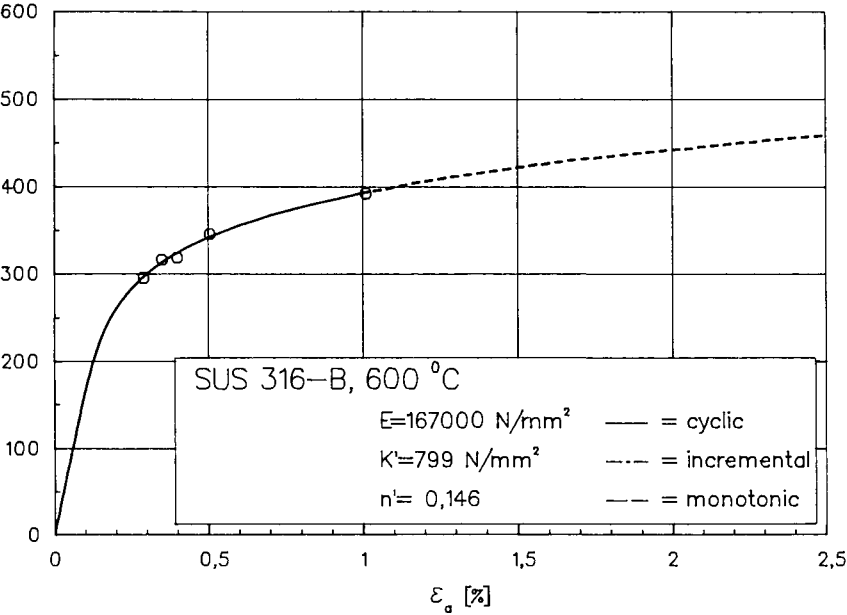
Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

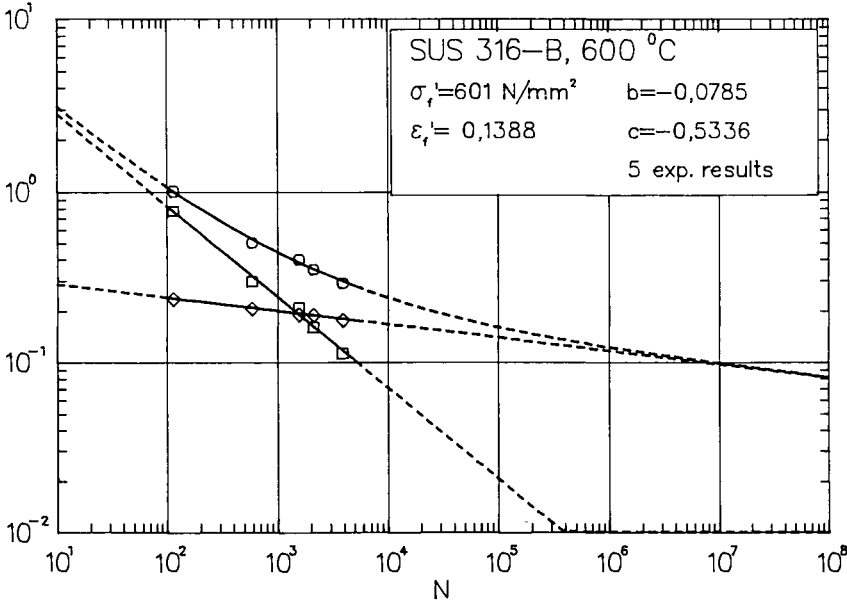
Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.40 (%/min)
 Waveform : triangular

Remarks :

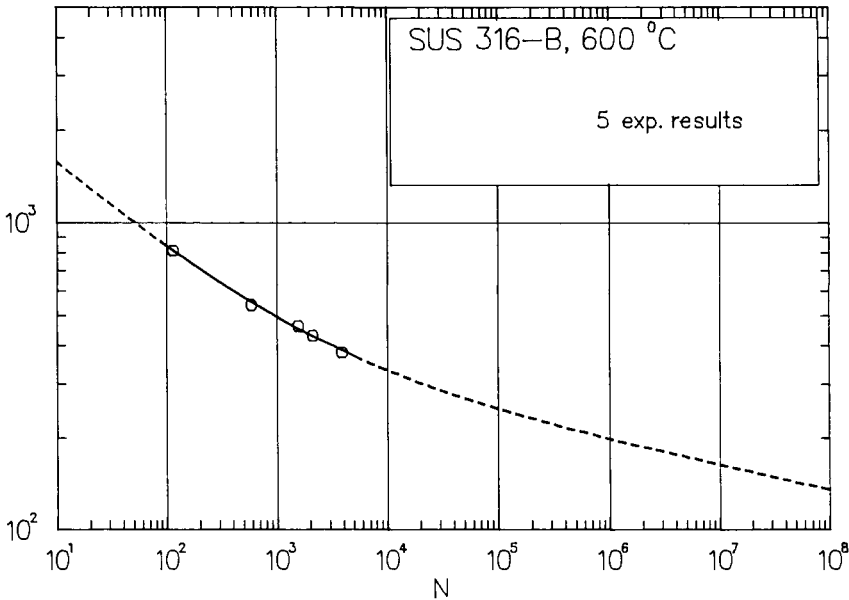
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 316-B, 600 °C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	392.4	0.0	1.0100	114.0
2.0000	345.8	0.0	0.5050	585.0
3.0000	318.8	0.0	0.4000	1560.0
4.0000	316.4	0.0	0.3500	2109.0
5.0000	295.8	0.0	0.2900	3872.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1050°C/30' water
Test temperature : +600°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.081	0.52	1.60	0.027	0.006	10.15	16.73	2.18	0.088	0.033	0.032

Monotonic properties

E	=	170000	N/mm ²	ν	=	-
R _{p0.2}	=	135	N/mm ²	K	=	N/mm ²
R _m	=	481	N/mm ²	n	=	-
A ₅	=	44	%	σ_f	=	N/mm ²
Z	=	70	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	332	N/mm ²	K'	=	778	N/mm ²
σ_g	=	221	N/mm ²	n'	=	0.137	-
ϵ_g	=	0.137	%	σ'_f	=	579	N/mm ²
N _T	=	2997	cycles	ϵ'_f	=	0.170	-
T _{σ}	=	1.146	-	b	=	-0.063	-
T _{ep}	=	1.396	-	c	=	-0.513	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

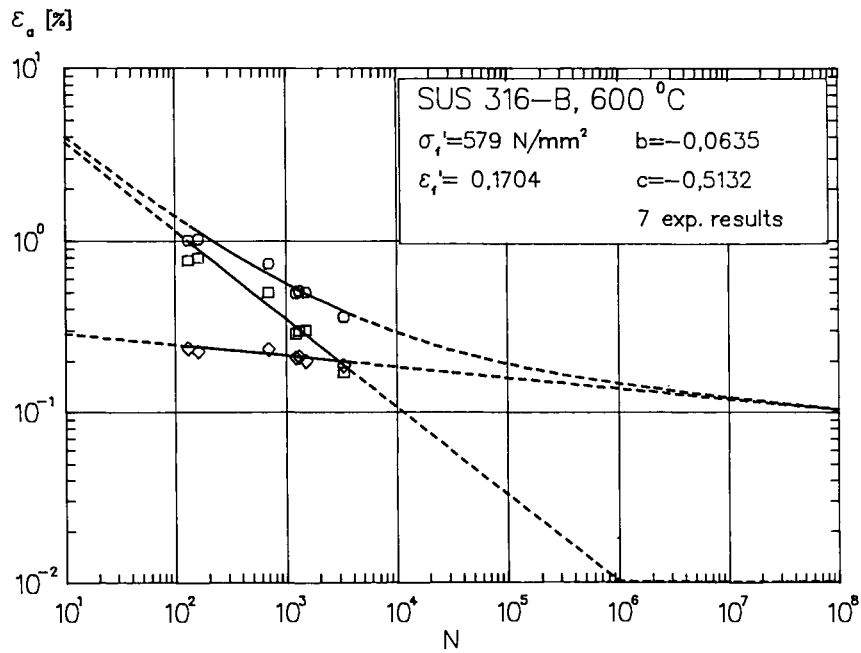
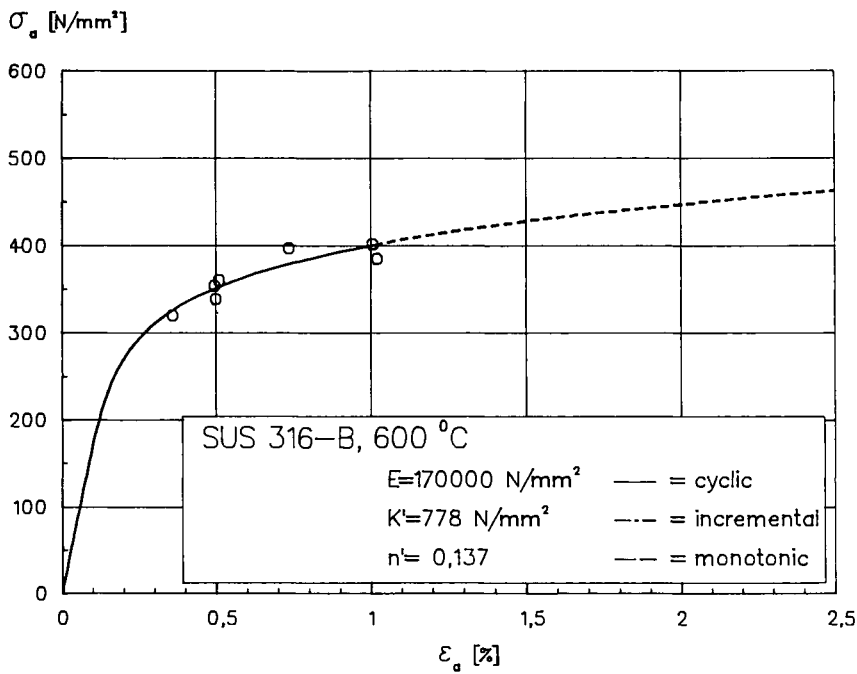
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 6 mm
Specimen location : in rolling direction
Gauge length : 30 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

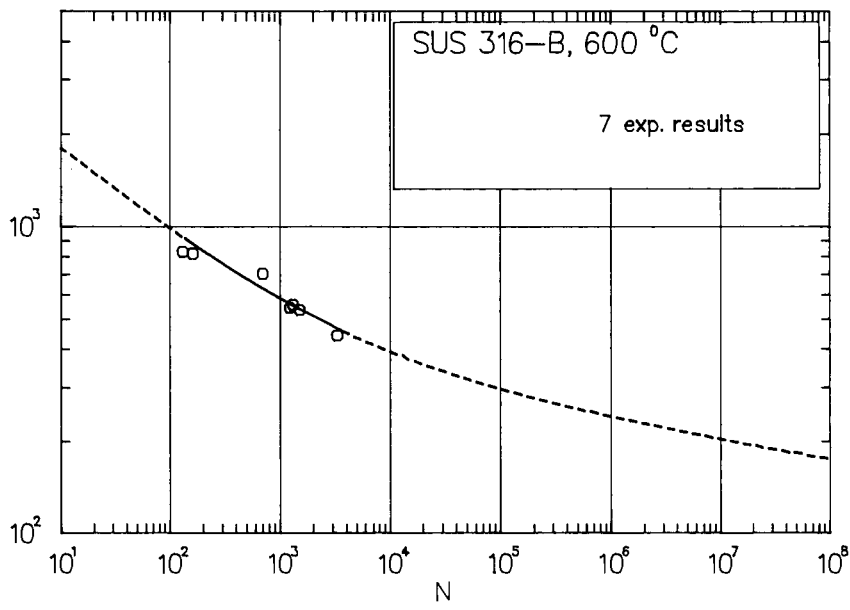
Cyclic test

Loading condition : total strain control, R_e = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
2.0000	401.7	0.0	1.0050	131.0
1.0000	385.0	0.0	1.0200	162.0
3.0000	396.8	0.0	0.7350	698.0
6.0000	353.6	0.0	0.4950	1229.0
4.0000	360.0	0.0	0.5100	1318.0
5.0000	338.5	0.0	0.5000	1516.0
7.0000	320.3	0.0	0.3600	3292.0

X 5 CrNiMo 18 10	1.4401	SUS 316-HP
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Heat treatment : hot rolled, 1100°C/30' water
Test temperature : +600°C
Semifinished material : plate, 24x2300x5600 mm
Reference : [4.2]
Year : 1979

Hardness :

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.05	0.70	1.10	0.034	0.003	12.60	17.05	2.24	0.31	0.03	0.001

Microstructure :

Monotonic properties

E	=	168500	N/mm ²	ν	=	-
R _{p0.2}	=	164	N/mm ²	K	=	N/mm ²
R _m	=	449	N/mm ²	n	=	-
A ₅	=	41	%	σ_f	=	860 N/mm ²
Z	=	62	%	ε_f	=	-

Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate :

Cyclic properties

R' _{p0.2}	=	308	N/mm ²	K'	=	1230	N/mm ²
σ'_g	=	182	N/mm ²	n'	=	0.223	-
ε'_g	=	0.126	%	σ'_f	=	681	N/mm ²
N _T	=	6108	cycles	ε'_f	=	0.072	-
T _{σ}	=	1.146	-	b	=	-0.087	-
T _{ε_p}	=	1.554	-	c	=	-0.393	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

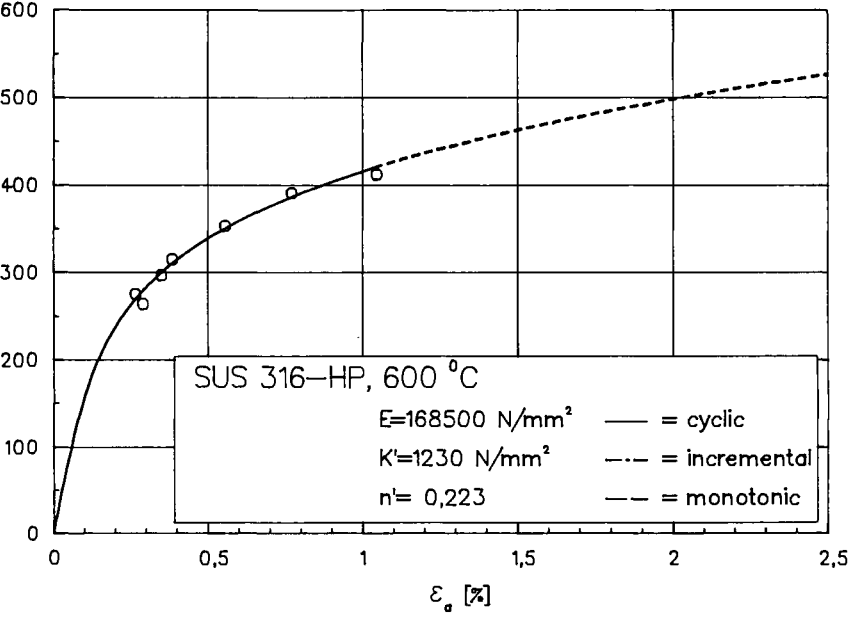
Cyclic test

Loading condition : total strain control, R _{ε} = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 13 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 6 (%/min)
Waveform : triangular

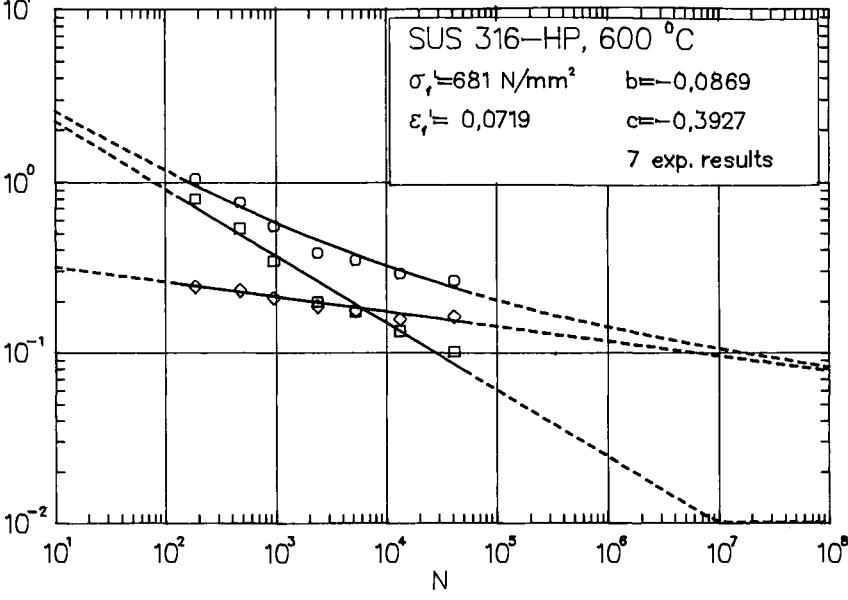
Failure criterion : 25% decrease in the max. tensile load of N/2
 σ/ε -values valid for : half life until complete spec. rupture
Remarks : Young's modulus estimated

Remarks :

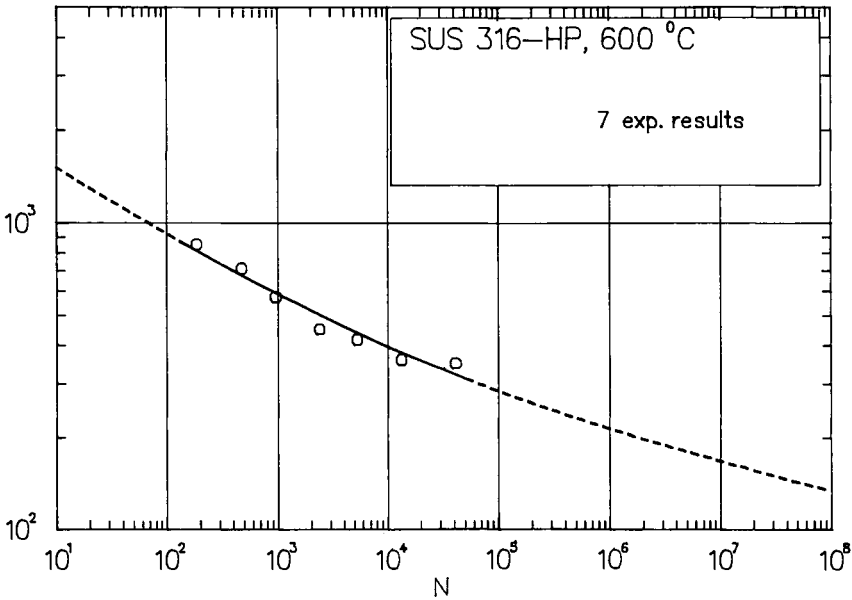
σ_a [N/mm²]



ϵ_a [%]



PSWT [N/mm²]



Material : SUS 316-HP, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	412.0	0.0	1.0450	186.0
2.0000	391.0	0.0	0.7700	474.0
3.0000	353.0	0.0	0.5550	956.0
4.0000	315.0	0.0	0.3850	2377.0
5.0000	297.0	0.0	0.3500	5247.0
6.0000	264.0	0.0	0.2900	13240.0
7.0000	275.5	0.0	0.2650	41100.0

X 5 CrNiMo 18 10	1.4401	SUS 316-HP
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Heat treatment : hot rolled, 1100°C/30' water
 Test temperature : +600°C
 Semifinished material : plate, 24x2300x5600 mm
 Reference : [4.2]
 Year : 1979

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.05	0.70	1.10	0.034	0.003	12.60	17.05	2.24	0.31	0.03	0.001

Monotonic properties

E	=	168500	N/mm ²	ν	=	-
R _{p0.2}	=	164	N/mm ²	K	=	N/mm ²
R _m	=	449	N/mm ²	n	=	-
A ₅	=	41	%	σ_f	=	630 N/mm ²
Z	=	62	%	ε_f	=	-

Cyclic properties

R _{p0.2}	=	306	N/mm ²	K'	=	1262	N/mm ²
σ_g	=	185	N/mm ²	n'	=	0.228	-
ε_g	=	0.132	%	σ'_f	=	615	N/mm ²
N _T	=	4740	cycles	ε'_f	=	0.041	-
T _{σ}	=	1.089	-	b	=	-0.079	-
T _{ε_p}	=	1.471	-	c	=	-0.343	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : 25% decrease in the max. tensile load of N/2

σ/ε -values valid for : half life until complete spec. rupture

Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

Loading condition :

Specimen : cylindrical, Ø 10 mm

Specimen location : in rolling direction

Gauge length : 50 mm

Testing machine :

Strain rate :

Cyclic test

Loading condition : total strain control, R_e = -1

Specimen : cylindrical, Ø 6 mm

Surface : mechanically polished

Specimen location : in rolling direction

Gauge length : 13 mm

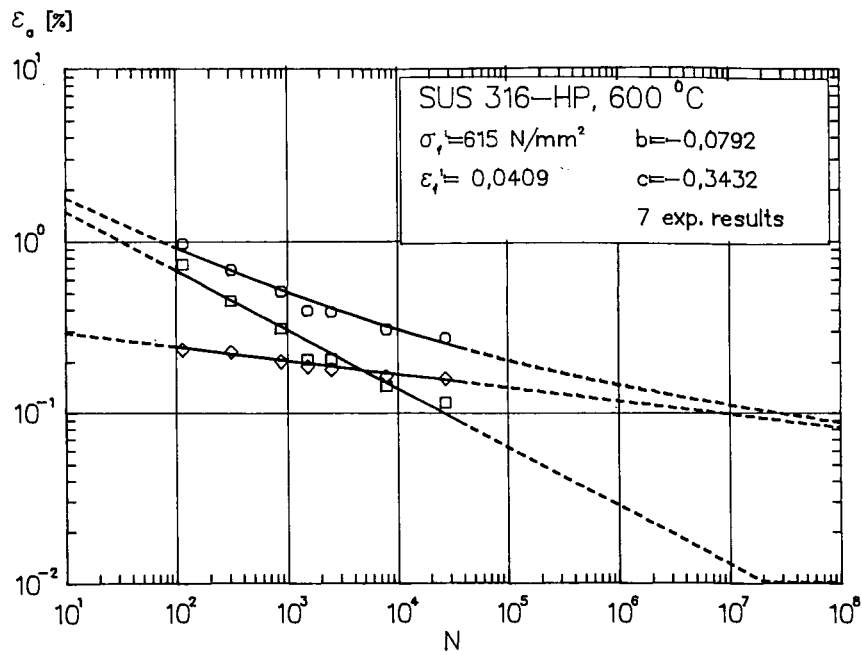
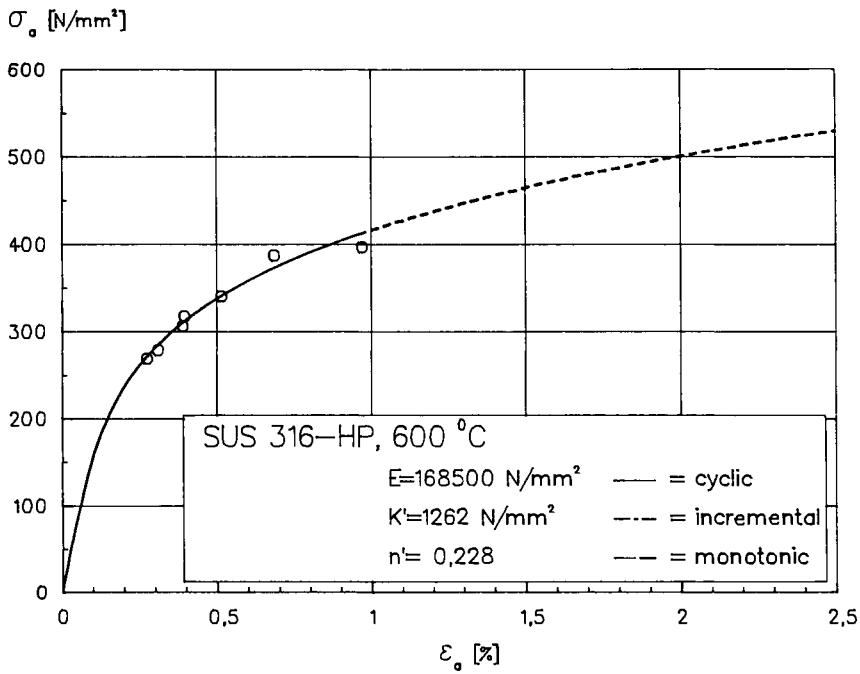
Testing machine : servohydraulic, max. 50 kN

Frequency :

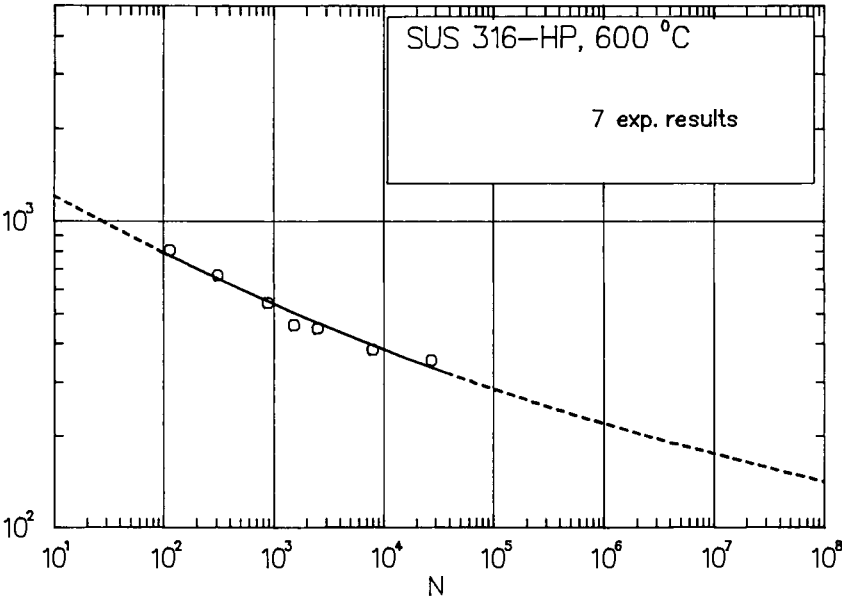
Strain rate : 0.6 (%/min)

Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-HP, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	397.0	0.0	0.9700	114.0
2.0000	387.0	0.0	0.6850	311.0
3.0000	340.5	0.0	0.5150	878.0
4.0000	317.5	0.0	0.3950	1520.0
5.0000	306.5	0.0	0.3900	2488.0
6.0000	279.0	0.0	0.3100	7864.0
7.0000	269.0	0.0	0.2750	27212.0

X 5 CrNiMo 18 10	1.4401	SUS 316-HP
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Heat treatment : hot rolled, 1100°C/30' water
 Test temperature : +600°C
 Semifinished material : plate, 24x2300x5600 mm
 Reference : [4.2]
 Year : 1979

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.05	0.70	1.10	0.034	0.003	12.60	17.05	2.24	0.31	0.03	0.001

Monotonic properties

E	=	168500	N/mm ²	ν	=	-
R _{p0.2}	=	164	N/mm ²	K	=	N/mm ²
R _m	=	449	N/mm ²	n	=	-
A ₅	=	41	%	σ_f	=	860 N/mm ²
Z	=	62	%	ε_f	=	-

Cyclic properties

R' _{p0.2}	=	652	N/mm ²	K'	=	991	N/mm ²
σ'_g	=	458	N/mm ²	n'	=	0.067	-
ε'_g	=	0.273	%	σ'_f	=	869	N/mm ²
N _r	=	148	cycles	ε'_f	=	0.141	-
T _{σ}	=	1.016	-	b	=	-0.042	-
T _{ε_p}	=	1.058	-	c	=	-0.624	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : 25% decrease in the max. tensile load of N/2
 σ/ε -values valid for : half life until complete spec. rupture
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

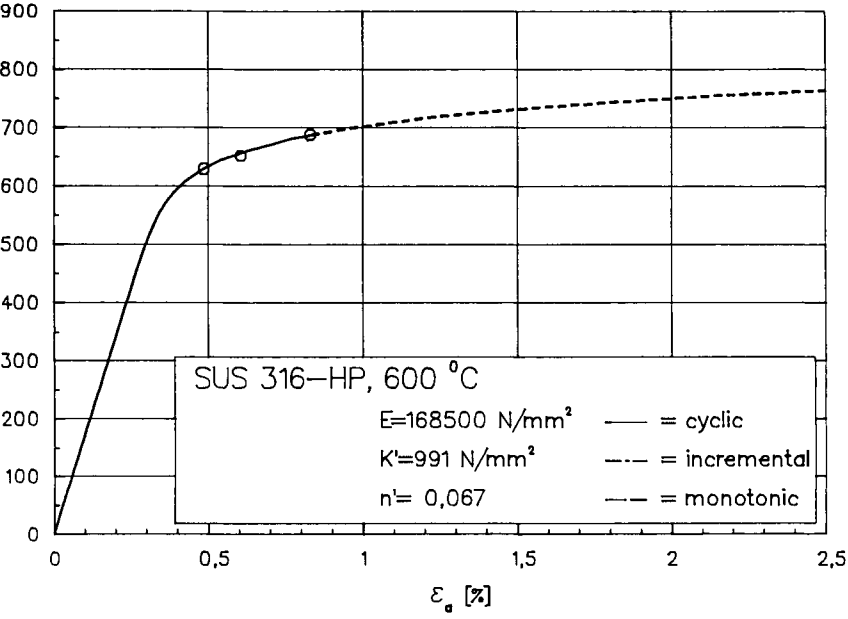
Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate :

Cyclic test

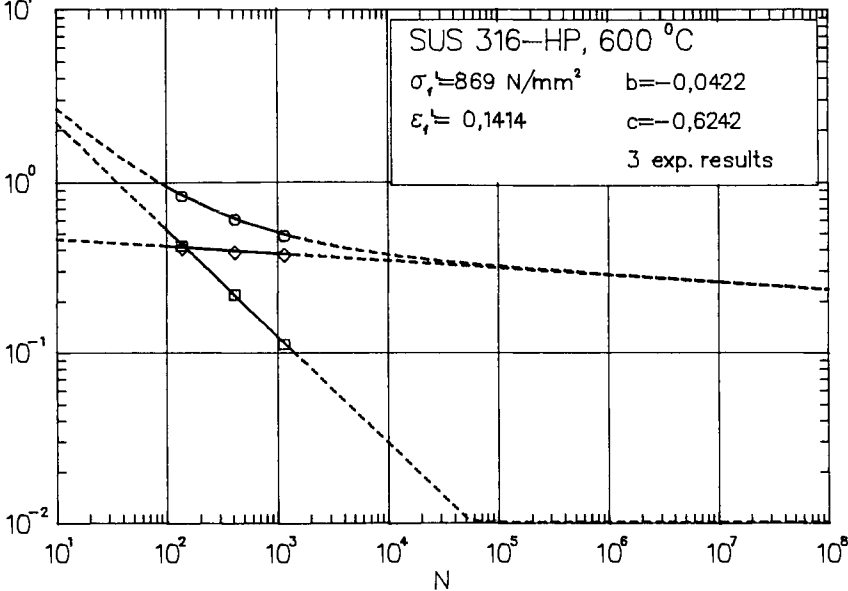
Loading condition : total strain control, R _{ε} = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 13 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.06 (%/min)
 Waveform : triangular

Remarks :

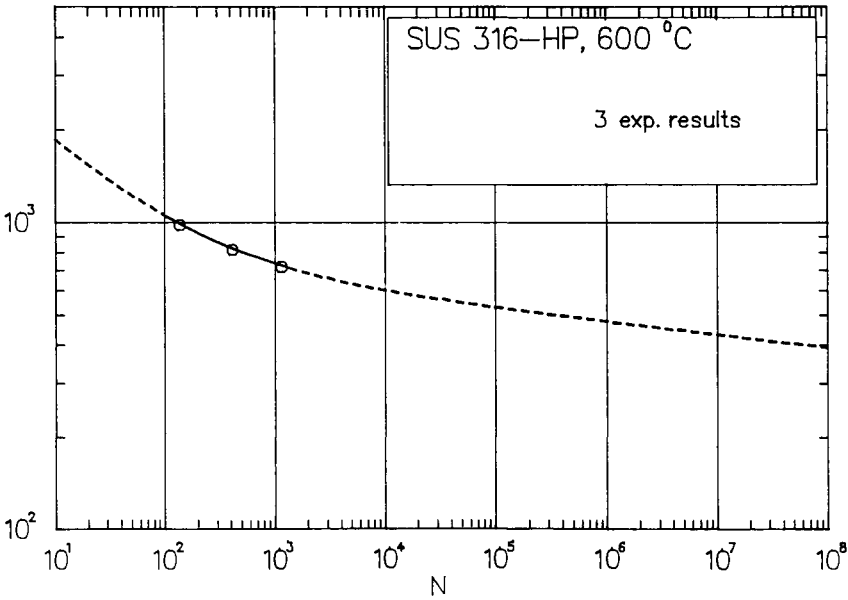
σ_e [N/mm²]



ϵ_e [%]



PSWT [N/mm²]



Material : SUS 316-HP, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	688.0	0.0	0.8300	137.0
2.0000	652.0	0.0	0.6050	411.0
3.0000	629.0	0.0	0.4850	1150.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1075°C/30' water, 1100°C/1h water
Test temperature : +700°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.075	0.77	1.49	0.030	0.009	10.02	16.45	2.09	0.18	0.040	0.098

Monotonic properties

E	=	159000	N/mm ²	ν	=	-
R _{p0.2}	=	113	N/mm ²	K	=	N/mm ²
R _m	=	313	N/mm ²	n	=	-
A ₅	=	57	%	σ_f	=	N/mm ²
Z	=	66	%	e_f	=	-

Cyclic properties

R' _{p0.2}	=	228	N/mm ²	K'	=	859	N/mm ²
σ'_g	=	105	N/mm ²	n'	=	0.214	-
ϵ'_g	=	0.071	%	σ'_f	=	667	N/mm ²
N _T	=	7283	cycles	ϵ'_f	=	0.305	-
T _{σ}	=	1.030	-	b	=	-0.122	-
T _{ϵ_p}	=	1.123	-	c	=	-0.569	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

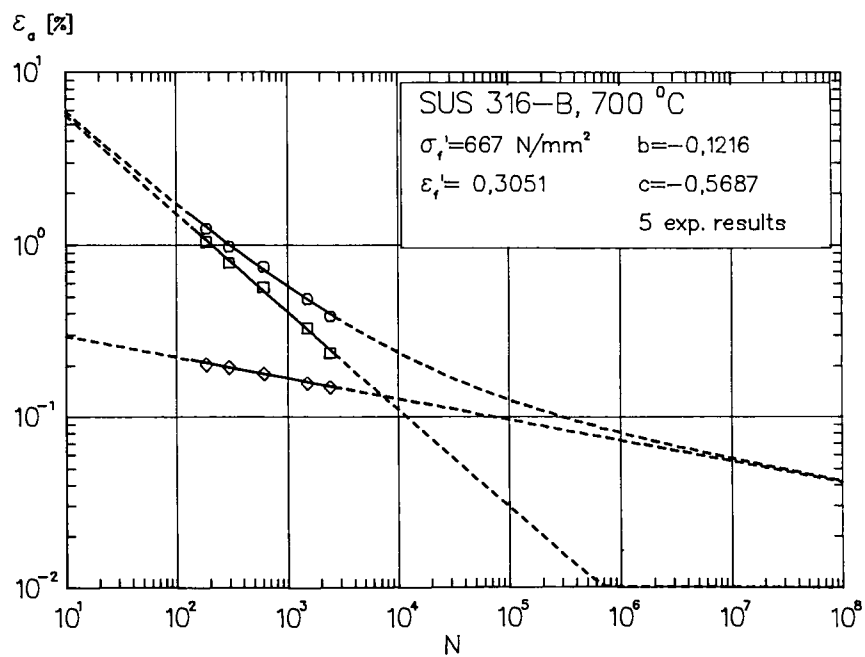
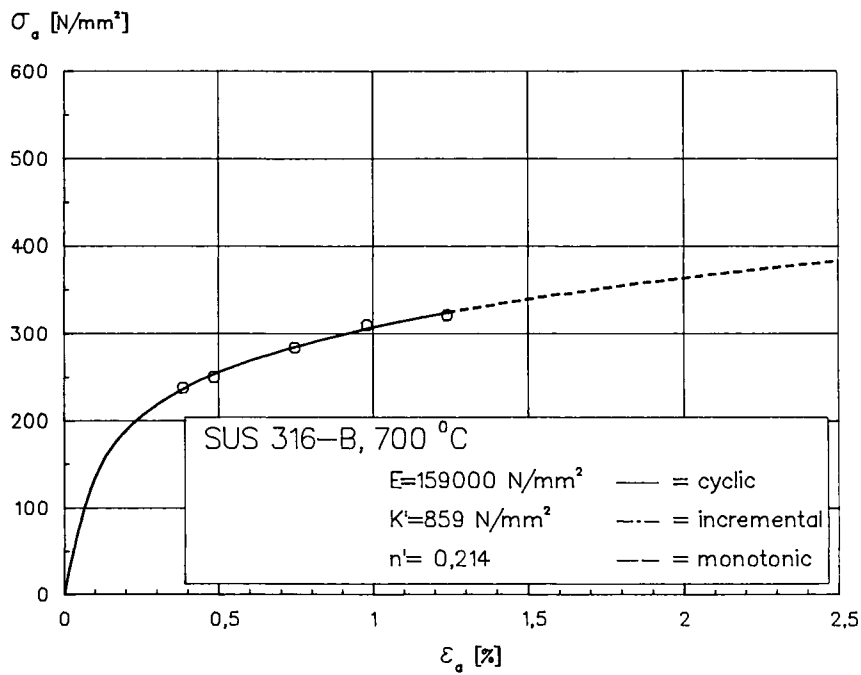
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

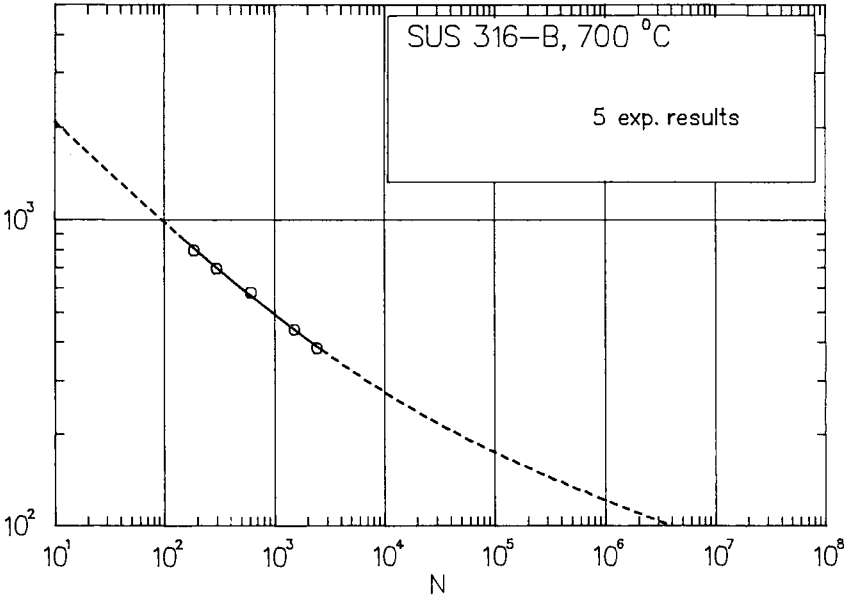
Cyclic test

Loading condition : total strain control, R_e = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-B, 700 °C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	321.3	0.0	1.2400	186.0
2.0000	310.0	0.0	0.9800	299.0
3.0000	284.0	0.0	0.7450	610.0
4.0000	250.2	0.0	0.4850	1515.0
5.0000	237.9	0.0	0.3850	2419.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1050°C/30' water
Test temperature : +700°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.081	0.52	1.60	0.027	0.006	10.15	16.73	2.18	0.088	0.033	0.032

Monotonic properties

E	=	168000	N/mm ²	ν	=	-
R _{p0.2}	=	114	N/mm ²	K	=	N/mm ²
R _m	=	326	N/mm ²	n	=	-
A ₅	=	43	%	σ_f	=	N/mm ²
Z	=	67	%	ε_f	=	-

Cyclic properties

R' _{p0.2}	=	234	N/mm ²	K'	=	936	N/mm ²
σ'_g	=	106	N/mm ²	n'	=	0.223	-
ε'_g	=	0.069	%	σ'_f	=	735	N/mm ²
N _T	=	8902	cycles	ε'_f	=	0.359	-
T _{σ}	=	1.101	-	b	=	-0.127	-
T _{ε_p}	=	1.204	-	c	=	-0.578	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ε -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

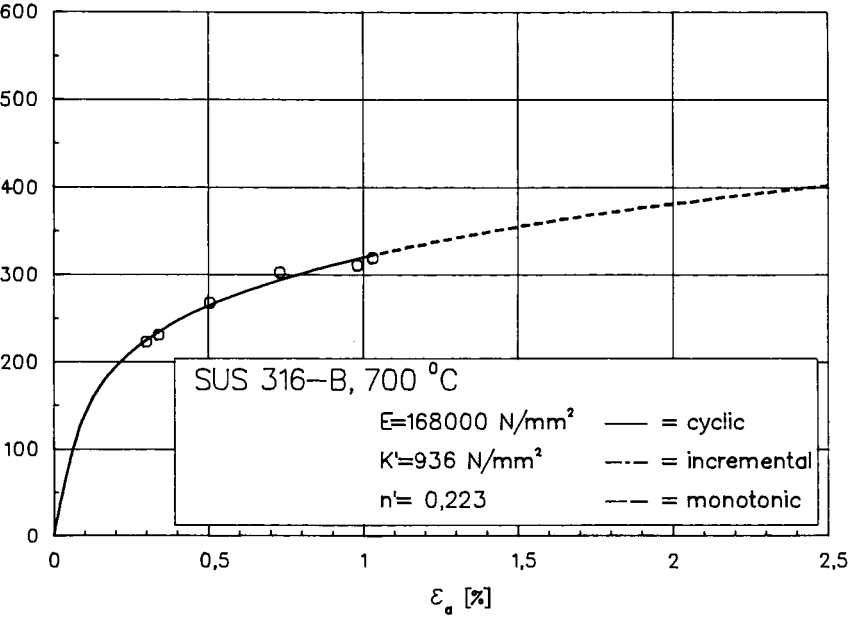
Loading condition :
Specimen : cylindrical, Ø 6 mm
Specimen location : in rolling direction
Gauge length : 30 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

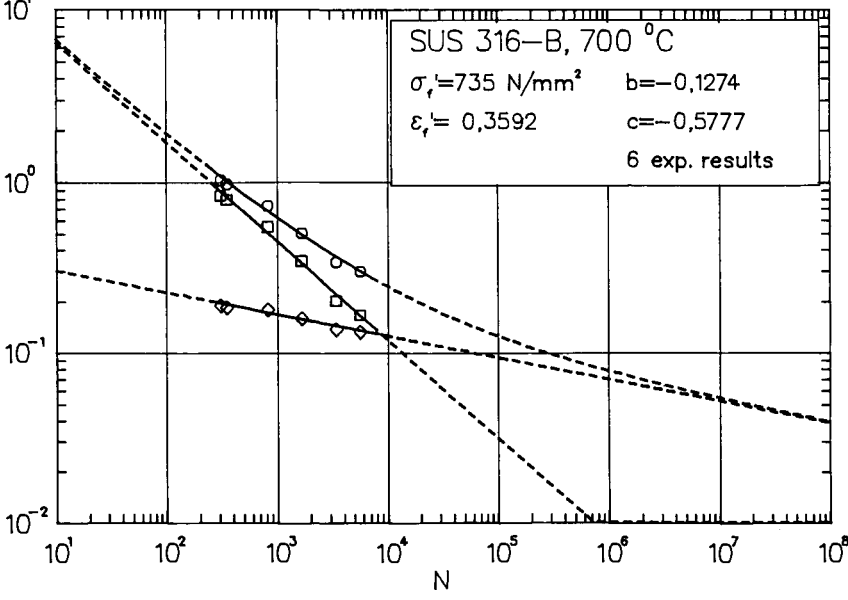
Loading condition : total strain control, R_e = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :

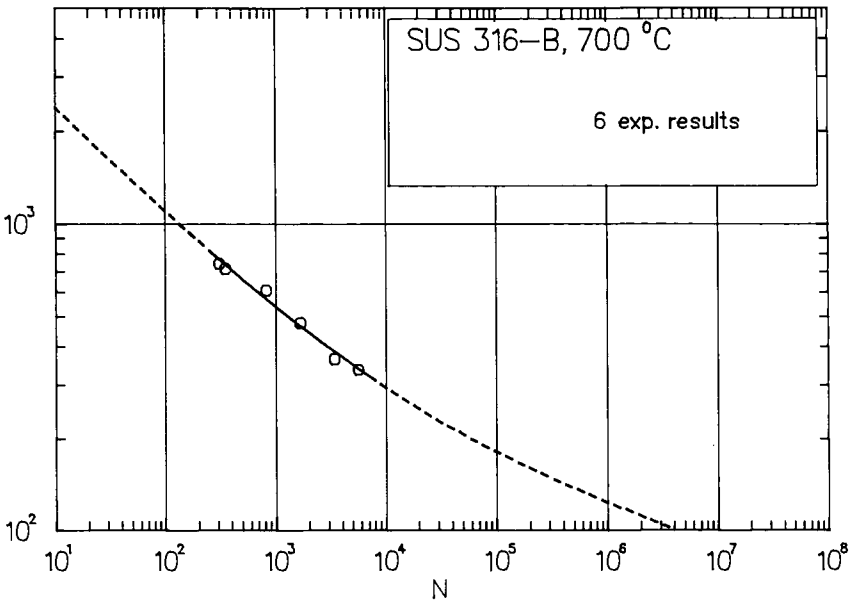
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 316-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	319.3	0.0	1.0300	308.0
2.0000	311.0	0.0	0.9800	351.0
3.0000	302.6	0.0	0.7300	817.0
4.0000	267.8	0.0	0.5050	1658.0
5.0000	231.5	0.0	0.3400	3394.0
6.0000	223.3	0.0	0.3000	5617.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1075°C/30' water, 1100°C/1h water
Test temperature : +700°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.075	0.77	1.49	0.030	0.009	10.02	16.45	2.09	0.18	0.040	0.098

Monotonic properties

E	=	159000	N/mm ²	ν	=	-
R _{p0.2}	=	113	N/mm ²	K	=	N/mm ²
R _m	=	313	N/mm ²	n	=	-
A ₅	=	57	%	σ _f	=	N/mm ²
Z	=	66	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	224	N/mm ²	K'	=	573	N/mm ²
σ _g	=	128	N/mm ²	n'	=	0.152	-
ε _g	=	0.086	%	σ' _f	=	467	N/mm ²
N _T	=	5997	cycles	ε' _f	=	0.262	-
T _σ	=	1.073	-	b	=	-0.085	-
T _{εp}	=	1.093	-	c	=	-0.563	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

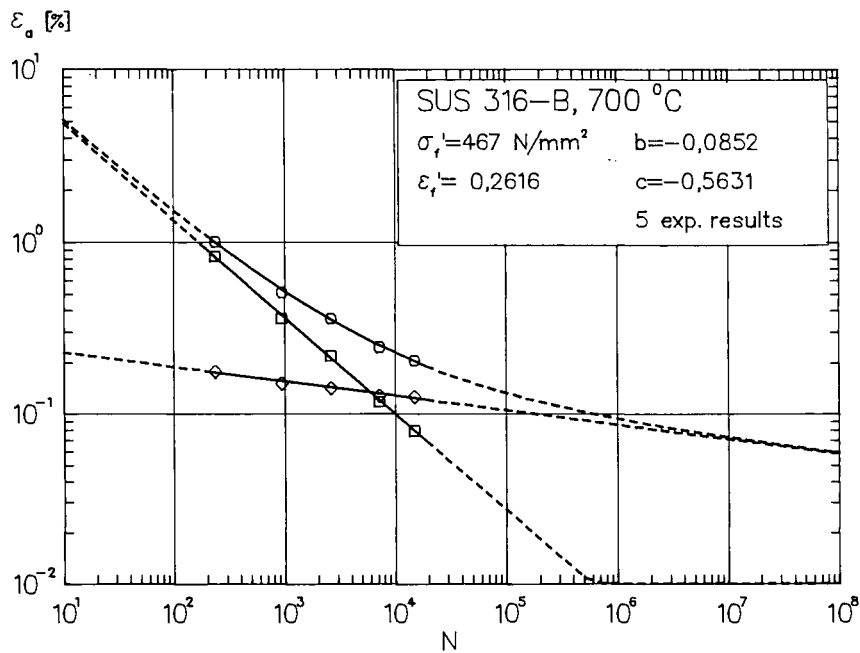
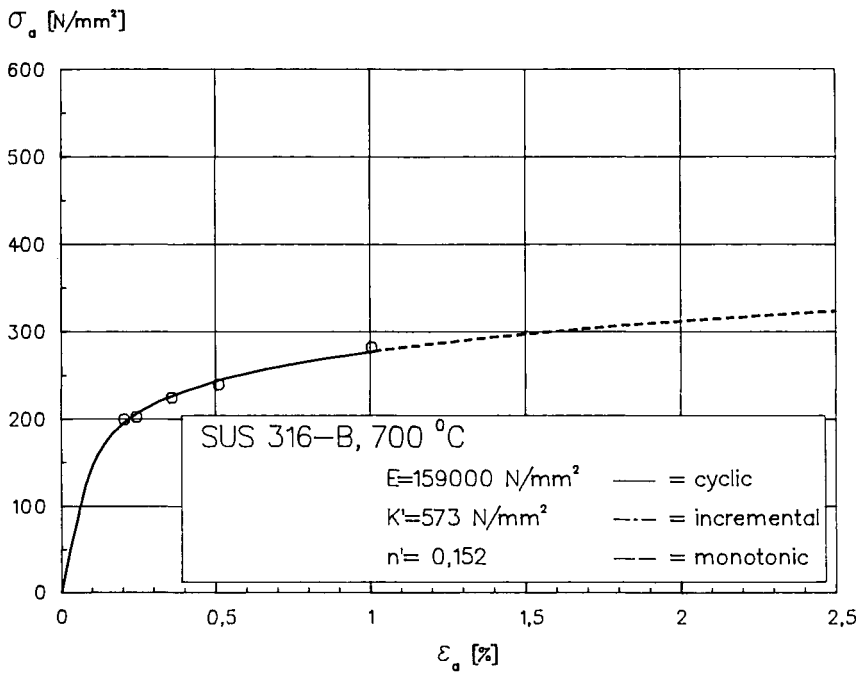
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

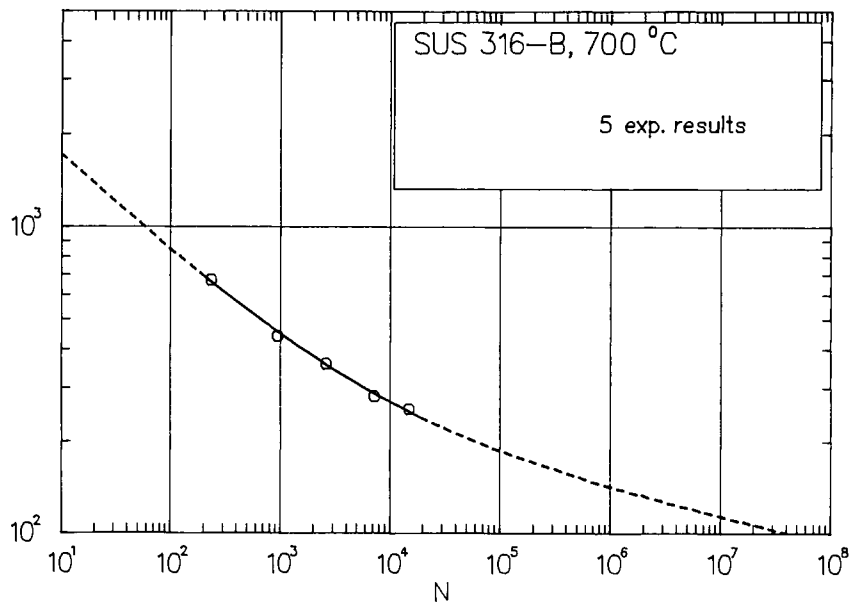
Cyclic test

Loading condition : total strain control, R_e = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 4.0 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	282.5	0.0	1.0050	236.0
2.0000	239.9	0.0	0.5100	944.0
3.0000	224.6	0.0	0.3600	2620.0
4.0000	202.6	0.0	0.2450	7188.0
5.0000	199.6	0.0	0.2050	14880.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1050°C/30' water
Test temperature : +700°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.081	0.52	1.60	0.027	0.006	10.15	16.73	2.18	0.088	0.033	0.032

Monotonic properties

E	=	168000	N/mm ²	ν	=	-
R _{p0.2}	=	114	N/mm ²	K	=	N/mm ²
R _m	=	326	N/mm ²	n	=	-
A _g	=	43	%	σ _f	=	N/mm ²
Z	=	67	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	201	N/mm ²	K'	=	893	N/mm ²
σ _g	=	117	N/mm ²	n'	=	0.240	-
ε _g	=	0.091	%	σ' _f	=	528	N/mm ²
N _T	=	45424	cycles	ε' _f	=	0.108	-
T _σ	=	1.029	-	b	=	-0.099	-
T _{εp}	=	1.232	-	c	=	-0.409	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

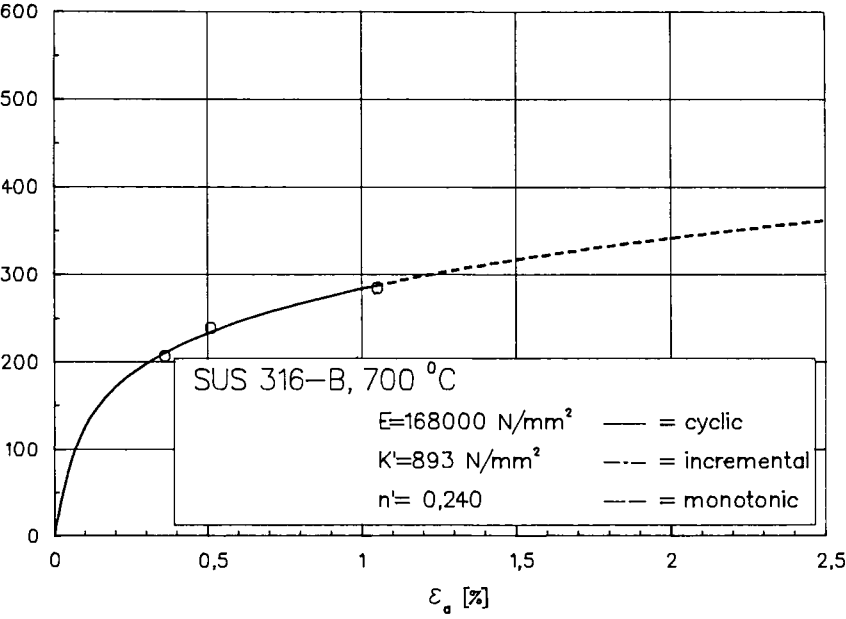
Loading condition :
Specimen : cylindrical, Ø 6 mm
Specimen location : in rolling direction
Gauge length : 30 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

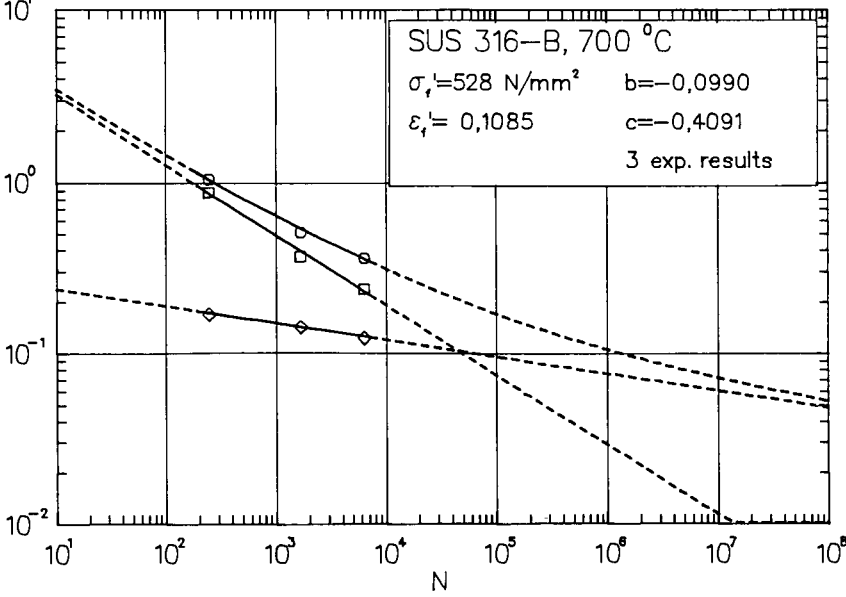
Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 4.1 (%/min)
Waveform : triangular

Remarks :

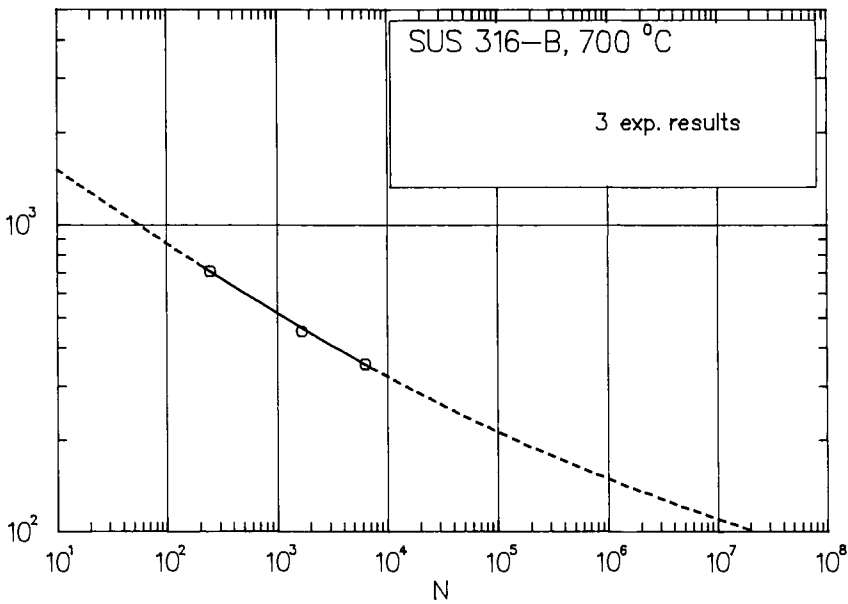
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 316-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	285.0	0.0	1.0500	247.0
2.0000	238.9	0.0	0.5100	1670.0
3.0000	206.5	0.0	0.3600	6301.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1075°C/30' water, 1100°C/1h water
 Test temperature : +700°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.1]
 Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.075	0.77	1.49	0.030	0.009	10.02	16.45	2.09	0.18	0.040	0.098

Monotonic properties

E	=	159000	N/mm ²	v	=	-
R _{p0.2}	=	113	N/mm ²	K	=	N/mm ²
R _m	=	313	N/mm ²	n	=	-
A ₅	=	57	%	σ _f	=	N/mm ²
Z	=	66	%	e _f	=	-

Cyclic properties

R' _{p0.2}	=	196	N/mm ²	K'	=	728	N/mm ²
σ _g	=	92	N/mm ²	n'	=	0.211	-
e _g	=	0.063	%	σ' _f	=	503	N/mm ²
N _T	=	7281	cycles	e' _f	=	0.173	-
T _σ	=	1.030	-	b	=	-0.112	-
T _{εp}	=	1.177	-	c	=	-0.529	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture

σ/ε-values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

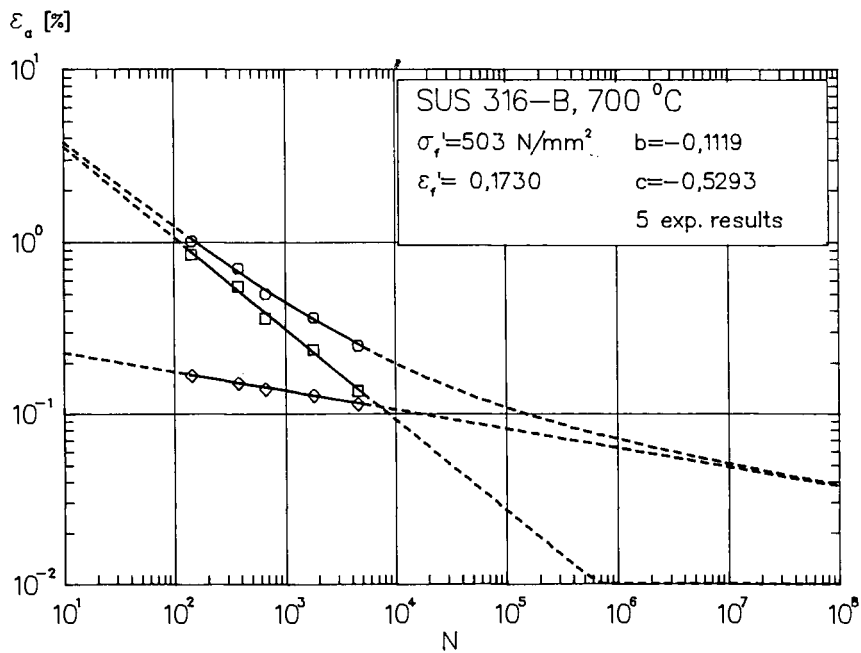
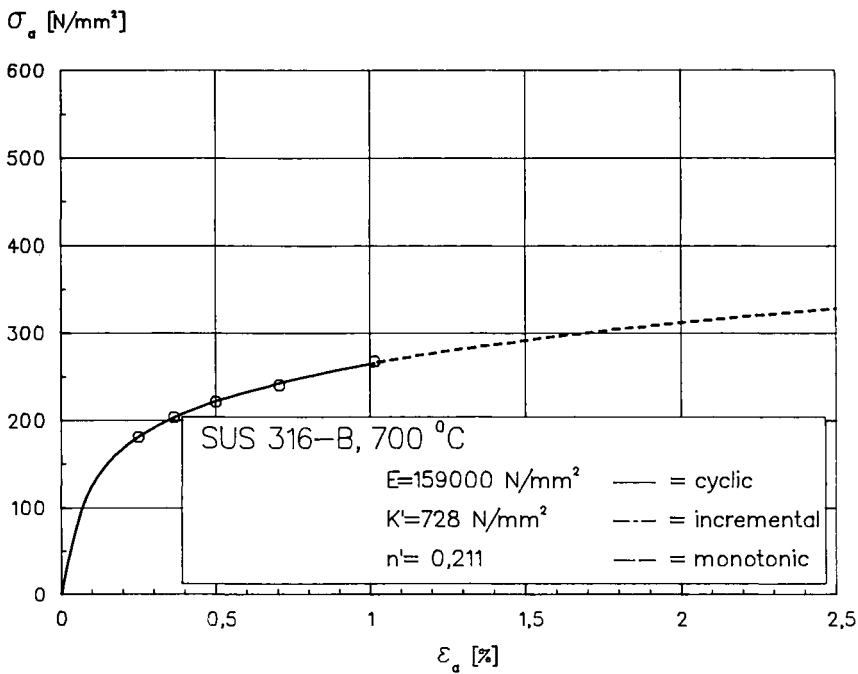
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

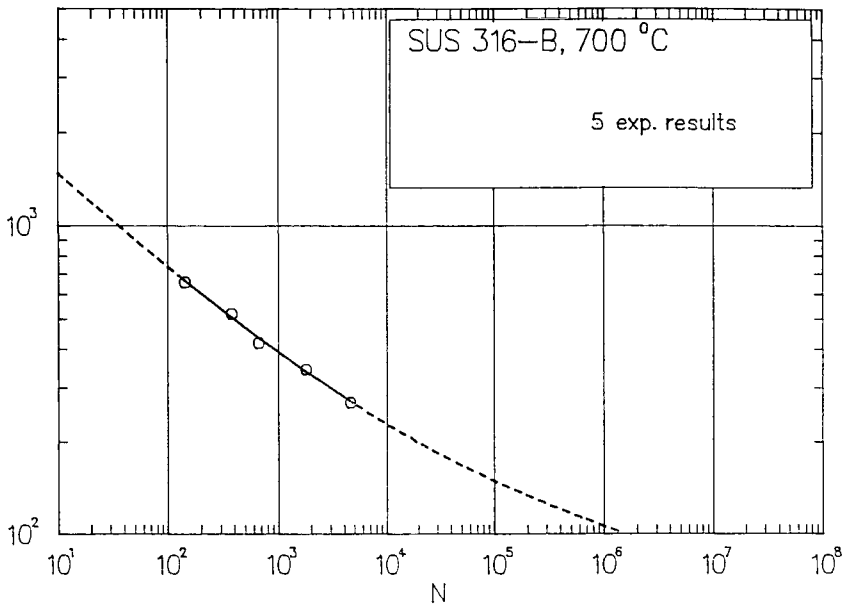
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.40 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	267.8	0.0	1.0150	143.0
2.0000	240.8	0.0	0.7050	379.0
3.0000	221.7	0.0	0.5000	661.0
4.0000	203.6	0.0	0.3650	1797.0
5.0000	181.0	0.0	0.2500	4556.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1050°C/30' water
Test temperature : +700°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.081	0.52	1.60	0.027	0.006	10.15	16.73	2.18	0.088	0.033	0.032

Monotonic Properties

E	=	168000	N/mm ²	ν	=	-
R _{p0.2}	=	114	N/mm ²	K	=	N/mm ²
R _m	=	326	N/mm ²	n	=	-
A ₅	=	43	%	σ_f	=	N/mm ²
Z	=	67	%	ε_f	=	-

Cyclic properties

R'p0.2	=	184	N/mm ²	K'	=	471	N/mm ²
σ_g	=	112	N/mm ²	n'	=	0.151	-
ε_g	=	0.073	%	σ'_f	=	389	N/mm ²
N _T	=	15832	cycles	ε'_f	=	0.297	-
T _{σ}	=	1.119	-	b	=	-0.082	-
T _{ε_p}	=	1.083	-	c	=	-0.550	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ε -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

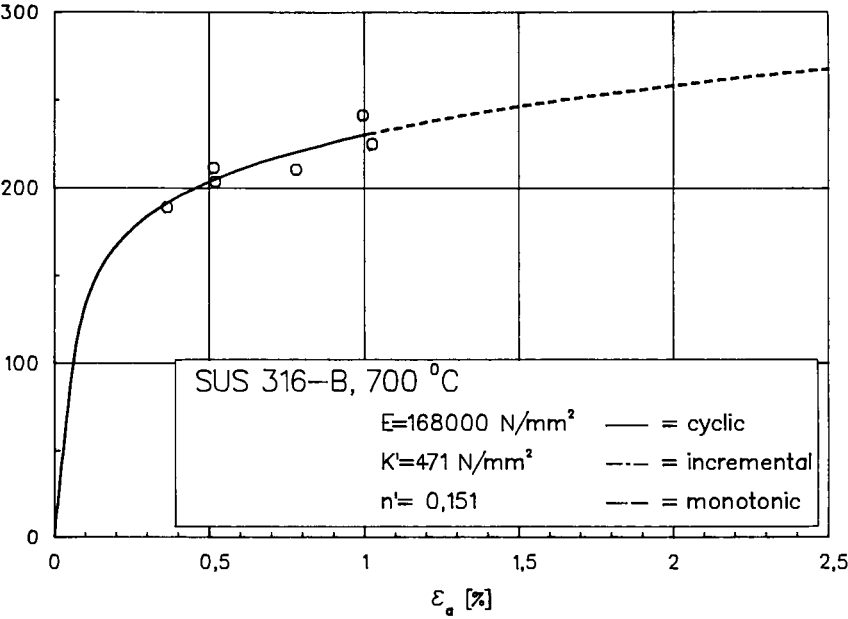
Loading condition :
Specimen : cylindrical, Ø 6 mm
Specimen location : in rolling direction
Gauge length : 30 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

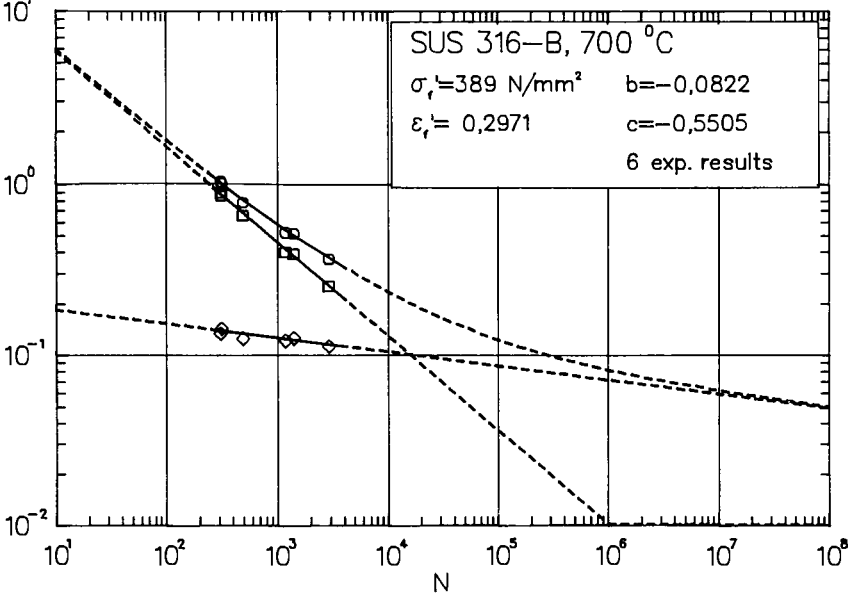
Loading condition : total strain control, R_e = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.41 (%/min)
Waveform : triangular

Remarks :

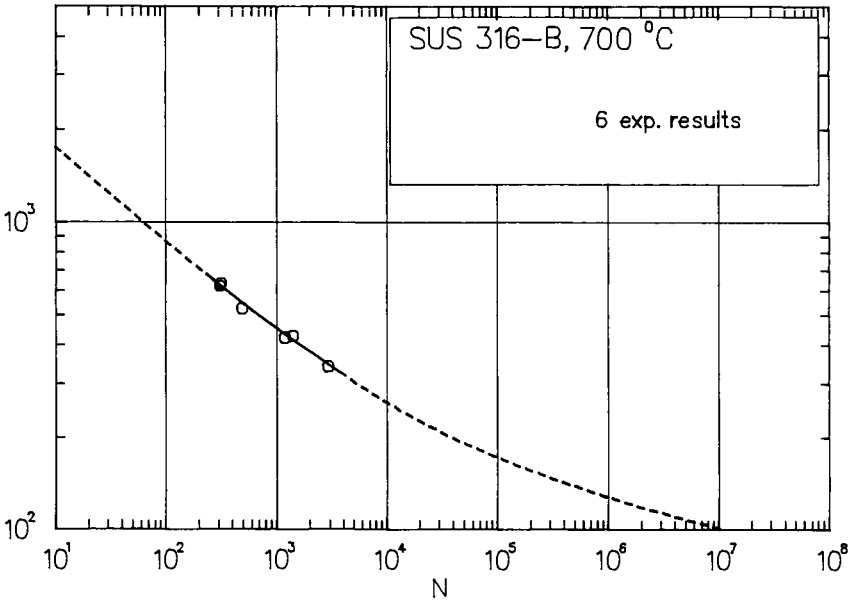
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 316-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	225.1	0.0	1.0250	307.0
2.0000	241.3	0.0	0.9950	314.0
3.0000	210.4	0.0	0.7800	488.0
4.0000	203.6	0.0	0.5200	1185.0
5.0000	211.4	0.0	0.5150	1402.0
6.0000	188.8	0.0	0.3650	2896.0

X 5 CrNiMo 18 10	1.4401	SUS 316-HP
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Heat treatment : hot rolled, 1100°C/30' water
Test temperature : +700°C
Semifinished material : plate, 24x2300x5600 mm
Reference : [4.2]
Year : 1979

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.05	0.70	1.10	0.034	0.003	12.60	17.05	2.24	0.31	0.03	0.001

Monotonic properties

E	=	175500	N/mm ²	ν	=	-
R _{p0.2}	=	155	N/mm ²	K	=	N/mm ²
R _m	=	319	N/mm ²	n	=	-
A ₅	=	61	%	σ_f	=	630 N/mm ²
Z	=	68	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	207	N/mm ²	K'	=	818 N/mm ²
σ'_g	=	99	N/mm ²	n'	=	0.221 -
ϵ'_g	=	0.064	%	σ'_f	=	586 N/mm ²
N _T	=	13253	cycles	ϵ'_f	=	0.205 -
T _{σ}	=	1.092	-	b	=	-0.117 -
T _{ϵ_p}	=	1.879	-	c	=	-0.521 -
Incremental step test :				K'	=	N/mm ²
				n'	=	-

Failure criterion : 25% decrease in the max. tensile load of N/2
 σ/ϵ -values valid for : half life until complete spec. rupture
Remarks : Young's modulus estimated

Hardness :

Microstructure :

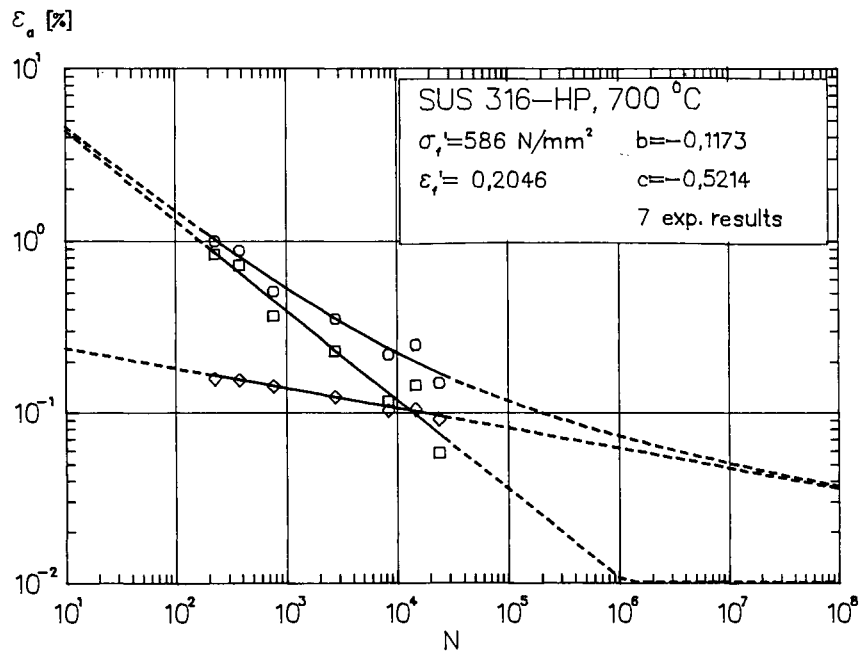
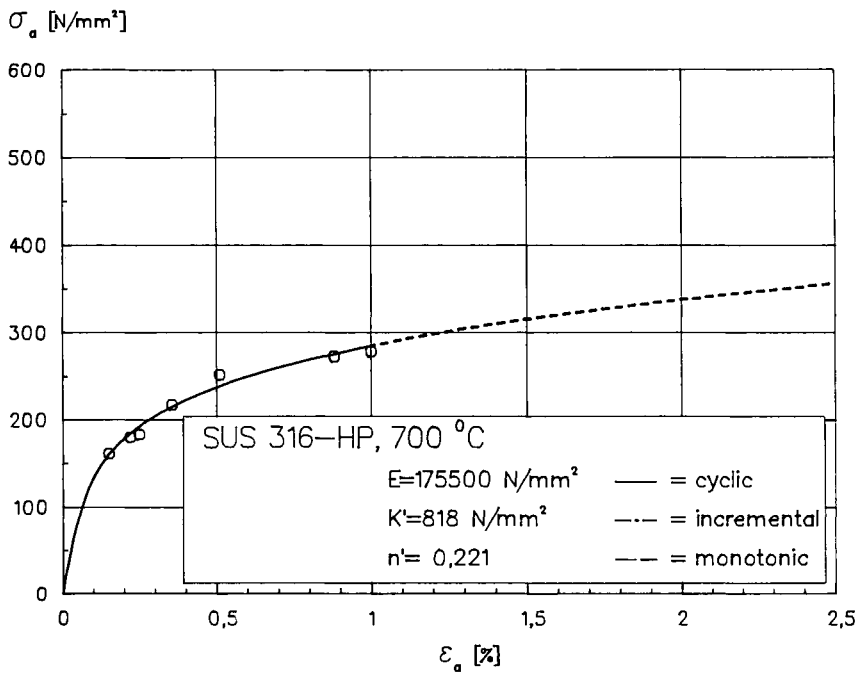
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate :

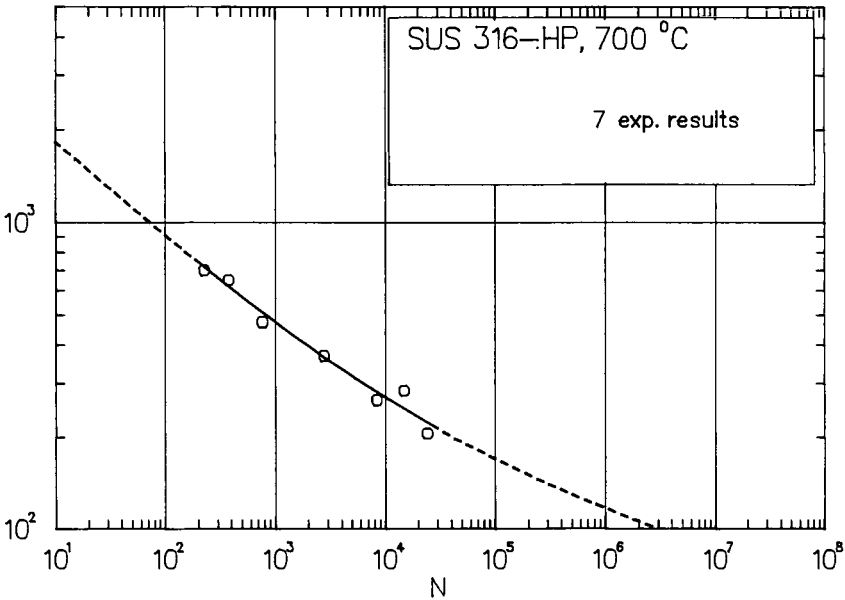
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 13 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 6 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-HP, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	278.5	0.0	1.0000	225.0
2.0000	273.0	0.0	0.8800	377.0
3.0000	251.5	0.0	0.5100	764.0
4.0000	217.5	0.0	0.3550	2767.0
6.0000	180.5	0.0	0.2200	8340.0
5.0000	183.5	0.0	0.2500	14715.0
7.0000	161.0	0.0	0.1500	24042.0

X 5 CrNiMo 18 10	1.4401	SUS 316-HP
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Heat treatment : hot rolled, 1100°C/30' water
Test temperature : +700°C
Semifinished material : plate, 24x2300x5600 mm
Reference : [4.2]
Year : 1979

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.05	0.70	1.10	0.034	0.003	12.60	17.05	2.24	0.31	0.03	0.001

Monotonic properties

E	=	175500	N/mm ²	ν	=	-
R _{p0.2}	=	155	N/mm ²	K	=	N/mm ²
R _m	=	319	N/mm ²	n	=	-
A ₅	=	61	%	σ_f	=	630 N/mm ²
Z	=	68	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	184	N/mm ²	K'	=	550	N/mm ²
σ_g	=	108	N/mm ²	n'	=	0.177	-
ϵ_g	=	0.072	%	σ'_f	=	395	N/mm ²
N _T	=	20635	cycles	ϵ'_f	=	0.148	-
T _{σ}	=	1.025	-	b	=	-0.086	-
T _{ϵ_p}	=	1.354	-	c	=	-0.479	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : 25% decrease in the max. tensile load of N/2

σ/ϵ -values valid for : half life until complete spec. rupture

Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

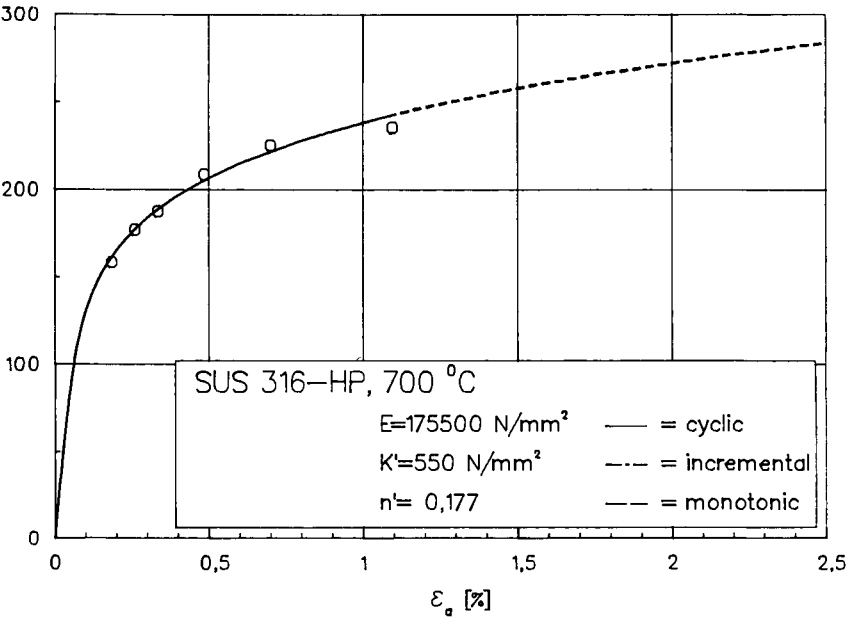
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate :

Cyclic test

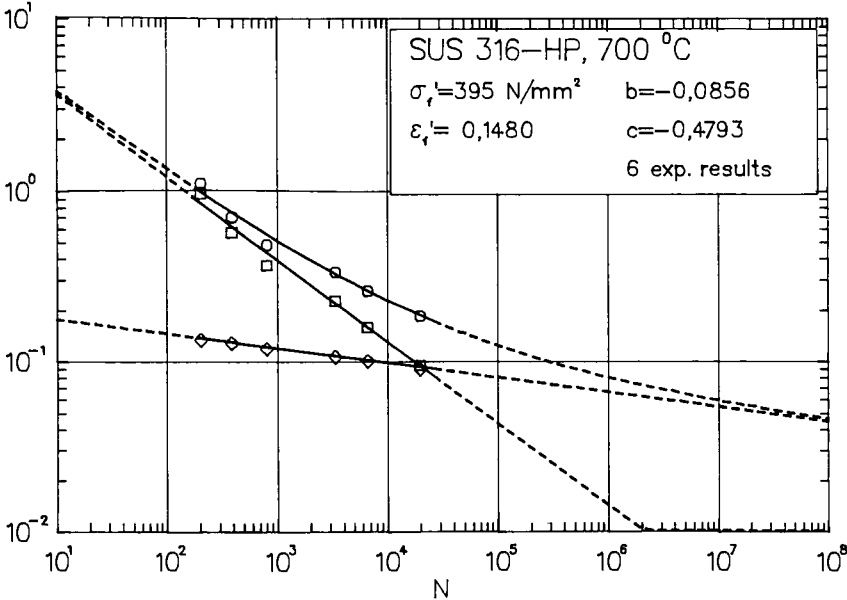
Loading condition : total strain control, R _{ϵ} = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 13 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.6 (%/min)
Waveform : triangular

Remarks :

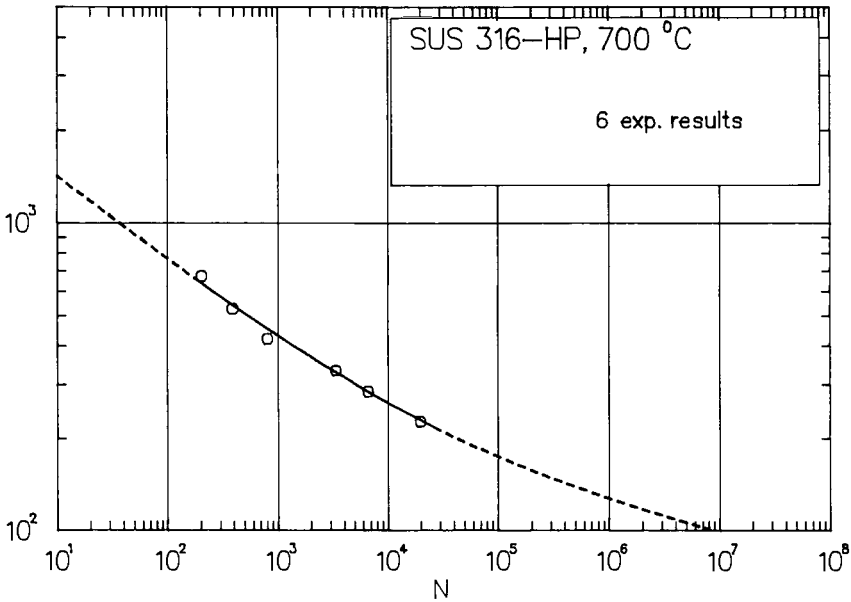
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 316-HP, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	235.5	0.0	1.0950	202.0
2.0000	225.5	0.0	0.7000	388.0
3.0000	208.5	0.0	0.4850	799.0
4.0000	187.5	0.0	0.3350	3350.0
5.0000	177.0	0.0	0.2600	6608.0
6.0000	158.5	0.0	0.1850	19700.0

X 5 CrNiMo 18 10	1.4401	SUS 316-HP
------------------	--------	------------

Heat treatment : hot rolled, 1100°C/30' water
Test temperature : +700°C
Semifinished material : plate, 24x2300x5600 mm
Reference : [4.2]
Year : 1979

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.05	0.70	1.10	0.034	0.003	12.60	17.05	2.24	0.31	0.03	0.001

Monotonic properties

E	=	175500	N/mm ²	ν	=	-
R _{p0.2}	=	155	N/mm ²	K	=	N/mm ²
R _m	=	319	N/mm ²	n	=	-
A ₅	=	61	%	σ_f	=	630 N/mm ²
Z	=	68	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	159	N/mm ²	K'	=	395	N/mm ²
σ'_g	=	80	N/mm ²	n'	=	0.147	-
ϵ'_g	=	0.048	%	σ'_f	=	355	N/mm ²
N _T	=	7200	cycles	ϵ'_f	=	0.512	-
T _{σ}	=	1.068	-	b	=	-0.098	-
T _{ϵ_p}	=	1.225	-	c	=	-0.676	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : 25% decrease in the max. tensile load of N/2
 σ/ϵ -values valid for : half life until complete spec. rupture
Remarks : Young's modulus estimated

Hardness :

Microstructure :

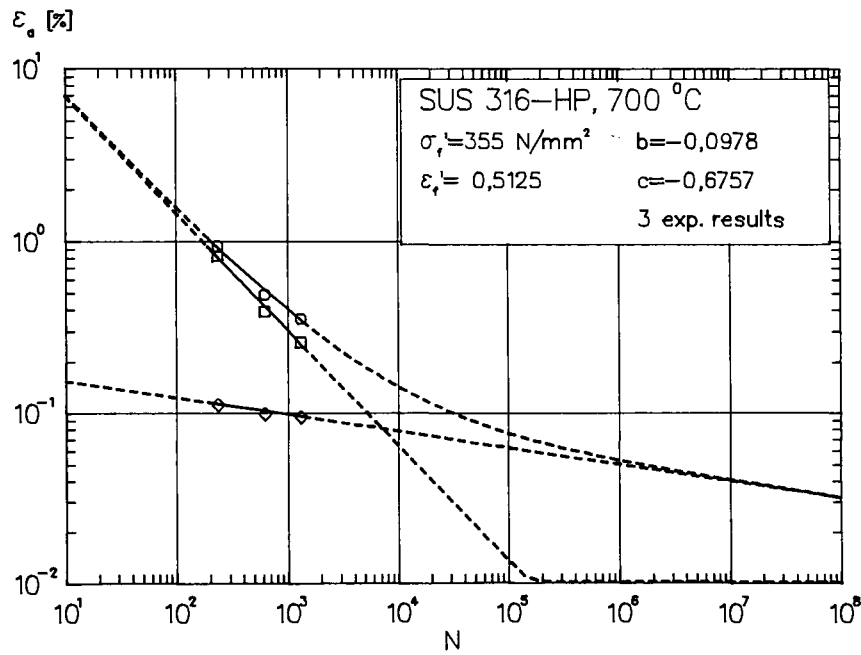
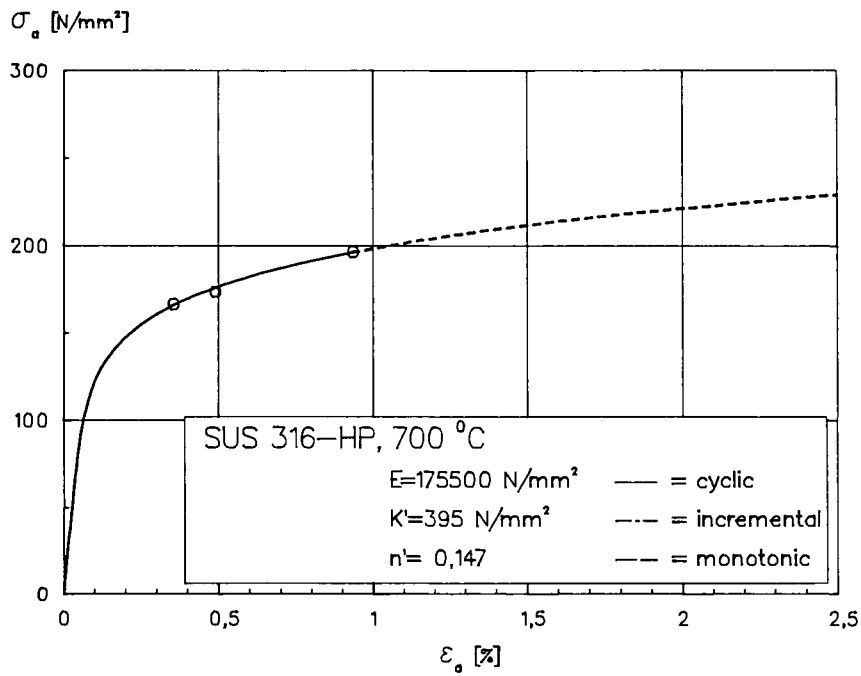
Monotonic test

Loading condition :
Specimen : cylindrical, $\varnothing$ 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate :

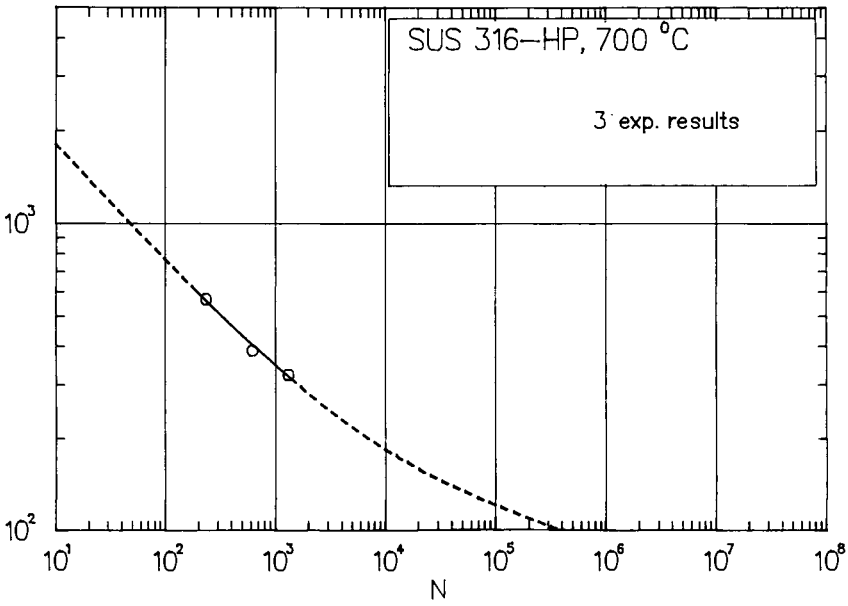
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
Specimen : cylindrical, $\varnothing$ 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 13 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.06 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-HP, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	196.5	0.0	0.9350	235.0
2.0000	173.5	0.0	0.4900	619.0
3.0000	166.5	0.0	0.3550	1314.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1075°C/30' water, 1100°C/1h water
Test temperature : +800°C
Semifinished material : bar, Ø 22 mm
Reference : [4.1]
Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.075	0.77	1.49	0.030	0.009	10.02	16.45	2.09	0.18	0.040	0.098

Monotonic properties

E	=	123600	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=		%	σ_f	=	N/mm ²
Z	=		%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	163	N/mm ²	K'	=	567	N/mm ²
σ_g	=	64	N/mm ²	n'	=	0.200	-
ϵ_g	=	0.053	%	σ'_f	=	540	N/mm ²
N _T	=	5128	cycles	ϵ'_f	=	0.800	-
T _σ	=	1.066	-	b	=	-0.141	-
T _{εp}	=	1.168	-	c	=	-0.705	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

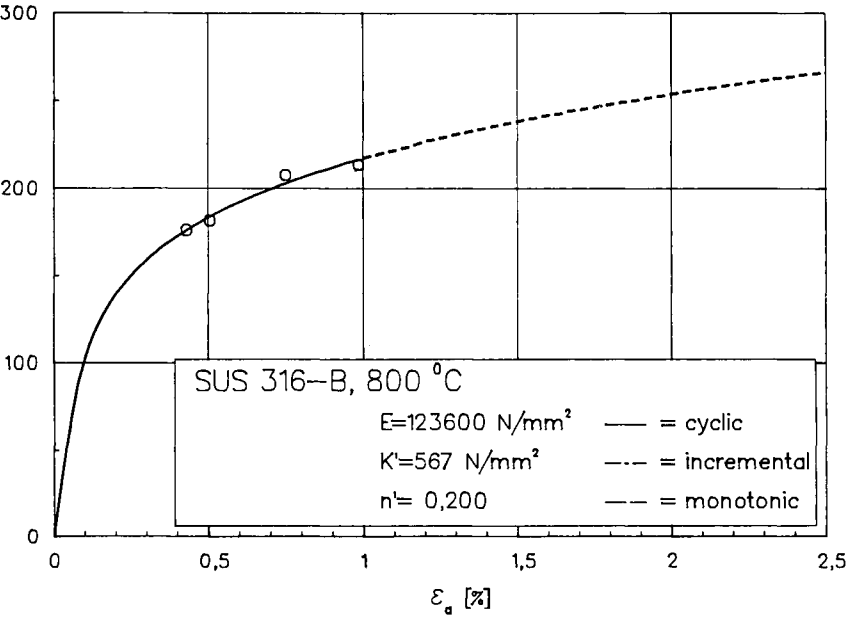
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

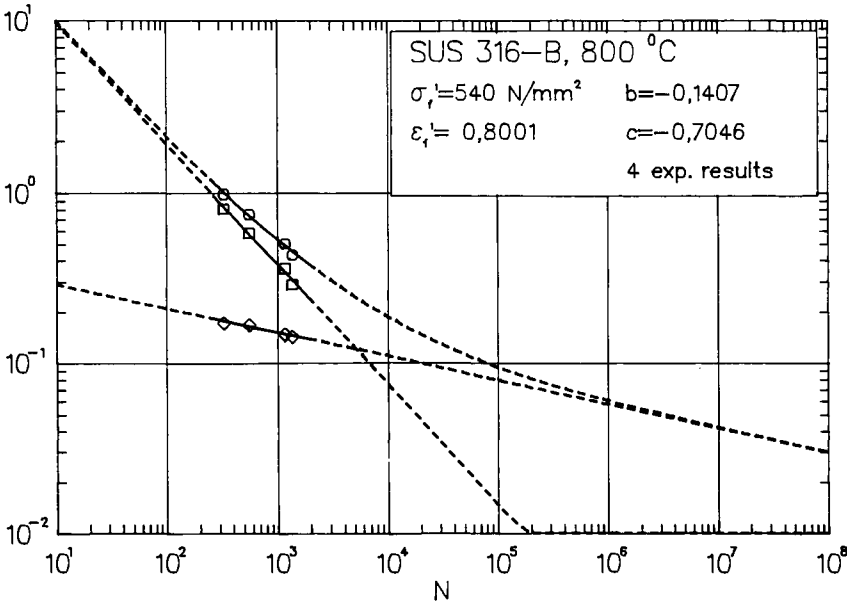
Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 39 (%/min)
Waveform : triangular

Remarks :

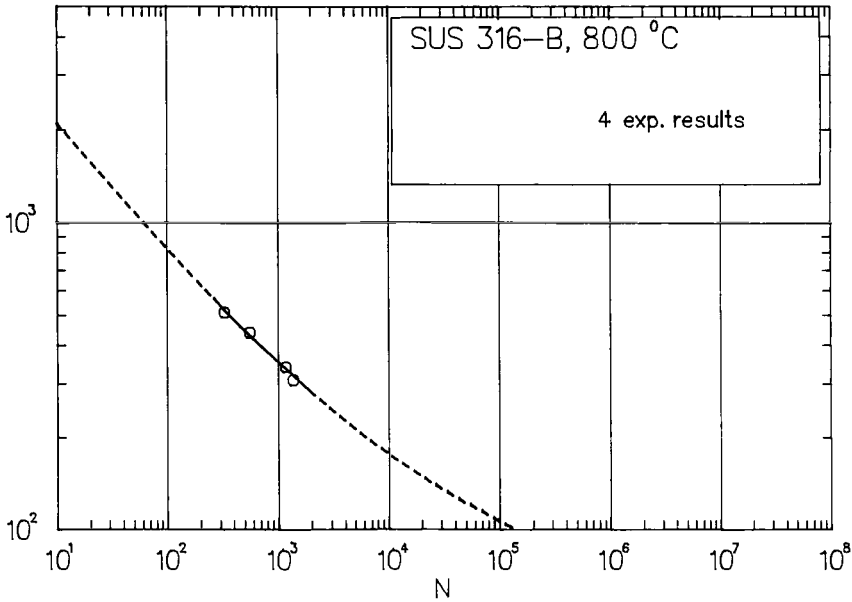
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 316-B, 800°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	213.4	0.0	0.9850	328.0
2.0000	207.5	0.0	0.7500	555.0
3.0000	181.5	0.0	0.5050	1170.0
4.0000	176.1	0.0	0.4300	1361.0

X 5 CrNiMo 18 10	1.4401	SUS 316-B
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Heat treatment : 1075°C/30' water, 1100°C/1h water
 Test temperature : +800°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.1]
 Year : 1977

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Ti	Nb+Ta
0.075	0.77	1.49	0.030	0.009	10.02	16.45	2.09	0.18	0.040	0.098

Monotonic properties

E	=	123600	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=		%	σ _f	=	N/mm ²
Z	=		%	ε _f	=	-

Cyclic properties

R'p0.2	=	132	N/mm ²	K'	=	187	N/mm ²
σ _g	=	100	N/mm ²	n'	=	0.056	-
ε _g	=	0.082	%	σ' _f	=	182	N/mm ²
N _T	=	3695	cycles	ε' _f	=	0.869	-
T _σ	=	1.123	-	b	=	-0.040	-
T _{εp}	=	1.069	-	c	=	-0.756	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture

σ/ε-values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

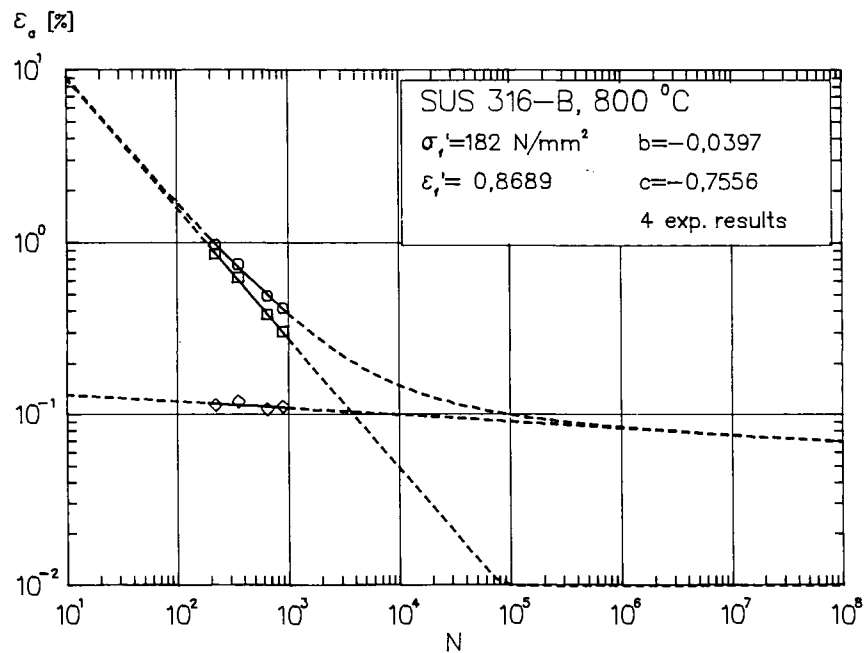
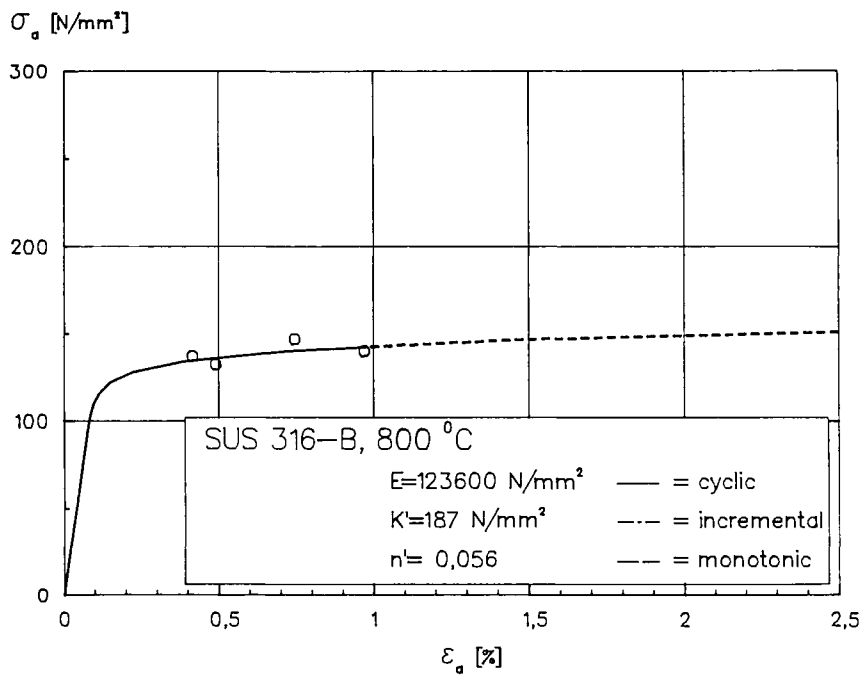
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

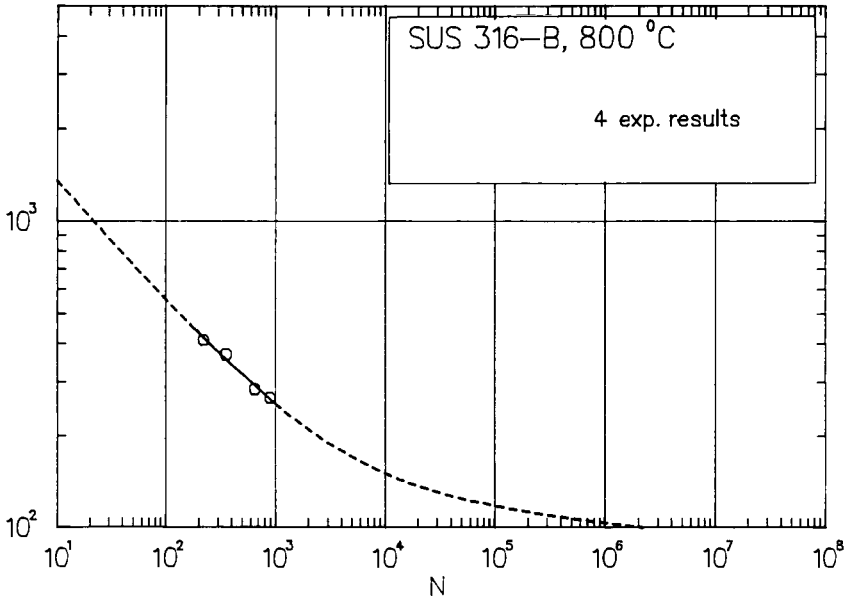
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.40 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 316-B, 800°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	140.3	0.0	0.9700	221.0
2.0000	147.1	0.0	0.7450	356.0
3.0000	132.4	0.0	0.4900	645.0
4.0000	137.3	0.0	0.4150	891.0

X 6 CrNi 9 19		AISI 304
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Heat treatment : solution treated, 1066°C, 1149°C, 1177°C, water
Test temperature : +22°C
Semifinished material :
Reference : [4.18]
Year : 1981

Hardness :

Chemical composition

Microstructure :

C	Ni	Mn	Cr	Mo
0.06	9.38	0.91	18.50	0.05

Monotonic properties

Monotonic test

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=		%	σ_f	=	N/mm ²
Z	=		%	ϵ_f	=	-

Loading condition :
Specimen :
Specimen location :
Gauge length :
Testing machine :
Strain rate :

Cyclic properties

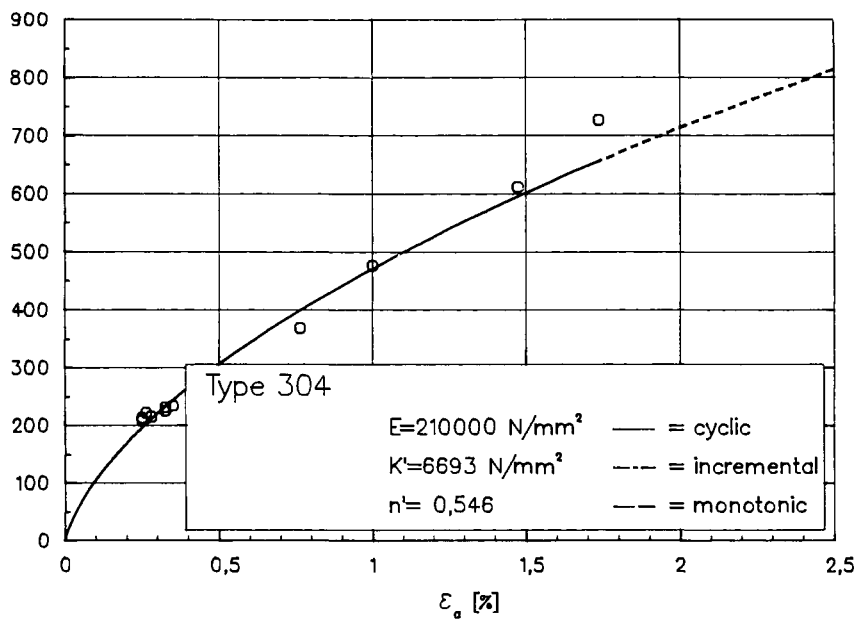
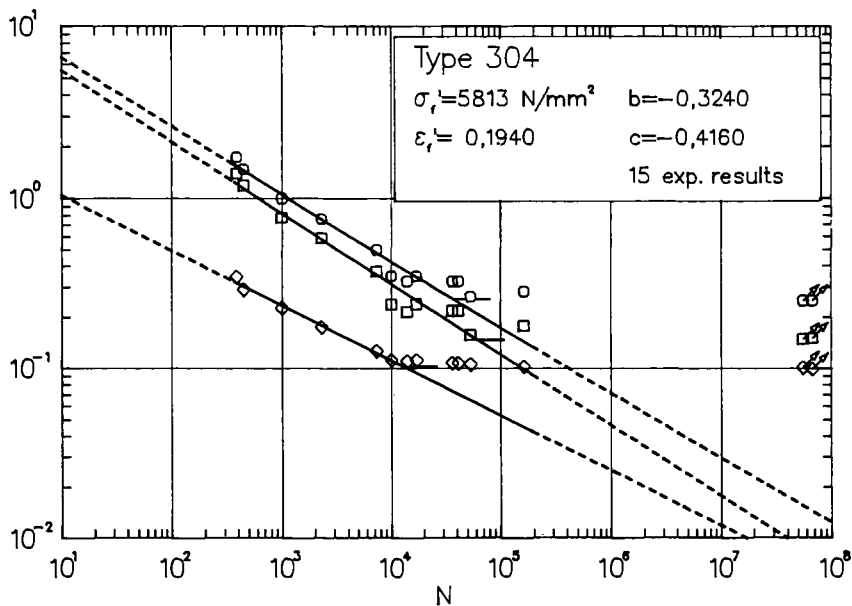
Cyclic test

R' _{p0.2}	=	225	N/mm ²	K'	=	6693	N/mm ²
σ_g	=	42	N/mm ²	n'	=	0.546	-
ϵ_g	=	0.055	%	σ'_f	=	5813	N/mm ²
N _T	=		cycles	ϵ'_f	=	0.194	-
T _{σ}	=	1.109	-	b	=	-0.324	-
T _{ϵ_p}	=	1.48	-	c	=	-0.416	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

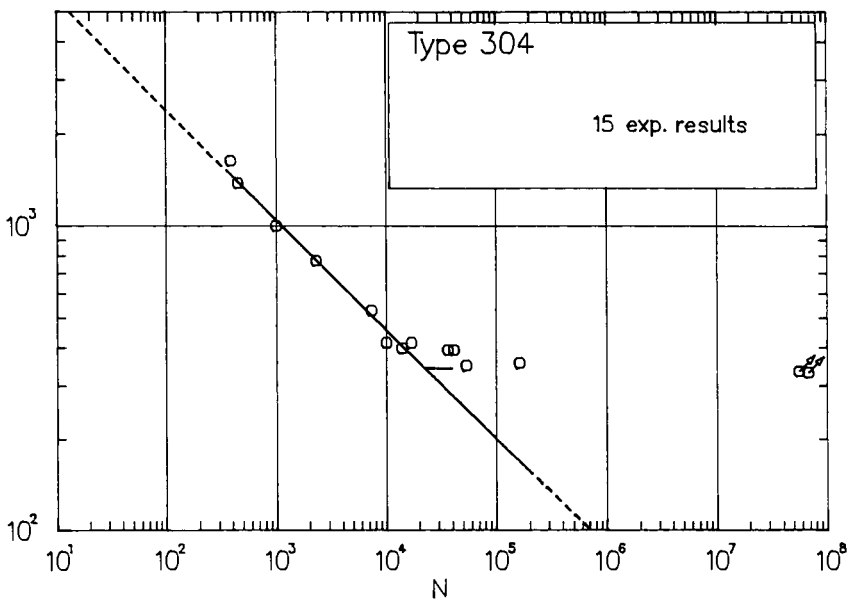
Loading condition : total strain control¹⁾, R _{ϵ} = -1
Specimen : hourglass shaped, $\emptyset$ 3.2 mm
Surface :
Specimen location :
Gauge length :
Testing machine : MTS, electrohydraulic
Frequency : max. 40 Hz
Strain rate : 24 (%/min) for low cycle fatigue tests
Waveform : sinusoidal

Failure criterion :
 σ/ϵ -values valid for : half failure life
Remarks :

Remarks : 1) tests beyond 10⁵ cycles were done in load control

σ_e [N/mm²] ϵ_e [%]

PSWT [N/mm²]



Material : Type 304

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	727.3	0.0	1.7370	386.1
2.0000	611.5	0.0	1.4740	450.1
3.0000	476.3	0.0	1.0000	1000.0
4.0000	368.3	0.0	0.7630	2291.0
5.0000	266.2	0.0	0.5000	7356.0
7.0000	234.5	0.0	0.3500	10000.0
8.0000	231.9	0.0	0.3250	13918.0
9.0000	234.5	0.0	0.3500	17013.0
10.0000	225.5	0.0	0.3250	36437.0
11.0000	225.5	0.0	0.3250	41246.0
6.0000	221.6	0.0	0.2630	53293.0
12.0000	215.1	0.0	0.2800	162277.0
14.0000	208.5	0.0	0.2500	>66933112.0
15.0000	215.1	0.0	0.2800	>*****
13.0000	212.6	0.0	0.2500	>55410204.0

X 6 CrNi 9 19		AISI 304
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Heat treatment : solution treated, 1066°C, 1149°C, 1177°C, water
 Test temperature : +427°C
 Semifinished material :
 Reference : [4.18]
 Year : 1981

Chemical composition

C	Ni	Mn	Cr	Mo
0.06	9.38	0.91	18.50	0.05

Hardness :

Microstructure :

Monotonic properties

E	=	179000	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=		%	σ_f	=	N/mm ²
Z	=		%	ε_f	=	-

Monotonic test

Loading condition :
 Specimen :
 Specimen location :
 Gauge length :
 Testing machine :
 Strain rate :

Cyclic properties

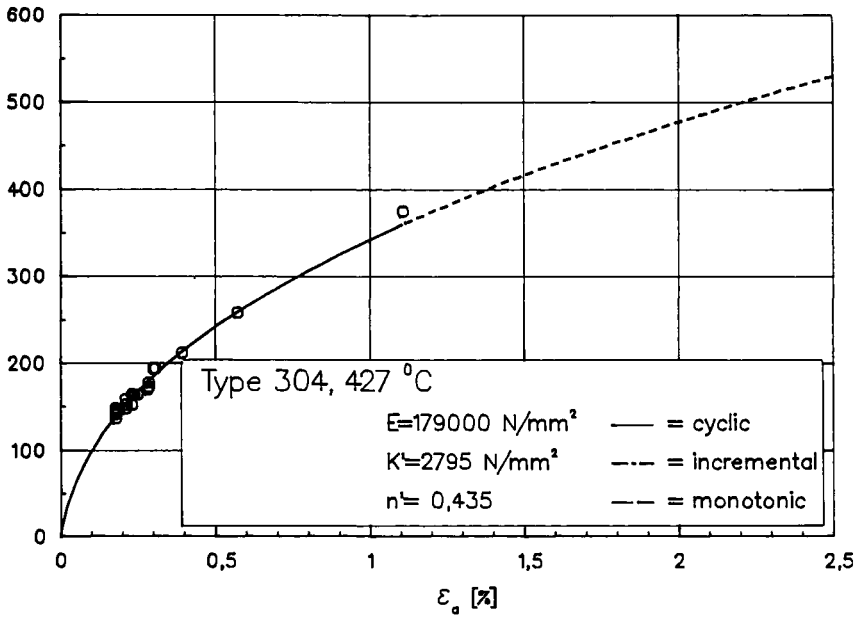
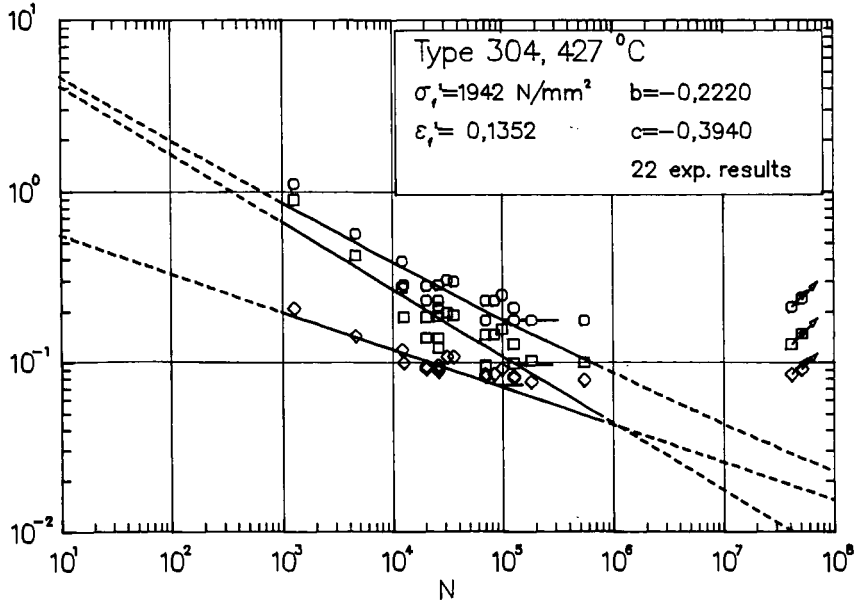
R' _{p0.2}	=	187	N/mm ²	K'	=	2795	N/mm ²
σ_g	=	66	N/mm ²	n'	=	0.435	-
ε_g	=	0.071	%	σ'_f	=	1942	N/mm ²
N _T	=		cycles	ε'_f	=	0.1352	-
T _{σ}	=	1.263	-	b	=	-0.222	-
T _{ep}	=	2.131	-	c	=	-0.394	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Cyclic test

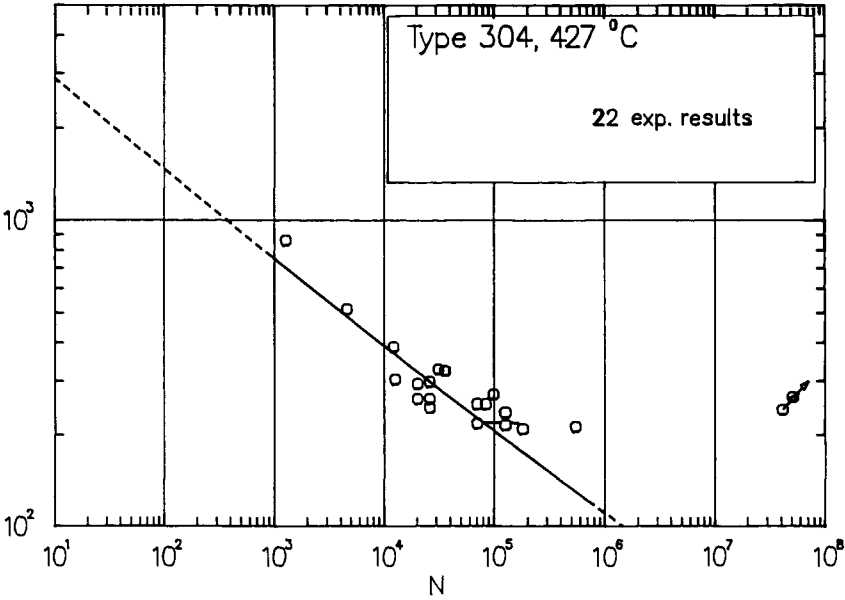
Loading condition : stress control¹⁾, R _{σ} = -1
 Specimen : hourglass shaped, Ø 3.2 mm
 Surface :
 Specimen location :
 Gauge length :
 Testing machine : MTS, electrohydraulic
 Frequency : max. 40 Hz
 Strain rate : 24 (%/min) for low cycle fatigue tests
 Waveform : sinusoidal

Failure criterion :
 σ/ε -values valid for : half failure life
 Remarks :
 control

Remarks : 1) tests beyond $\varepsilon_a = 3.0$ % were done in total strain

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : Type 304, 427°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	374.8	0.0	1.1070	1275.0
2.0000	258.3	0.0	0.5720	4583.0
3.0000	212.2	0.0	0.3930	12115.0
6.0000	177.8	0.0	0.2860	12515.0
7.0000	170.0	0.0	0.2820	20070.0
8.0000	164.0	0.0	0.2320	20070.0
9.0000	172.4	0.0	0.2860	26025.0
10.0000	164.0	0.0	0.2320	26025.0
11.0000	158.9	0.0	0.2110	26025.0
4.0000	194.2	0.0	0.3070	31221.0
5.0000	194.2	0.0	0.3000	35938.0
12.0000	152.4	0.0	0.2320	70170.0
13.0000	147.8	0.0	0.1790	70170.0
14.0000	152.4	0.0	0.2320	83768.0
15.0000	164.0	0.0	0.2500	98826.0
16.0000	147.8	0.0	0.2110	125893.0
17.0000	144.4	0.0	0.1790	125893.0
18.0000	136.7	0.0	0.1790	181090.0
19.0000	141.1	0.0	0.1790	545559.0
20.0000	152.4	0.0	0.2140	>41246264.0
21.0000	164.0	0.0	0.2400	>51014344.0
22.0000	141.1	0.0	0.1790	>*****

X 6 CrNi 9 19		AISI 304
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Heat treatment : solution treated, 1066°C, 1149°C, 1177°C, water
Test temperature : +538°C
Semifinished material :
Reference : [4.18]
Year : 1981

Hardness :

Chemical composition

C	Ni	Mn	Cr	Mo
0.06	9.38	0.91	18.50	0.05

Microstructure :

Monotonic properties

E	=	193000	N/mm ²	v	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=	%		σ _f	=	N/mm ²
Z	=	%		ε _f	=	-

Monotonic test

Loading condition :
Specimen :
Specimen location :
Gauge length :
Testing machine :
Strain rate :

Cyclic properties

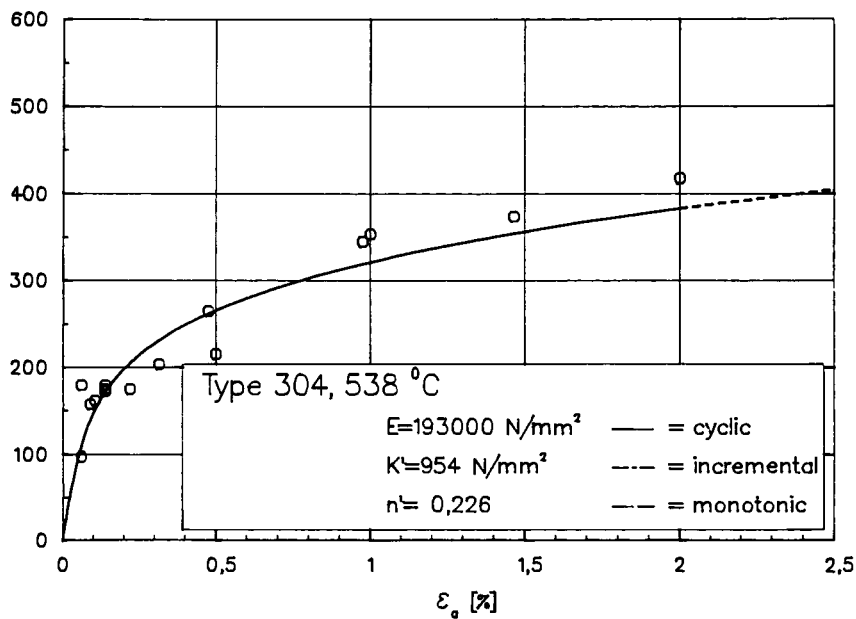
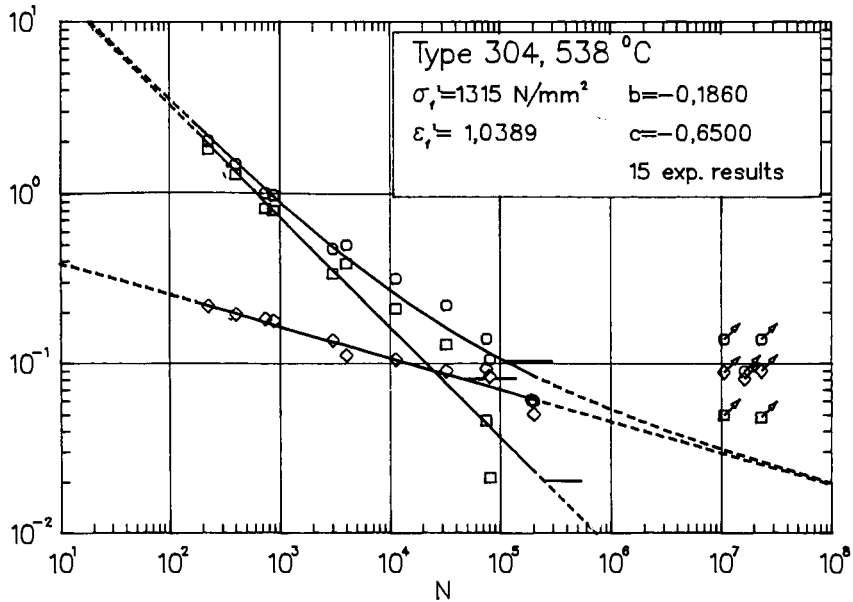
R _{p0.2}	=	234	N/mm ²	K'	=	954	N/mm ²
σ _g	=	78	N/mm ²	n'	=	0.226	-
ε _g	=	0.046	%	σ' _f	=	1315	N/mm ²
N _T	=	1123750	cycles	ε' _f	=	1.0389	-
T _σ	=	1.52	-	b	=	-0.186	-
T _{εp}	=	6.205	-	c	=	-0.650	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Cyclic test

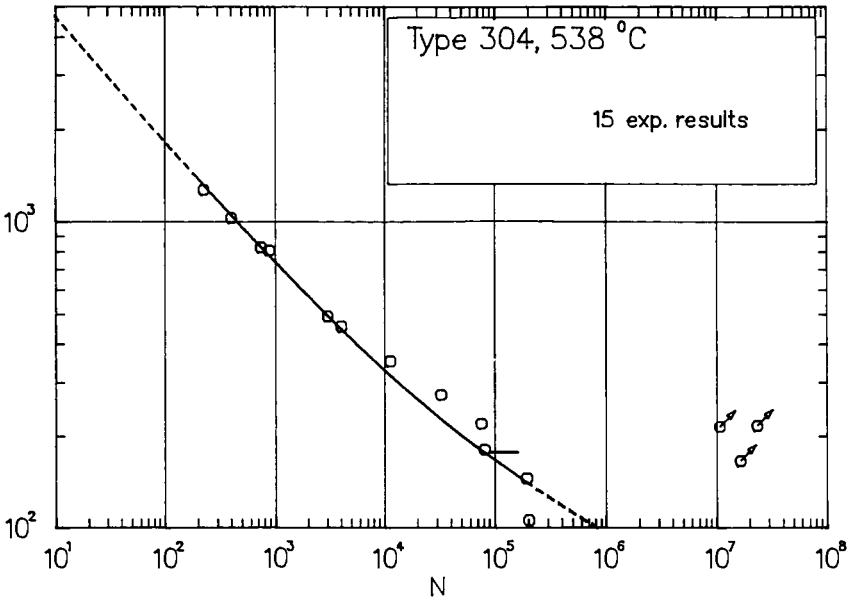
Loading condition : total strain control¹⁾, R_e = -1
Specimen : hourglass shaped, Ø 3.2 mm
Surface :
Specimen location :
Gauge length :
Testing machine : MTS, electrohydraulic
Frequency : max. 40 Hz
Strain rate : 24 (%/min) for low cycle fatigue tests
Waveform : sinusoidal

Failure criterion :
σ/ε-values valid for : half failpre life
Remarks :

Remarks : 1) tests beyond 4·10³ cycles were done in load control

σ_e [N/mm²] ϵ_e [%]

PSWT [N/mm²]



Material : Type 304, 538°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	417.3	0.0	2.0000	223.0
2.0000	374.1	0.0	1.4650	400.0
3.0000	353.2	0.0	1.0000	739.0
4.0000	344.6	0.0	0.9750	877.0
5.0000	264.8	0.0	0.4750	3000.0
6.0000	215.8	0.0	0.5000	4000.0
7.0000	203.6	0.0	0.3150	11220.0
8.0000	174.8	0.0	0.2200	32442.0
11.0000	179.5	0.0	0.1390	74438.0
9.0000	161.9	0.0	0.1050	80000.0
12.0000	179.5	0.0	0.0610	191448.0
10.0000	97.1	0.0	0.0600	200000.0
14.0000	157.3	0.0	0.0900	>16237767.0
15.0000	175.0	0.0	0.1390	>23126110.0
13.0000	172.3	0.0	0.1390	>10608184.0

X 6 CrNi 9 19	AISI 304
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Heat treatment : solution treated, 1066°C, 1149°C, 1177°C, water
 Test temperature : +593°C
 Semifinished material :
 Reference : [4.18]
 Year : 1981

Hardness :

Chemical composition

Microstructure :

C	Ni	Mn	Cr	Mo
0.06	9.38	0.91	18.50	0.05

Monotonic properties

E	=	171000	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=		%	σ_f	=	N/mm ²
Z	=		%	ϵ_f	=	-

Monotonic test

Loading condition :
 Specimen :
 Specimen location :
 Gauge length :
 Testing machine :
 Strain rate :

Cyclic properties

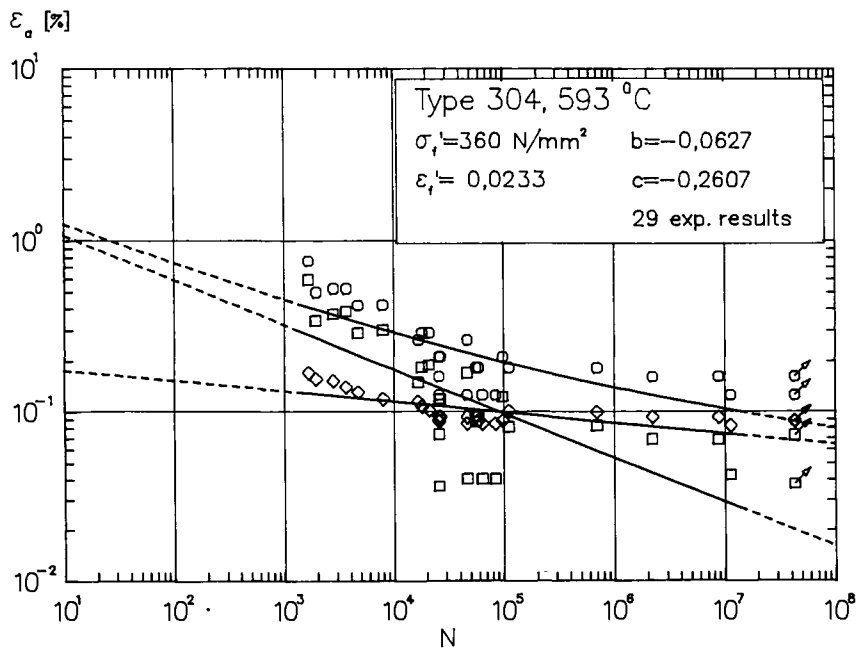
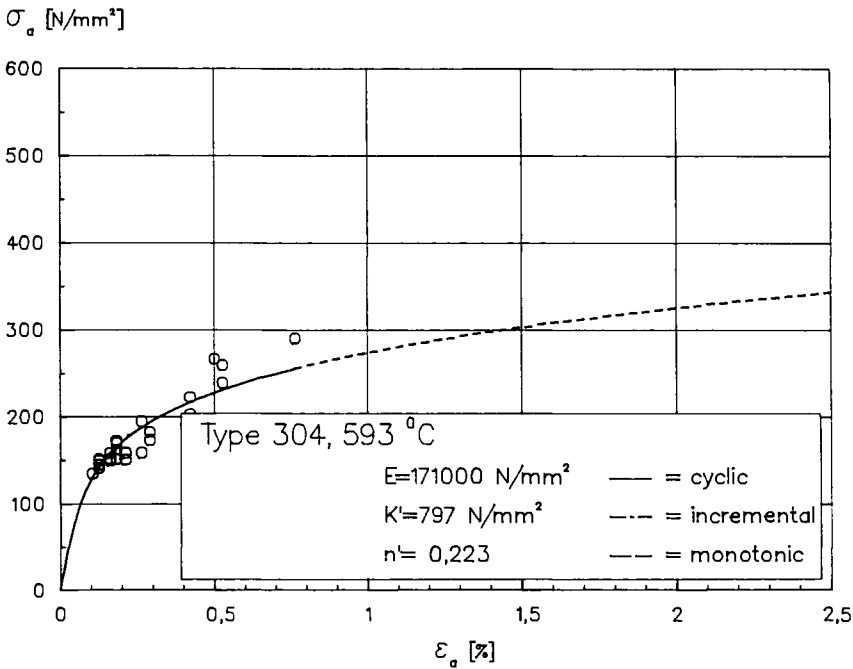
R _{p0.2}	=	199	N/mm ²	K'	=	797	N/mm ²
σ_g	=	139	N/mm ²	n'	=	0.223	-
ϵ_g	=	0.125	%	σ'_f	=	360	N/mm ²
N _T	=	92310	cycles	ϵ'_f	=	0.023	-
T _{σ}	=	1.507	-	b	=	-0.063	-
T _{ϵ_p}	=	4.699	-	c	=	-0.261	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Cyclic test

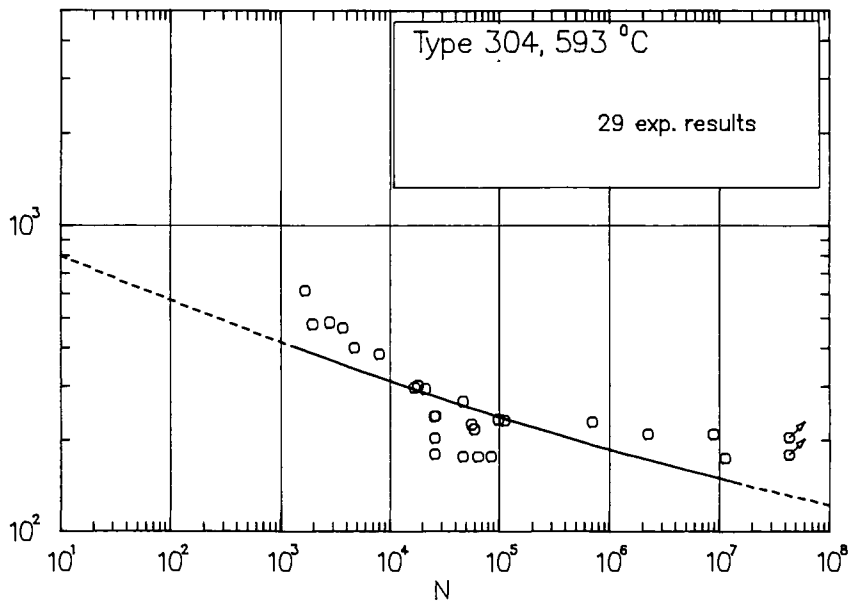
Loading condition : total strain control¹⁾, R _{ϵ} = -1
 Specimen : hourglass shaped, ϕ 3.2 mm
 Surface :
 Specimen location :
 Gauge length :
 Testing machine : MTS, electrohydraulic
 Frequency : max. 40 Hz
 Strain rate : 24 (%/min) for low cycle fatigue tests
 Waveform : sinusoidal

Failure criterion :
 σ/ϵ -values valid for : half failure life
 Remarks :

Remarks : 1) tests beyond 10⁴ cycles were done in load control



PSWT [N/mm²]



Material : Type 304, 593°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	290.6	0.0	0.7630	1668.0
2.0000	266.9	0.0	0.5000	1945.0
3.0000	259.7	0.0	0.5270	2783.0
4.0000	238.9	0.0	0.5270	3640.0
5.0000	223.0	0.0	0.4210	4701.0
6.0000	202.9	0.0	0.4210	7943.0
7.0000	195.0	0.0	0.2630	16681.0
8.0000	182.7	0.0	0.2900	18012.0
9.0000	173.4	0.0	0.2900	21000.0
13.0000	158.5	0.0	0.2110	25768.0
14.0000	151.3	0.0	0.1250	25768.0
15.0000	149.5	0.0	0.1610	25768.0
10.0000	159.0	0.0	0.2110	26438.0
16.0000	144.8	0.0	0.1250	46416.0
11.0000	159.0	0.0	0.2630	46714.0
17.0000	162.3	0.0	0.1820	56068.0
18.0000	151.3	0.0	0.1820	58780.0
19.0000	144.8	0.0	0.1250	63845.0
21.0000	144.8	0.0	0.1250	83768.0
12.0000	151.1	0.0	0.2110	97474.0
20.0000	172.5	0.0	0.1820	111213.0
22.0000	169.8	0.0	0.1820	693467.0
23.0000	158.5	0.0	0.1610	2205920.0

continued

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
24.0000	158.5	0.0	0.1610	8781925.0
25.0000	141.5	0.0	0.1250	11319993.0
26.0000	151.3	0.0	0.1610	>42733576.0
27.0000	149.5	0.0	0.1250	>42733576.0
28.0000	141.5	0.0	0.1250	>*****
29.0000	134.9	0.0	0.1040	>*****

X 6 CrNi 18 11		
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Heat treatment :
Test temperature : +600°C
Semifinished material :
Reference : [4.10]
Year : 1984

Chemical composition

Hardness :

Microstructure :

Monotonic properties

E	=	143200	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=		%	σ_f	=	N/mm ²
Z	=		%	ϵ_f	=	-

Monotonic test

Loading condition :
Specimen :
Specimen location :
Gauge length :
Testing machine :
Strain rate :

Cyclic properties

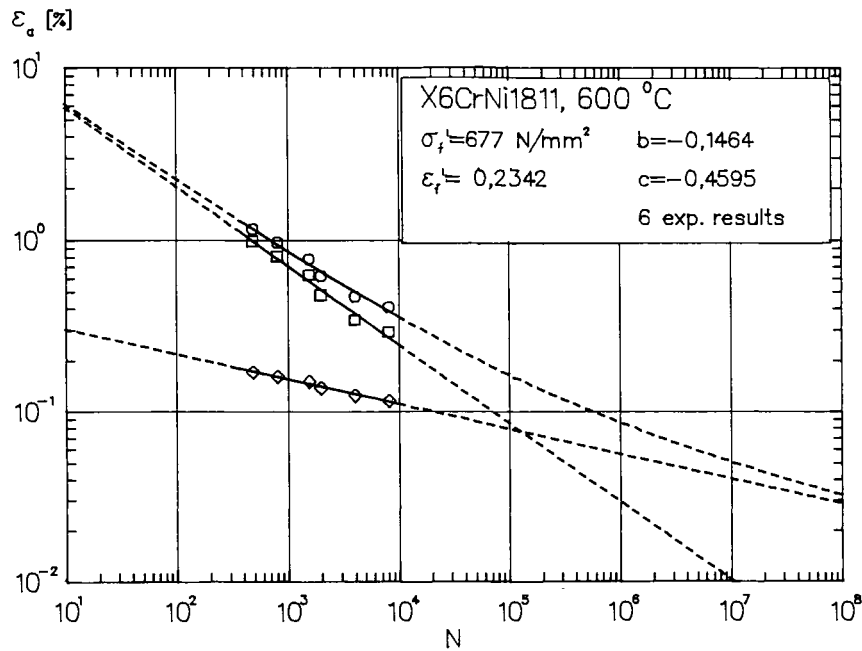
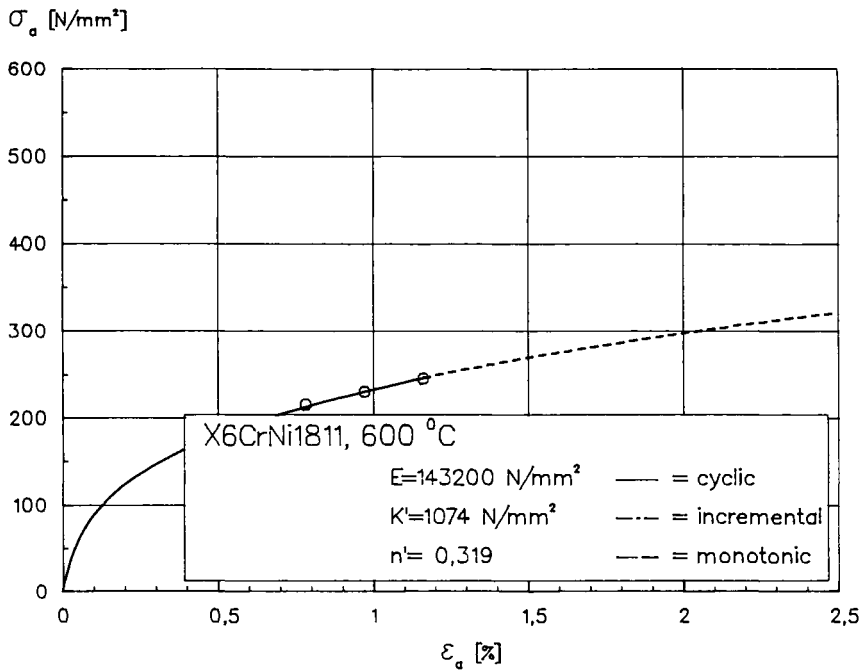
R' _{p0.2}	=	148	N/mm ²	K'	=	1074	N/mm ²
σ'_g	=	73	N/mm ²	n'	=	0.319	-
ϵ_g	=	0.073	%	σ'_f	=	677	N/mm ²
N _T	=	129398	cycles	ϵ'_f	=	0.234	-
T _{σ}	=	1.062	-	b	=	-0.146	-
T _{ep}	=	1.234	-	c	=	-0.459	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Cyclic test

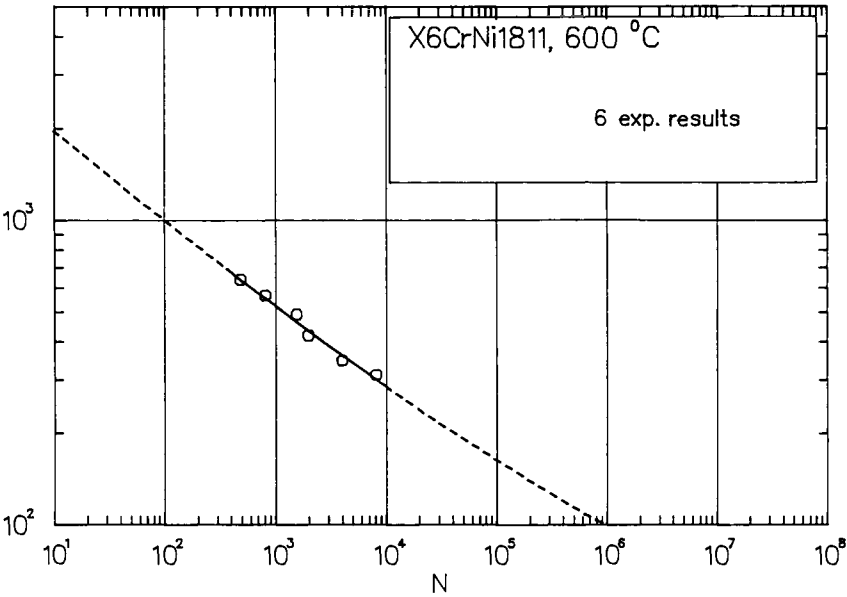
Loading condition : total strain control, R_e=-1
Specimen :
Surface :
Specimen location :
Gauge length :
Testing machine :
Frequency :
Strain rate :
Waveform :

Failure criterion :
 σ/ϵ -values valid for : half failure life
Remarks :

Remarks :



PSWT [N/mm²]



Material : X6CrNi1811, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	460.1	0.0	1.5550	500.0
2.0000	364.4	0.0	1.0050	1992.0
3.0000	264.9	0.0	0.4900	6700.0
4.0000	260.5	0.0	0.4050	8700.0

X 6 CrNi 19 11		AISI 304
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Heat treatment :
 Test temperature : +23°C
 Semifinished material :
 Reference : [4.16]
 Year : 1986

Hardness :

Chemical composition

Microstructure :

C	Si	Mn	Cr	Ni	P	S
0.037	0.40	1.6	19.2	10.8	<0.01	0.023

Monotonic properties

Monotonic test

E	=	183000	N/mm ²	ν	=	-
R _{p0.2}	=	325	N/mm ²	K	=	1210 N/mm ²
R _m	=	650	N/mm ²	n	=	0.193 -
A _g	=		%	σ_f	=	1400 N/mm ²
Z	=	80	%	ϵ_f	=	1.61 -

Loading condition :
 Specimen :
 Specimen location :
 Gauge length :
 Testing machine :
 Strain rate :

Cyclic properties

Cyclic test

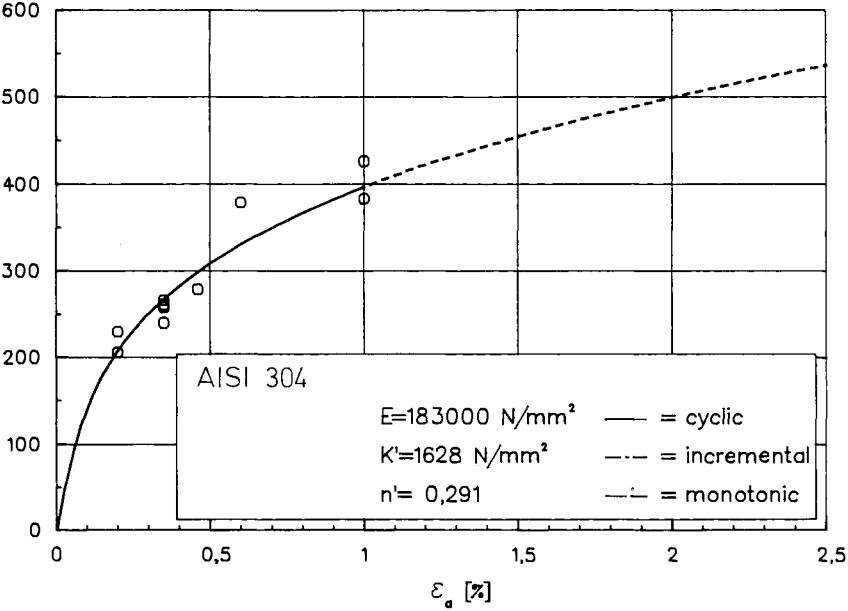
R' _{p0.2}	=	267	N/mm ²	K'	=	1628 N/mm ²
σ_g	=	166	N/mm ²	n'	=	0.291 -
ϵ_g	=	0.130	%	σ'_f	=	986 N/mm ²
N _T	=	104581	cycles	ϵ'_f	=	0.170 -
T _{σ}	=	1.253	-	b	=	-0.117 -
T _{ϵ_p}	=	1.232	-	c	=	-0.399 -
Incremental step test :				K'	=	N/mm ²
				n'	=	-

Loading condition : total strain control, R _{ϵ} = -1
 Specimen :
 Surface :
 Specimen location :
 Gauge length :
 Testing machine :
 Frequency :
 Strain rate :
 Waveform :

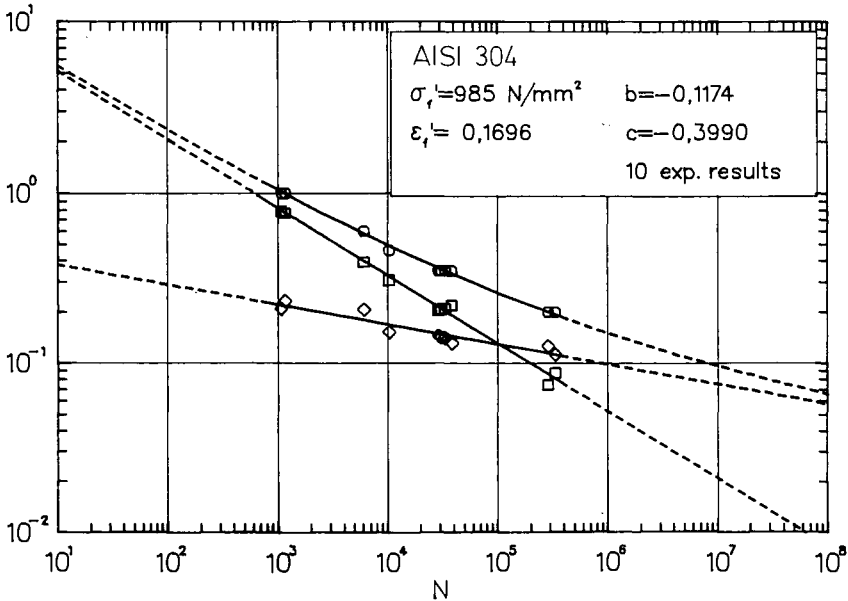
Failure criterion :
 σ/ϵ -values valid for : half failure life
 Remarks :

Remarks :

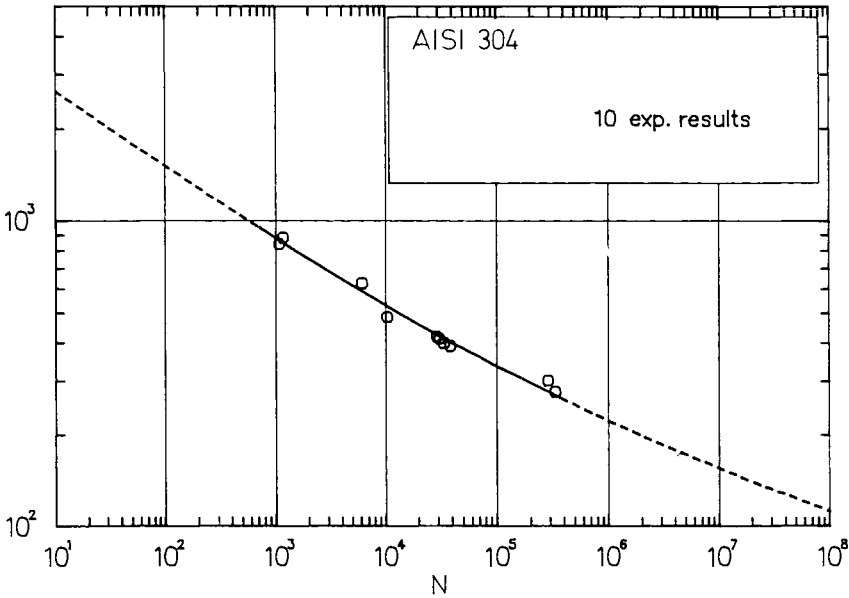
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : AISI 304

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
3.0000	383.0	2.0	1.0000	1070.0
9.0000	426.0	-1.4	1.0000	1167.0
6.0000	379.0	-21.9	0.6000	6080.0
6.0000	279.0	0.0	0.4600	10300.0
11.0000	266.0	8.4	0.3500	29000.0
1.0000	261.0	5.8	0.3500	30700.0
10.0000	258.0	-9.1	0.3500	33530.0
15.0000	240.0	-2.2	0.3500	38500.0
12.0000	230.0	16.5	0.2000	286400.0
2.0000	206.0	2.9	0.2000	333100.0

X 6 CrNi 19 11		AISI 304
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Heat treatment :
Test temperature : +23⁰C
Semifinished material :
Reference : [4.21]
Year :

Hardness :

Chemical composition

Microstructure :

C	Si	Mn	Cr	Ni	P	S
0.057	0.40	1.6	19.2	10.8	<0.01	0.023

Monotonic properties

Monotonic test

E	=	185000	N/mm ²	v	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=		%	σ _f	=	N/mm ²
Z	=		%	ε _f	=	-

Loading condition :
Specimen :
Specimen location :
Gauge length :
Testing machine :
Strain rate :

Cyclic properties

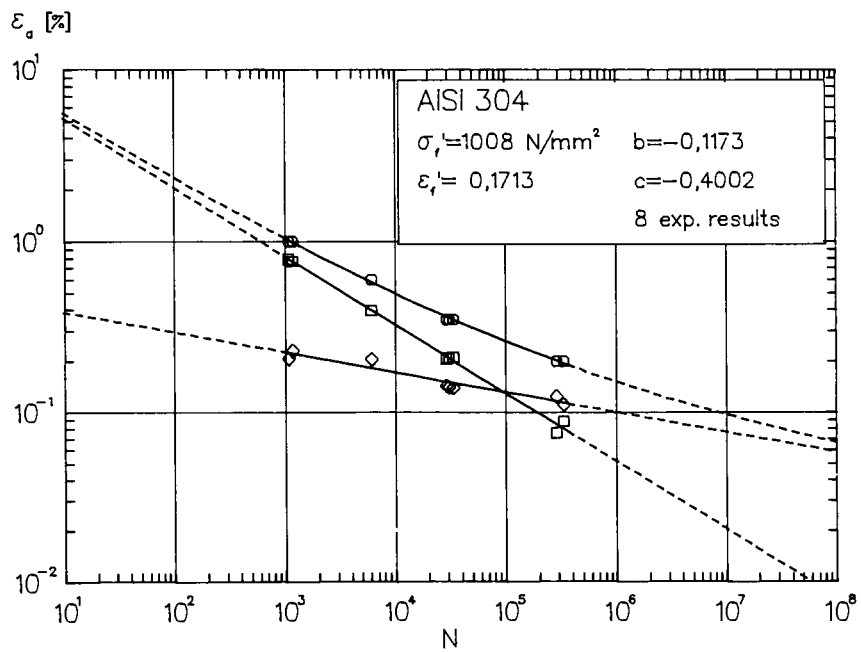
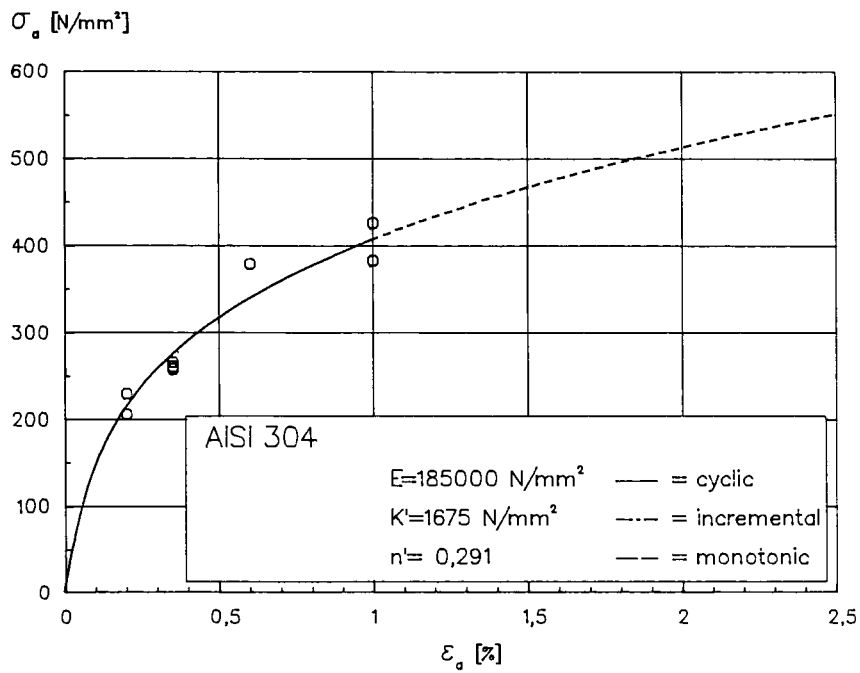
Cyclic test

R' _{p0.2}	=	274	N/mm ²	K'	=	1675	N/mm ²
σ _g	=	170	N/mm ²	n'	=	0.291	-
ε _g	=	0.131	%	σ' _f	=	1008	N/mm ²
N _T	=	98108	cycles	ε' _f	=	0.171	-
T _σ	=	1.229	-	b	=	-0.117	-
T _{εp}	=	1.192	-	c	=	-0.400	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

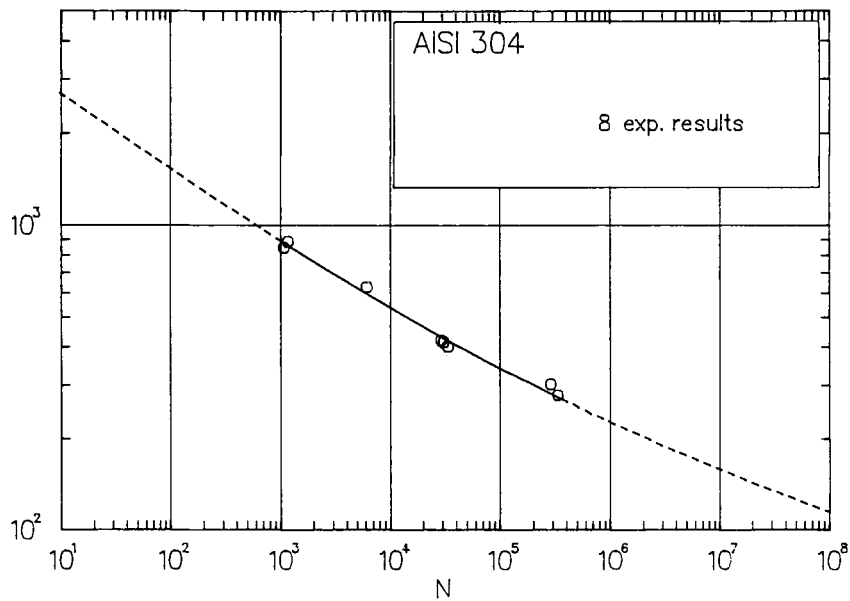
Loading condition : total strain control, R_ε = -1
Specimen :
Surface :
Specimen location :
Gauge length :
Testing machine :
Frequency :
Strain rate :
Waveform :

Failure criterion :
σ/s-values valid for : half failure life
Remarks :

Remarks :



PSWT [N/mm²]



Material : AISI 304

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
3.0000	383.0	2.0	1.0000	1070.0
9.0000	426.0	-1.4	1.0000	1167.0
6.0000	379.0	-21.9	0.6000	6080.0
11.0000	266.0	8.4	0.3500	29000.0
1.0000	261.0	5.8	0.3500	30700.0
10.0000	258.0	-9.1	0.3500	33530.0
12.0000	230.0	16.5	0.2000	286400.0
2.0000	206.0	2.9	0.2000	333100.0

X 10 CrNi 18 8		Remanit 1880
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Heat treatment : as received
 Test temperature : +23°C
 Semifinished material : rolled bar, 25 x 12 mm
 Reference : [4.5]
 Year : 1971

Chemical composition

C	Si	Mn	P	S	Ni	Cr
0.04	0.47	1.55	0.032	0.016	10.45	18.65

Monotonic properties

E	=	204000	N/mm ²	ν	=	-
R _{p0.2}	=	245	N/mm ²	K	=	1416 N/mm ²
R _m	=	635	N/mm ²	n	=	0.362 -
A ₅	=	75	%	σ_f	=	1908 N/mm ²
Z	=	79	%	ϵ_f	=	1.563 -

Cyclic properties

R' _{p0.2}	=	307	N/mm ²	K'	=	2397 N/mm ²
σ_g	=	126	N/mm ²	n'	=	0.331 -
ϵ_g	=	0.102	%	σ'_f	=	2032 N/mm ²
N _T	=	1769843	cycles	ϵ'_f	=	0.3249 -
T _{σ}	=	1.168	-	b	=	-0.183 -
T _{ep}	=	1.844	-	c	=	-0.441 -
Incremental step test :				K'	=	N/mm ²
				n'	=	-

Failure criterion : rupture
 σ/ϵ -values valid for : half failure life
 Remarks :

Hardness :

Microstructure :

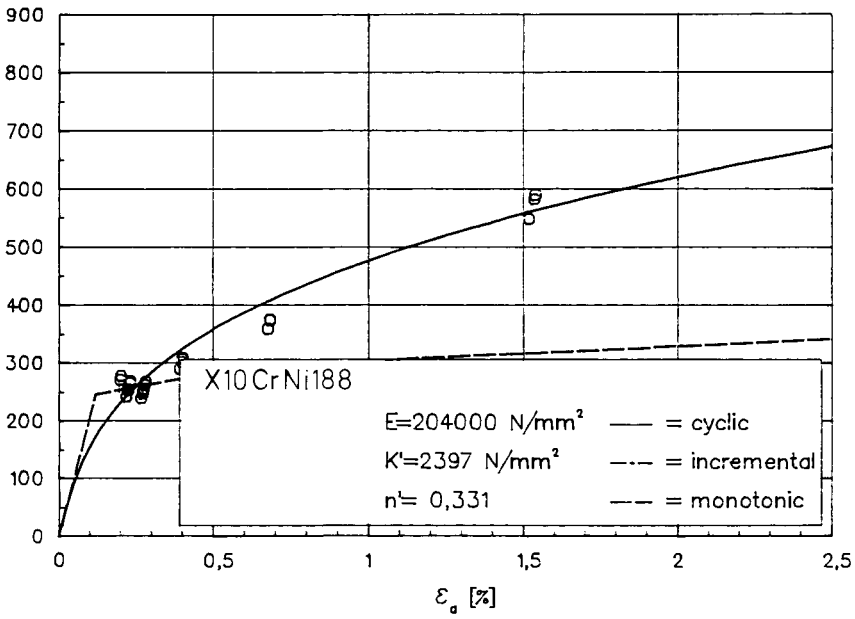
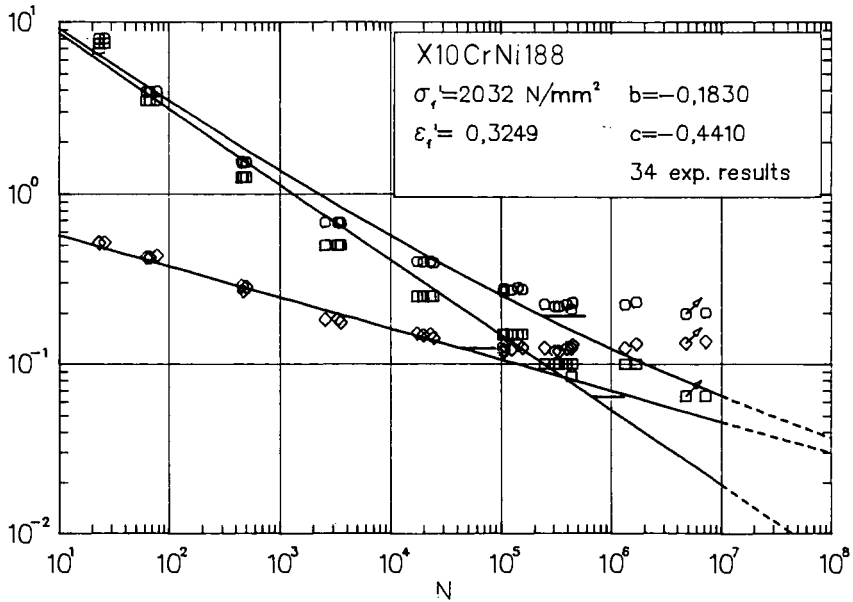
Monotonic test

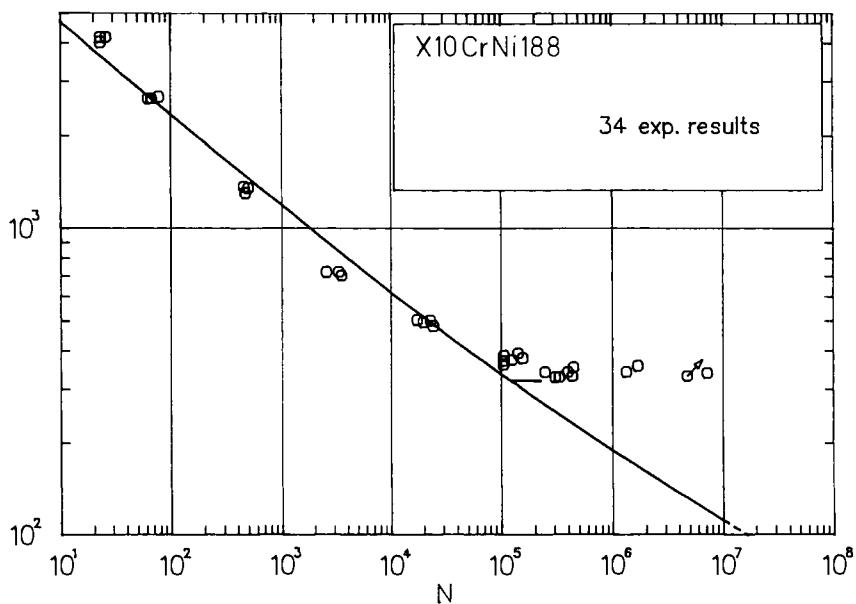
Loading condition : displacement control
 Specimen : hourglass shaped, Ø 6 mm
 Specimen location : in rolling direction
 Gauge length : diametral
 Testing machine : Schenck, PVT0 with special equipment
 Strain rate :

Cyclic test

Loading condition : plast. strain control, R_{ep} = -1
 Specimen : hourglass shaped, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : diametral
 Testing machine : Schenck, PVT0 with special equipment
 Frequency : 0.08 - 2.5 Hz
 Strain rate :
 Waveform : triangular

Remarks : for monotonic and very low cycle fatigue tests
 hydraulic was managed manually

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]

Material : X 10 CrNi 18 8

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
2.1100	1217.0	0.0	15.5966	4.9
2.8000	1210.0	0.0	15.5931	5.8
2.1400	1060.0	0.0	8.0196	23.0
1.4000	1052.0	0.0	7.5157	23.0
2.1000	1061.0	0.0	8.0201	26.0
1.1200	867.0	0.0	3.9250	62.0
1.1400	867.0	0.0	3.9250	67.0
2.3000	890.5	0.0	3.9363	78.0
1.3000	589.5	0.0	1.5390	456.0
1.1300	547.5	0.0	1.5184	470.0
2.1500	582.0	0.0	1.5353	501.0
1.2000	373.5	0.0	0.6831	2554.0
2.1700	375.0	0.0	0.6838	3333.0
1.6000	358.5	0.0	0.6757	3525.0
3.1700	309.0	0.0	0.4015	17300.0
3.1900	302.0	0.0	0.3980	19672.0
3.1000	307.5	0.0	0.4007	22920.0
3.2000	290.0	0.0	0.3922	24318.0
2.1300	239.0	0.0	0.2672	104000.0
1.1600	247.0	0.0	0.2711	105000.0
3.1200	262.0	0.0	0.2784	105000.0
2.1000	250.5	0.0	0.2728	124000.0
3.1400	268.5	0.0	0.2816	140619.0

continued

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.5000	255.0	0.0	0.2750	155000.0
3.9000	254.0	0.0	0.2245	245500.0
2.6000	242.0	0.0	0.2186	306000.0
2.1900	242.0	0.0	0.2186	333500.0
1.1500	254.0	0.0	0.2245	396500.0
3.1500	255.0	0.0	0.2100	436000.0
3.4000	265.5	0.0	0.2301	446000.0
1.1100	253.5	0.0	0.2243	1329140.0
1.7000	269.5	0.0	0.2321	1688000.0
2.9000	278.0	0.0	0.2013	7202000.0
3.1600	271.0	0.0	0.1978	> 4727000.0

X 10 CrNiMo 16 4 2		AM 350
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Heat treatment : cold drawn 25-35% reduction by supplier
Test temperature : +23°C
Semifinished material : blanks, Ø 19 mm
Reference : [4.12]
Year : 1963

Chemical composition

C	Mn	Si	Cr	Ni	Mo	N
0.10	0.75	0.35	16.50	4.25	2.75	0.10

Monotonic properties

E	=	179530	N/mm ²	ν	=	0.30	-
R _{p0.2}	=	1864	N/mm ²	K	=	2318	N/mm ²
R _m	=	1906	N/mm ²	n	=	0.047	-
A ₅	=		%	σ_f	=	2265	N/mm ²
Z	=	20	%	ϵ_f	=	0.23	-

Cyclic properties

R' _{p0.2}	=	1635	N/mm ²	K'	=	3072	N/mm ²
σ'_g	=	553	N/mm ²	n'	=	0.101	-
ϵ'_g	=	0.308	%	σ'_f	=	2947	N/mm ²
N _T	=	18	cycles	ϵ'_f	=	0.176	-
T _{σ}	=	1.366	-	b	=	-0.110	-
T _{ϵ_p}	=	5.511	-	c	=	-0.767	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks :

Hardness : Rockwell C-50 to 52

Microstructure :

Monotonic test

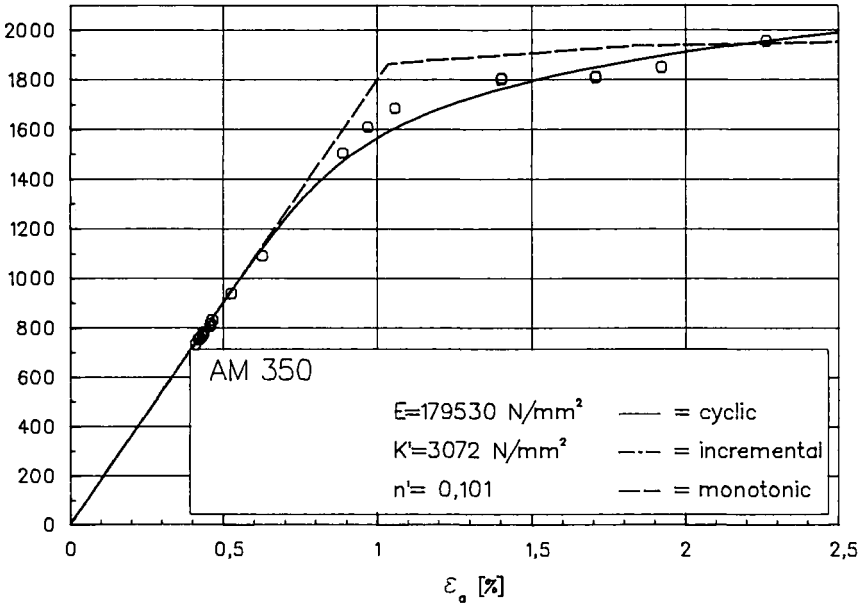
Loading condition :
Specimen : cylindrical, Ø 6.35 mm
Specimen location : in rolling direction
Gauge length : 38.1 mm
Testing machine : Rhiele, universal testing machine
Strain rate :

Cyclic test

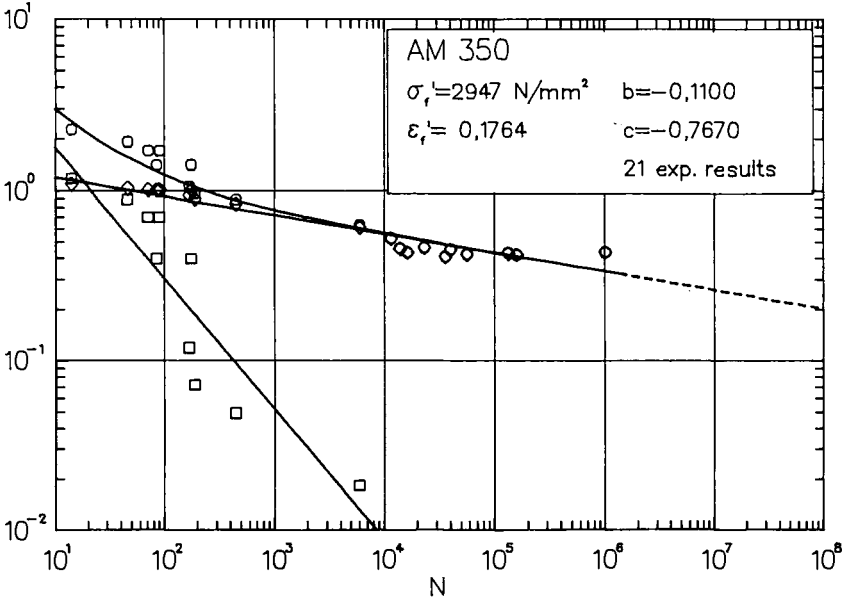
Loading condition : total diametral strain control, R_{ed} = -1
Specimen : hourglass shaped, Ø 6.35 mm
Surface : machined
Specimen location : in rolling direction
Gauge length : diametral
Testing machine : self designed
Frequency :
Strain rate :
Waveform :

Remarks :

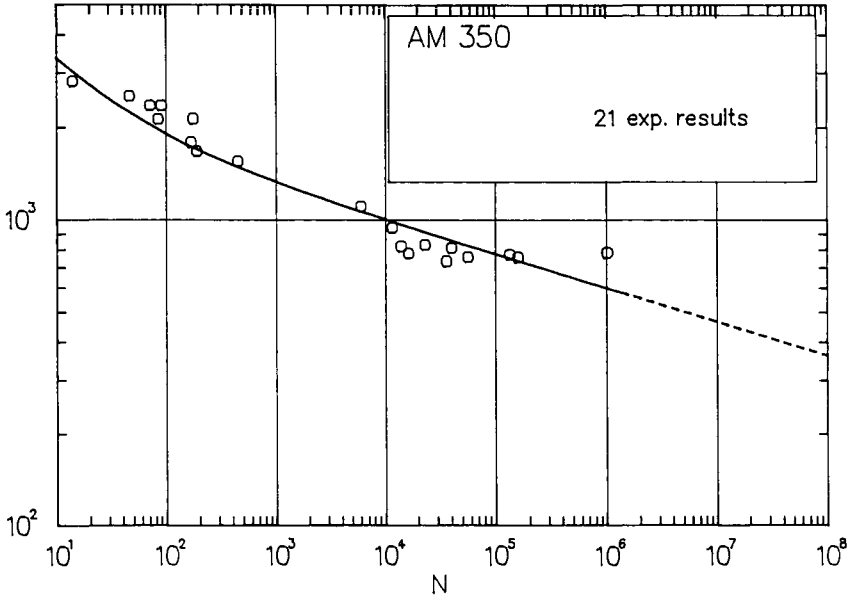
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : AM 350

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	1998.7	0.0	3.3790	3.0
2.0000	1957.3	0.0	2.2630	14.0
3.0000	1850.3	0.0	1.9200	46.0
4.0000	1812.3	0.0	1.7070	71.0
5.0000	1805.4	0.0	1.4030	85.0
6.0000	1808.8	0.0	1.7060	90.0
7.0000	1684.6	0.0	1.0570	169.0
8.0000	1801.9	0.0	1.4020	176.0
9.0000	1608.6	0.0	0.9680	190.0
10.0000	1505.1	0.0	0.8870	450.0
11.0000	1090.8	0.0	0.6260	5971.0
12.0000	938.9	0.0	0.5260	11500.0
13.0000	818.1	0.0	0.4580	13920.0
14.0000	776.7	0.0	0.4340	16300.0
15.0000	831.9	0.0	0.4640	23200.0
16.0000	735.3	0.0	0.4100	35940.0
17.0000	807.8	0.0	0.4550	40050.0
18.0000	759.4	0.0	0.4240	56600.0
19.0000	769.8	0.0	0.4320	133000.0
20.0000	756.0	0.0	0.4210	159000.0
21.0000	783.6	0.0	0.4360	1010000.0

X 10 CrNiMo 16 4 2	AM 350
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Heat treatment : hot rolled, pickled and annealed by supplier
 Test temperature : +23°C
 Semifinished material : blanks, Ø 19 mm
 Reference : [4,12]
 Year : 1963

Hardness :

Chemical composition

C	Mn	Si	Cr	Ni	Mo	N
0.10	0.75	0.35	16.50	4.25	2.75	0.10

Microstructure :

Monotonic properties

E	=	193340	N/mm ²	ν	=	0.32	-
R _{p0.2}	=	442	N/mm ²	K	=	906	N/mm ²
R _m	=	1319	N/mm ²	n	=	0.136	-
A ₅	=		%	σ _f	=	2341	N/mm ²
Z	=	52	%	ε _f	=	0.74	-

Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 6.35 mm
 Specimen location : in rolling direction
 Gauge length : 38.1 mm
 Testing machine : Rhiele, universal testing machine
 Strain rate :

Cyclic properties

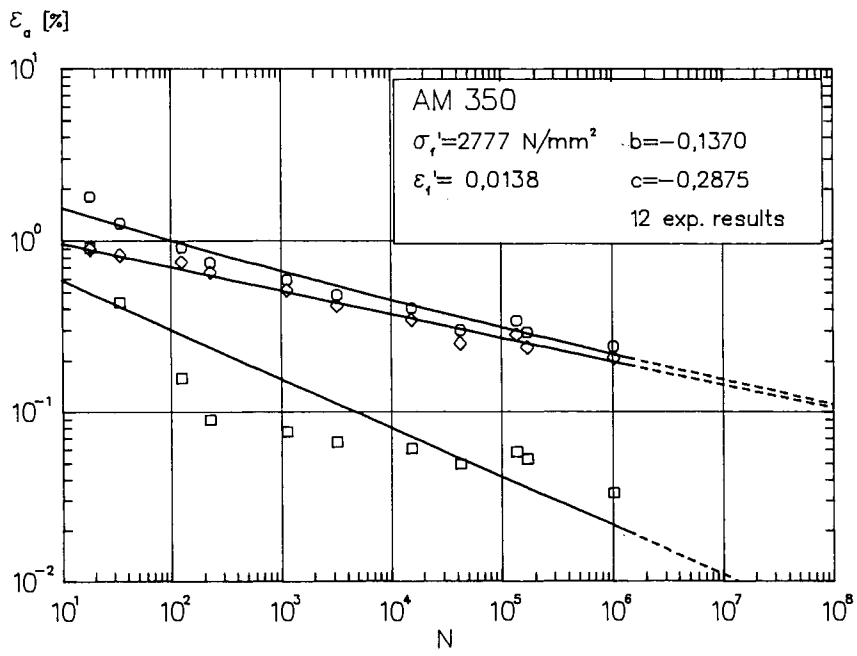
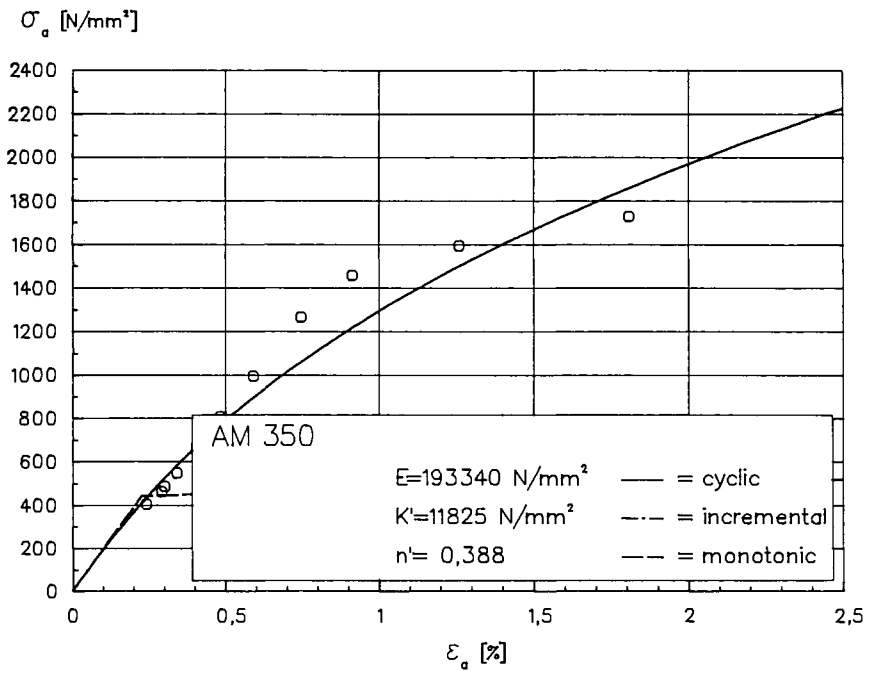
R' _{p0.2}	=	1063	N/mm ²	K'	=	11825	N/mm ²
σ' _g	=	346	N/mm ²	n'	=	0.388	-
ε' _g	=	0.196	%	σ' _f	=	2777	N/mm ²
N _T	=	0	cycles	ε' _f	=	0.014	-
T _σ	=	1.264	-	b	=	-0.137	-
T _{εp}	=	5.089	-	c	=	-0.287	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Cyclic test

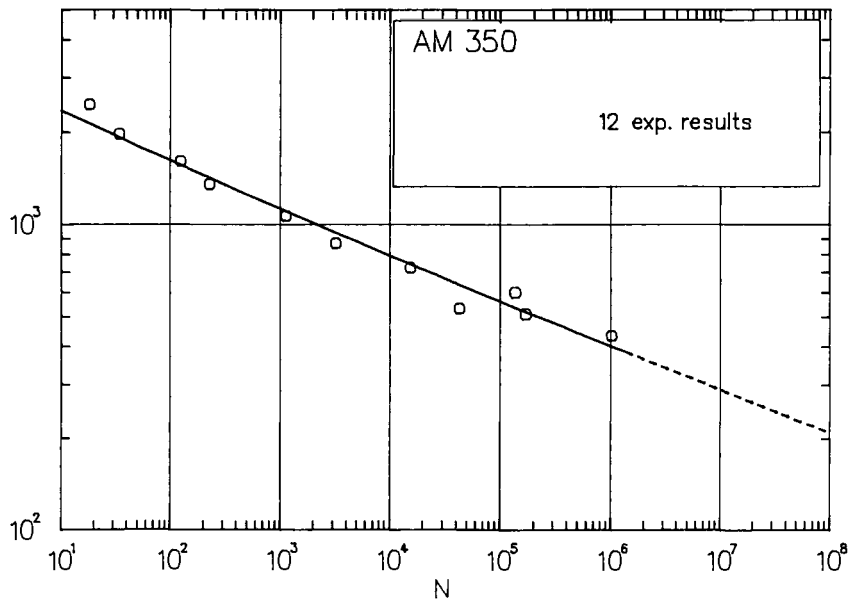
Loading condition : total diametral strain control, R_{εd} = -1
 Specimen : hourglass shaped, Ø 6.35 mm
 Surface : machined
 Specimen location : in rolling direction
 Gauge length : diametral
 Testing machine : self designed
 Frequency :
 Strain rate :
 Waveform :

Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks :

Remarks :



PSWT [N/mm²]



Material : AM 350

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	1722.6	0.0	2.6050	7.0
2.0000	1729.4	0.0	1.8070	18.0
3.0000	1594.8	0.0	1.2600	34.0
4.0000	1456.7	0.0	0.9120	125.0
5.0000	1266.9	0.0	0.7450	228.0
6.0000	994.2	0.0	0.5900	1134.0
7.0000	807.8	0.0	0.4840	3220.0
8.0000	666.2	0.0	0.4050	15410.0
9.0000	486.7	0.0	0.3010	42700.0
11.0000	548.9	0.0	0.3420	137000.0
12.0000	462.6	0.0	0.2920	170000.0
13.0000	403.9	0.0	0.2420	1020000.0

X 10 CrNiTi 18 9	1.4541	
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Heat treatment : as received
 Test temperature : +23°C
 Semifinished material :
 Reference : [4.7]
 Year : 1983

Chemical composition

C	Si	Mn	P	S	Cr	Ni	Ti
0.073	0.41	1.32	0.024	0.011	17.1	10.2	0.46

Monotonic properties

E	=	200000	N/mm ²	ν	=	-
R _{p0.2}	=	265	N/mm ²	K	=	1174 N/mm ²
R _m	=		N/mm ²	n	=	0.257 -
A ₅	=		%	σ_f	=	N/mm ²
Z	=		%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	343	N/mm ²	K'	=	1170 N/mm ²
σ'_g	=	191	N/mm ²	n'	=	0.201 -
ϵ'_g	=	0.129	%	σ'_f	=	1019 N/mm ²
N _T	=	1732816	cycles	ϵ'_f	=	0.1325 -
T _{σ}	=	1.168	-	b	=	-0.110 -
T _{ϵ_p}	=	1.366	-	c	=	-0.394 -
Incremental step test :				K'	=	N/mm ²
				n'	=	-

Failure criterion : crack initiation, 0.5 mm crack length
 σ/ϵ -values valid for : half failure life
 Remarks :

Hardness :

Microstructure :

Monotonic test

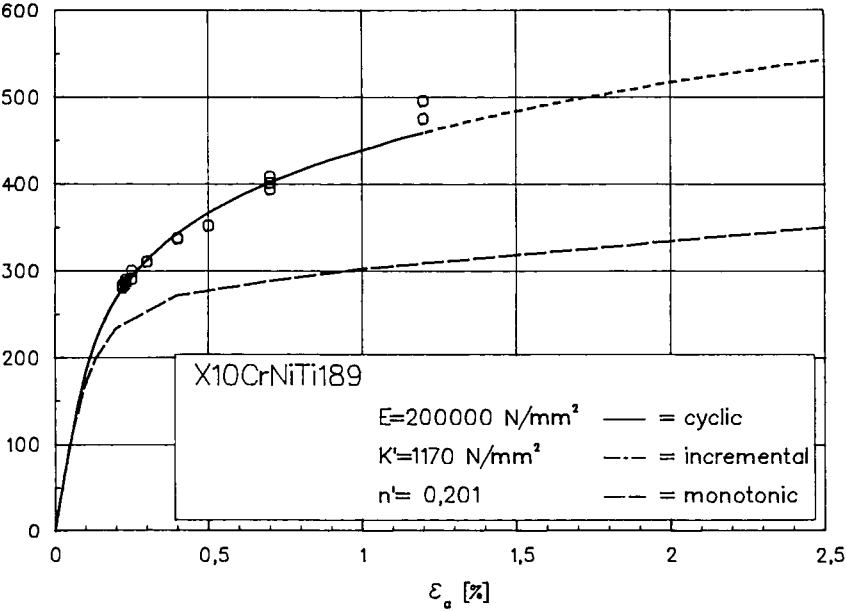
Loading condition : displacement control
 Specimen : hourglass shaped, $\emptyset$ 6 mm
 Specimen location : in rolling direction
 Gauge length : diametral
 Testing machine : Schenck, servohydraulic, max. 60 kN
 Strain rate : 0.42 (%/min)

Cyclic test

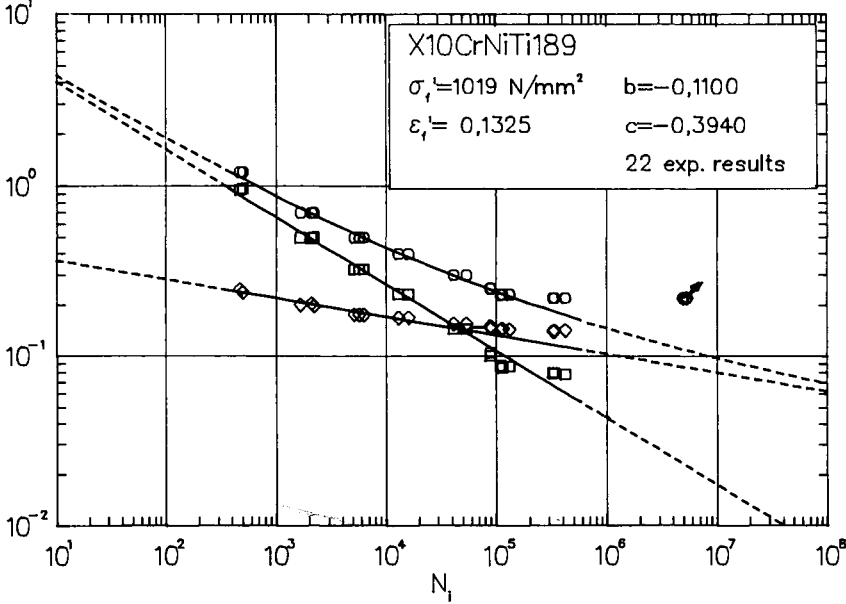
Loading condition : total strain control, R _{ϵ} = -1
 Specimen : hourglass shaped, $\emptyset$ 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 4 mm
 Testing machine : Schenck, servohydraulic, max. 60 kN
 Frequency : 0.1 - 11 Hz
 Strain rate :
 Waveform : sinusoidal

Remarks :

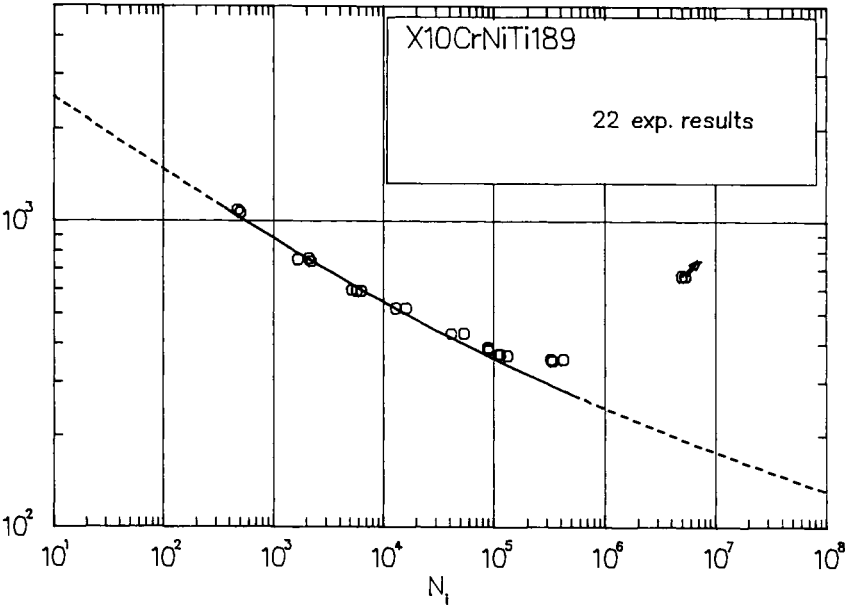
σ_a [N/mm²]



ϵ_a [%]



PSWT [N/mm²]



Material : X 10 CrNiTi 18 9

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
11.0000	495.7	-4.2	1.2000	471.0
12.0000	474.7	-3.1	1.2000	500.0
13.0000	401.2	0.7	0.7000	1666.0
2.4200	408.4	0.0	0.7000	2100.0
3.3700	393.9	-2.5	0.7000	2200.0
3.3600	352.2	2.6	0.5000	5150.0
3.3800	351.9	0.0	0.5000	5709.0
3.3900	351.9	0.0	0.5000	6324.0
1.1200	337.0	0.0	0.4000	12990.0
1.2100	338.0	0.0	0.4000	16000.0
1.1100	310.5	0.0	0.3000	41500.0
1.2200	310.8	0.0	0.3000	54000.0
1.3200	300.0	2.0	0.2500	89000.0
2.5200	291.0	0.0	0.2500	89600.0
1.1240	285.0	10.6	0.2300	110000.0
2.9300	289.8	5.0	0.2300	114000.0
2.9400	286.7	3.0	0.2300	132000.0
1.1210	280.3	7.8	0.2200	325000.0
2.1120	282.0	-1.4	0.2200	335000.0
8.0000	284.2	4.3	0.2200	420000.0
2.1040	336.0	9.3	0.2200	> 4940000.0
2.6200	350.0	0.0	0.2200	> 5300000.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C/30' water
 Test temperature : +23°C
 Semifinished material : bar, Ø 25 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.54	1.08	0.041	0.018	8.52	16.50	0.28

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	211	N/mm ²	K	=	N/mm ²
R _m	=	677	N/mm ²	n	=	-
A ₅	=	51	%	σ_f	=	N/mm ²
Z	=	69	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	496	N/mm ²	K'	=	3647	N/mm ²
σ_g	=	242	N/mm ²	n'	=	0.321	-
ϵ_g	=	0.014	%	σ'_f	=	1968	N/mm ²
N _T	=	7940	cycles	ϵ'_f	=	0.110	-
T _σ	=	1.198	-	b	=	-0.138	-
T _{εp}	=	1.499	-	c	=	-0.393	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness : HV 10 : 163

Microstructure : JIS G 0551 grain size: 9

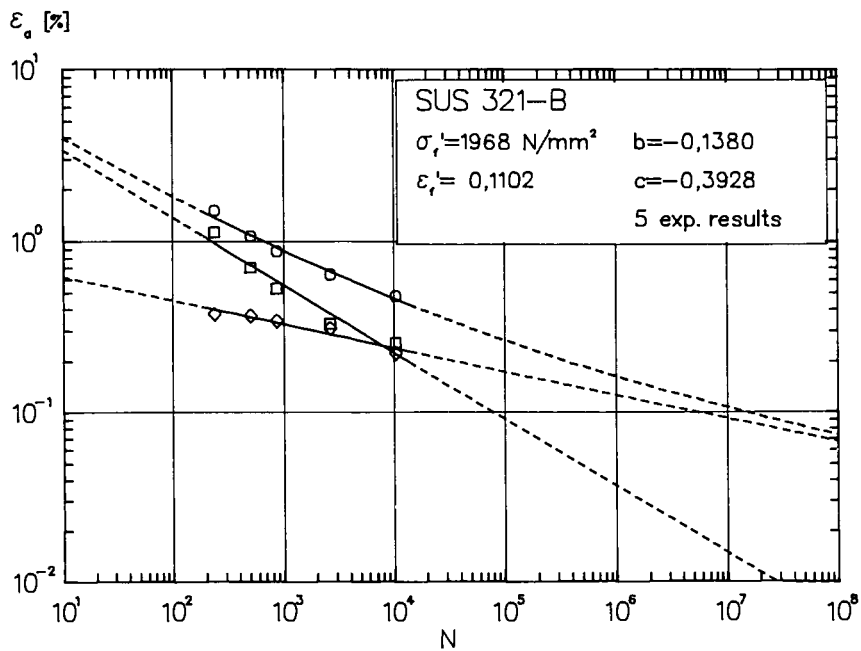
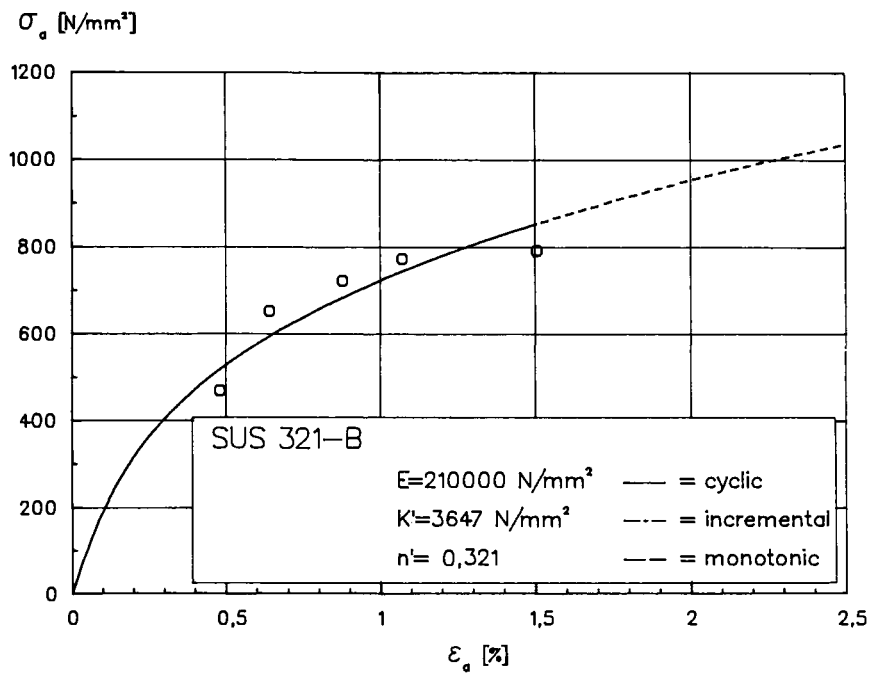
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

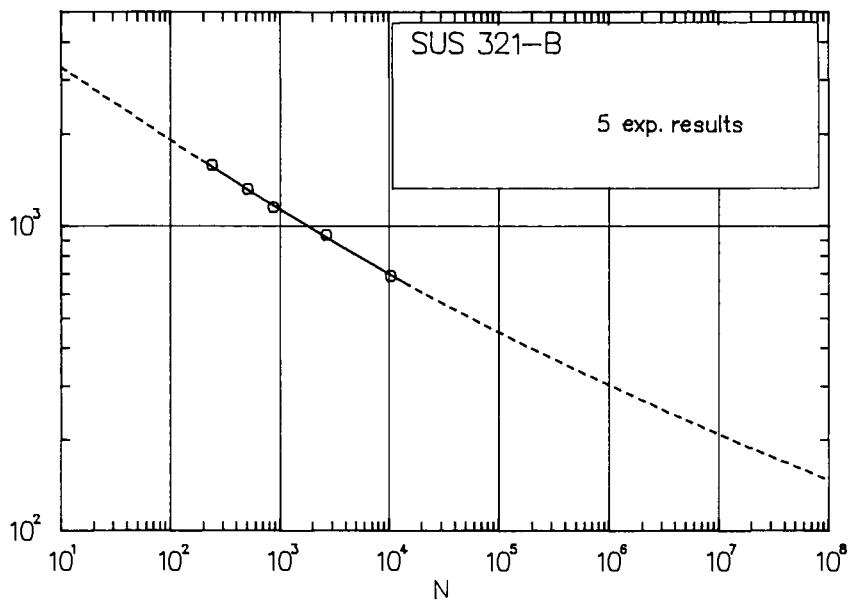
Cyclic test

Loading condition : total strain control, $R_e = -1$
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 39 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 321-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	791.2	0.0	1.5050	238.0
2.0000	772.5	0.0	1.0700	506.0
3.0000	721.5	0.0	0.8750	862.0
4.0000	651.9	0.0	0.6400	2639.0
5.0000	469.9	0.0	0.4800	10317.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C/30' water
Test temperature : +23°C
Semifinished material : bar, Ø 25 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.54	1.08	0.041	0.018	8.52	16.50	0.28

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	211	N/mm ²	K	=	N/mm ²
R _m	=	677	N/mm ²	n	=	-
A ₅	=	51	%	σ_f	=	N/mm ²
Z	=	67	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	455	N/mm ²	K'	=	8384	N/mm ²
σ_g	=	273	N/mm ²	n'	=	0.469	-
ϵ_g	=	0.200	%	σ'_f	=	2046	N/mm ²
N _T	=	27223	cycles	ϵ'_f	=	0.046	-
T _{σ}	=	1.187	-	b	=	-0.133	-
T _{ep}	=	1.424	-	c	=	-0.276	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness : HV 10 : 163

Microstructure : JIS G 0551 grain size: 9

Monotonic test

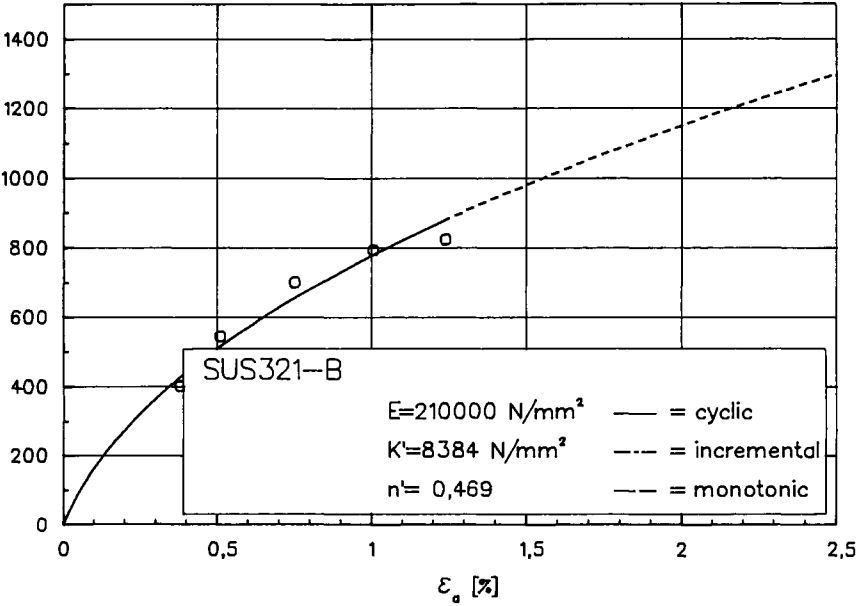
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

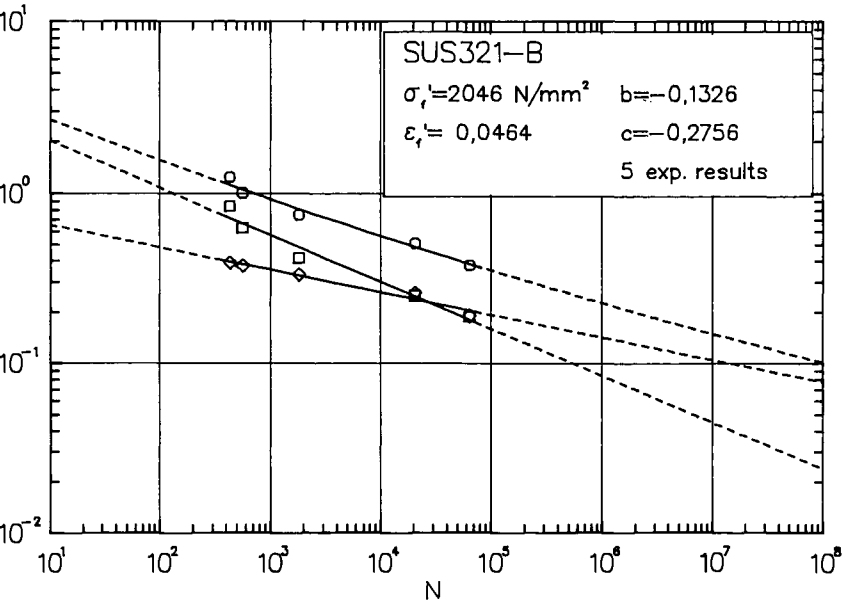
Loading condition : total strain control, R _{ϵ} = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 4.0 (%/min)
Waveform : triangular

Remarks :

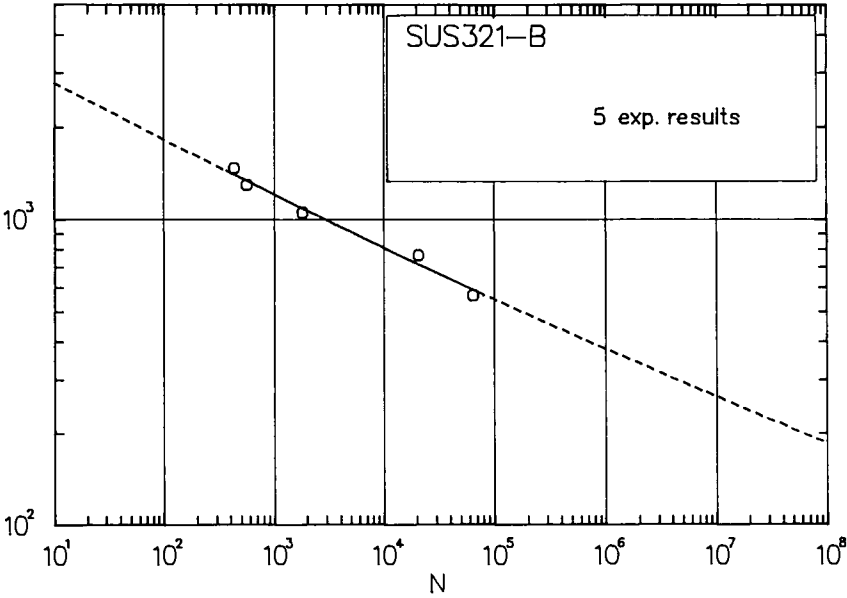
σ_e [N/mm²]



ϵ_e [%]



PSWT [N/mm²]



Material : SUS 321-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	824.0	0.0	1.2400	431.0
2.0000	792.7	0.0	1.0050	560.0
3.0000	700.4	0.0	0.7500	1819.0
4.0000	545.4	0.0	0.5100	20634.0
5.0000	401.2	0.0	0.3800	64300.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C/30' water, 1100°C/1h water
 Test temperature : +23°C
 Semifinished material : bar, Ø 25 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.54	1.08	0.041	0.018	8.52	16.50	0.28

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	182	N/mm ²	K	=	N/mm ²
R _m	=	668	N/mm ²	n	=	-
A ₅	=	56	%	σ_f	=	N/mm ²
Z	=	68	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	414	N/mm ²	K'	=	6179	N/mm ²
σ_g	=	224	N/mm ²	n'	=	0.435	-
ϵ_g	=	0.152	%	σ'_f	=	1998	N/mm ²
N _T	=	27027	cycles	ϵ'_f	=	0.081	-
T _{σ}	=	1.319	-	b	=	-0.144	-
T _{ep}	=	1.304	-	c	=	-0.341	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness : HV 10 : 135

Microstructure : JIS G 0551 grain size: 3.1

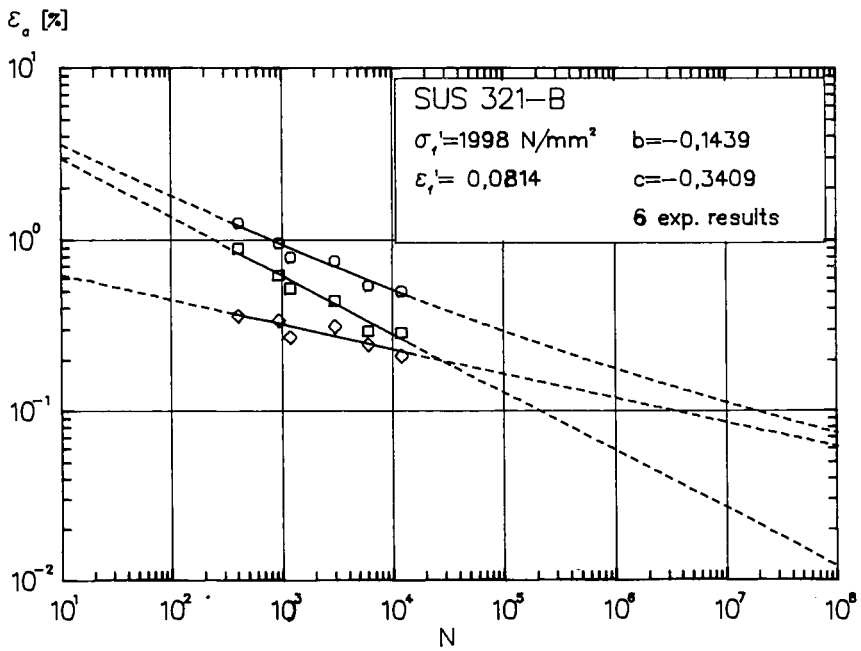
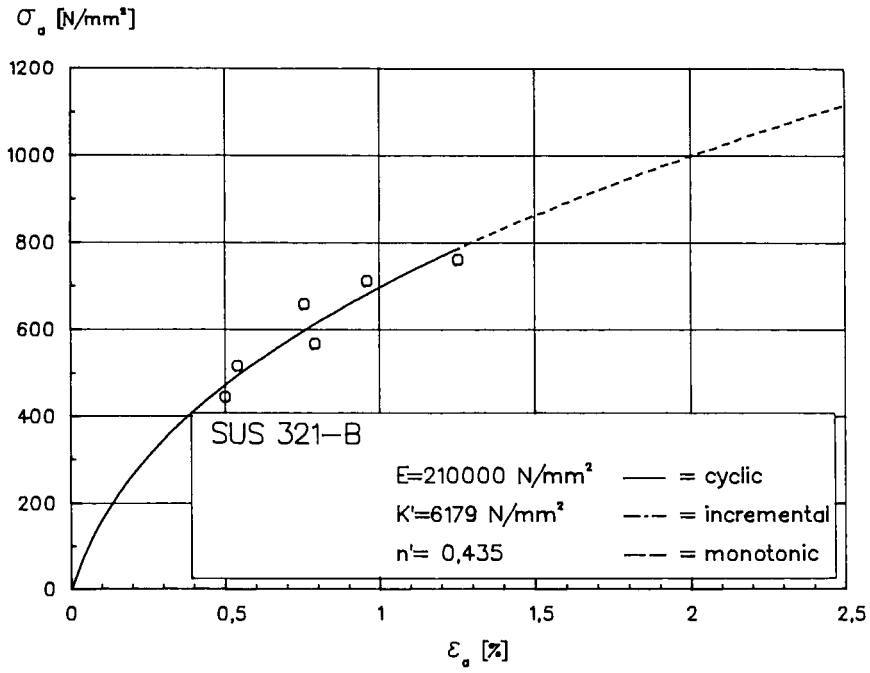
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

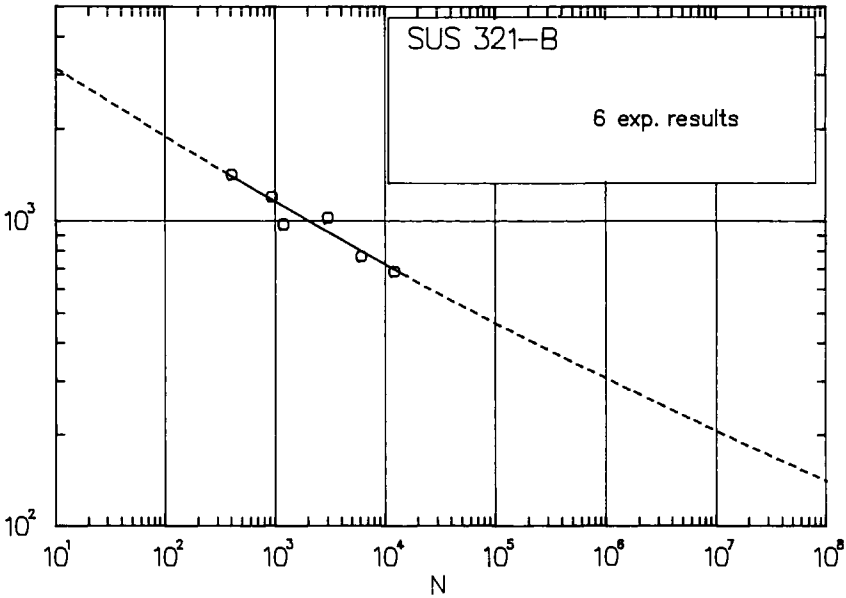
Cyclic test

Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 321-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	760.8	0.0	1.2550	403.0
2.0000	710.7	0.0	0.9600	937.0
3.0000	567.5	0.0	0.7900	1189.0
4.0000	658.7	0.0	0.7550	3016.0
5.0000	517.0	0.0	0.5400	6042.0
6.0000	444.4	0.0	0.5000	12071.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C/30' water, 1100°C/1h water
 Test temperature : +23°C
 Semifinished material : bar, Ø 25 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.54	1.08	0.041	0.018	8.52	16.50	0.28

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	182	N/mm ²	K	=	N/mm ²
R _m	=	668	N/mm ²	n	=	-
A ₅	=	56	%	σ _f	=	N/mm ²
Z	=	68	%	ε _f	=	-

Cyclic properties

R'p0.2	=	376	N/mm ²	K'	=	17743	N/mm ²
σ _g	=	185	N/mm ²	n'	=	0.620	-
ε _g	=	0.149	%	σ' _f	=	3005	N/mm ²
N _T	=	87287	cycles	ε' _f	=	0.061	-
T _σ	=	1.419	-	b	=	-0.183	-
T _{εp}	=	1.133	-	c	=	-0.304	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness : HV 10 : 135

Microstructure : JIS G 0551 grain size: 3.1

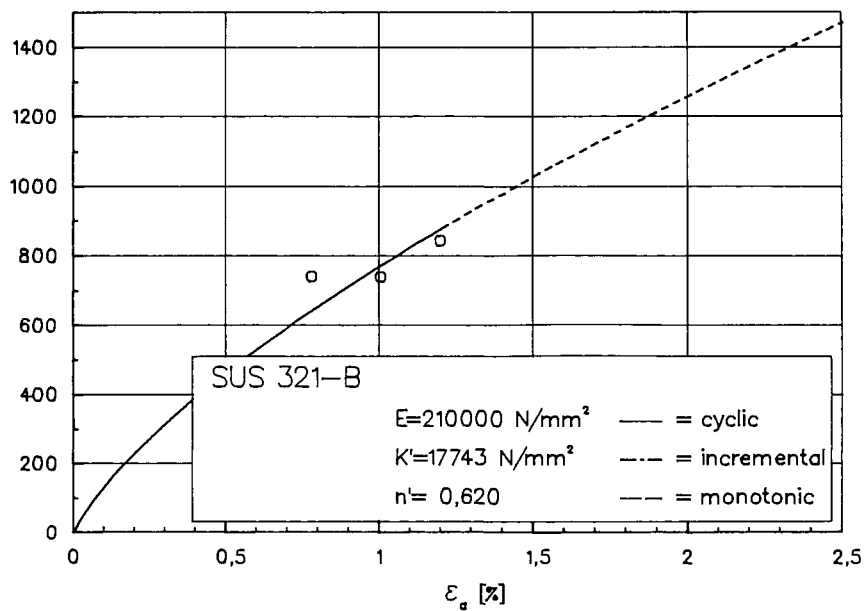
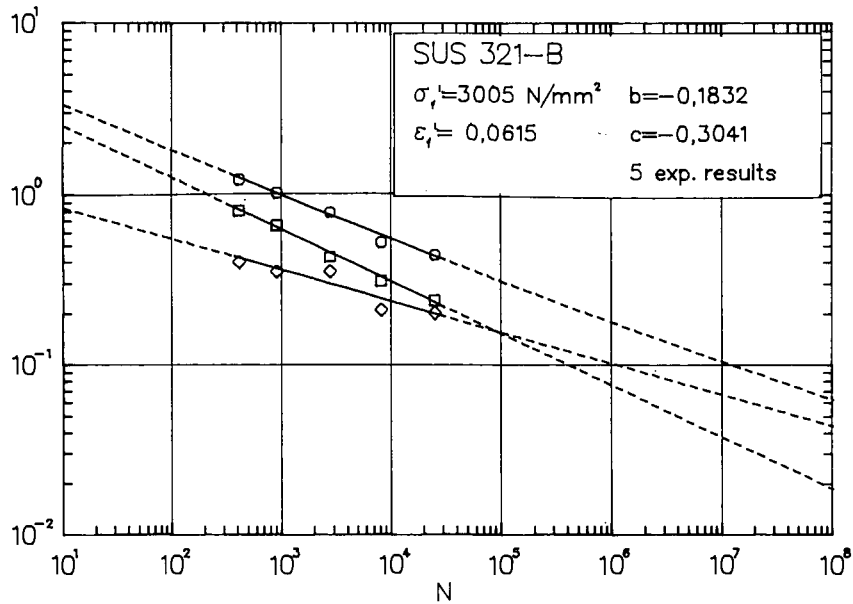
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

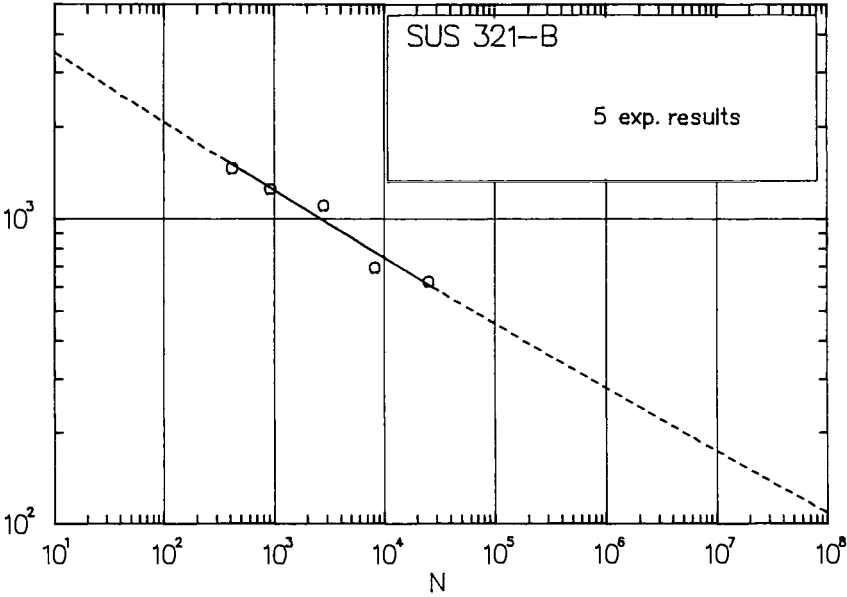
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 4.0 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUS 321-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	844.2	0.0	1.2000	414.0
2.0000	738.7	0.0	1.0050	916.0
3.0000	740.2	0.0	0.7800	2785.0
4.0000	441.9	0.0	0.5200	8182.0
5.0000	423.8	0.0	0.4400	25263.0

X 10 CrNiTi 18 9	1.4541	SDS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water
Test temperature : +23°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	177	N/mm ²	K	=	N/mm ²
R _m	=	516	N/mm ²	n	=	-
A ₅	=	70	%	σ _f	=	N/mm ²
Z	=	74	%	e _f	=	-

Cyclic properties

R' _{p0.2}	=	220	N/mm ²	K'	=	2264	N/mm ²
σ _g	=	83	N/mm ²	n'	=	0.375	-
ε _g	=	0.055	%	σ' _f	=	1969	N/mm ²
N _T	=	131441	cycles	e' _f	=	0.652	-
T _σ	=	1.099	-	b	=	-0.208	-
T _{εp}	=	1.526	-	c	=	-0.548	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

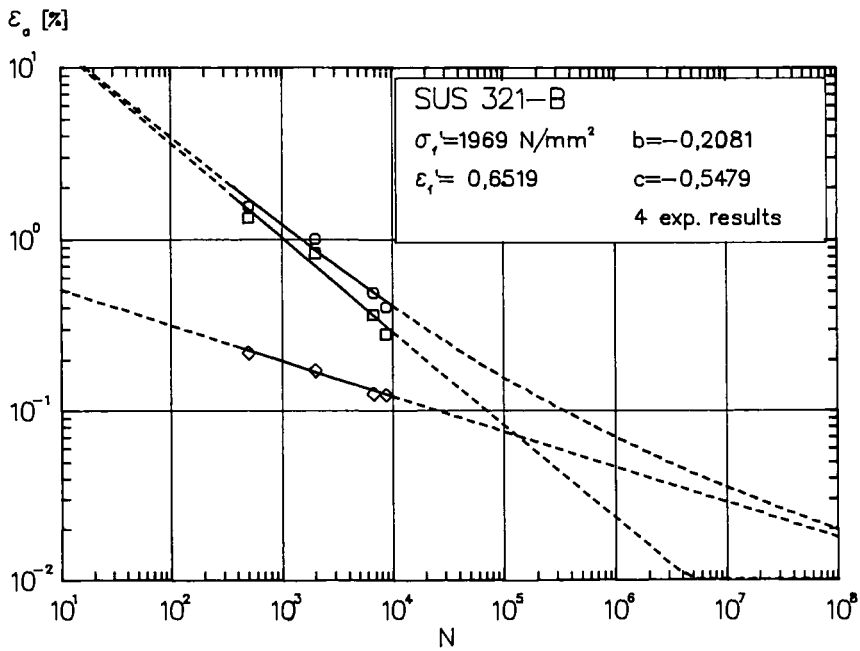
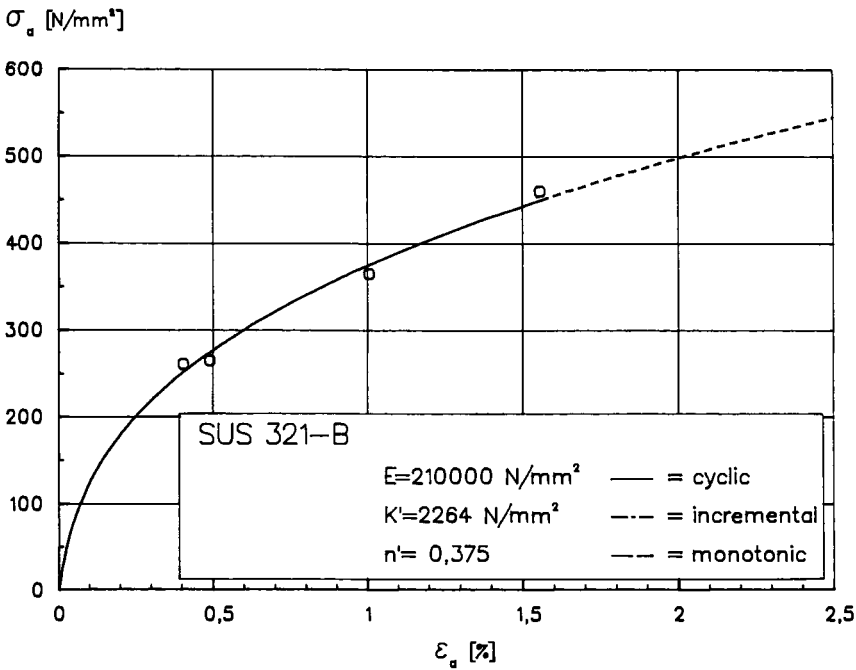
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

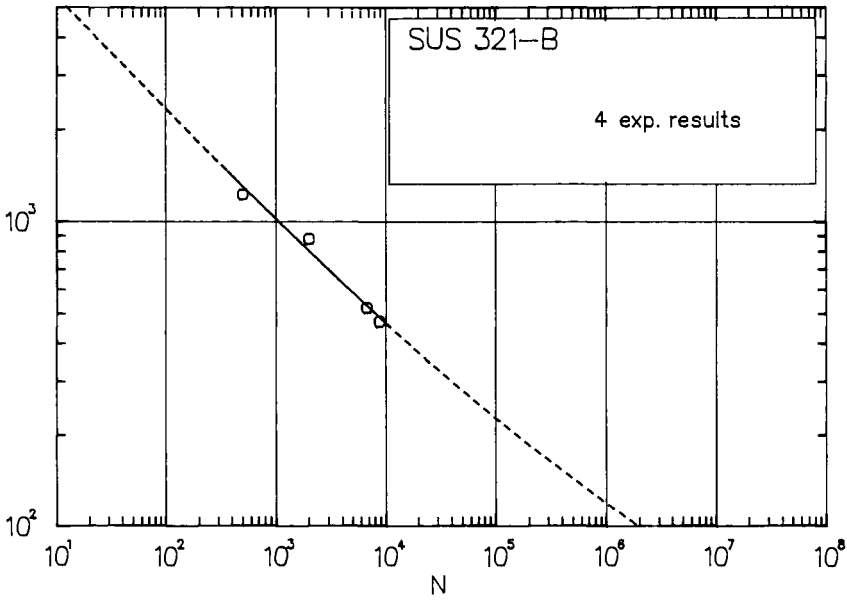
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 321-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	460.1	0.0	1.5550	500.0
2.0000	364.4	0.0	1.0050	1992.0
3.0000	264.9	0.0	0.4900	6700.0
4.0000	260.5	0.0	0.4050	8700.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water
Test temperature : +23°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	177	N/mm ²	K	=	N/mm ²
R _m	=	516	N/mm ²	n	=	-
A ₅	=	70	%	σ _f	=	N/mm ²
Z	=	74	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	250	N/mm ²	K'	=	1535	N/mm ²
σ _g	=	96	N/mm ²	n'	=	0.292	-
ε _g	=	0.053	%	σ' _f	=	1806	N/mm ²
N _T	=	43095	cycles	ε' _f	=	1.720	-
T _σ	=	1.260	-	b	=	-0.193	-
T _{εp}	=	1.316	-	c	=	-0.659	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ε-values valid for : half failure life

Remarks : Young's modulus estimated

Hardness : HV 10 : 108

Microstructure : JIS G 0551 grain size: 0.9

Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

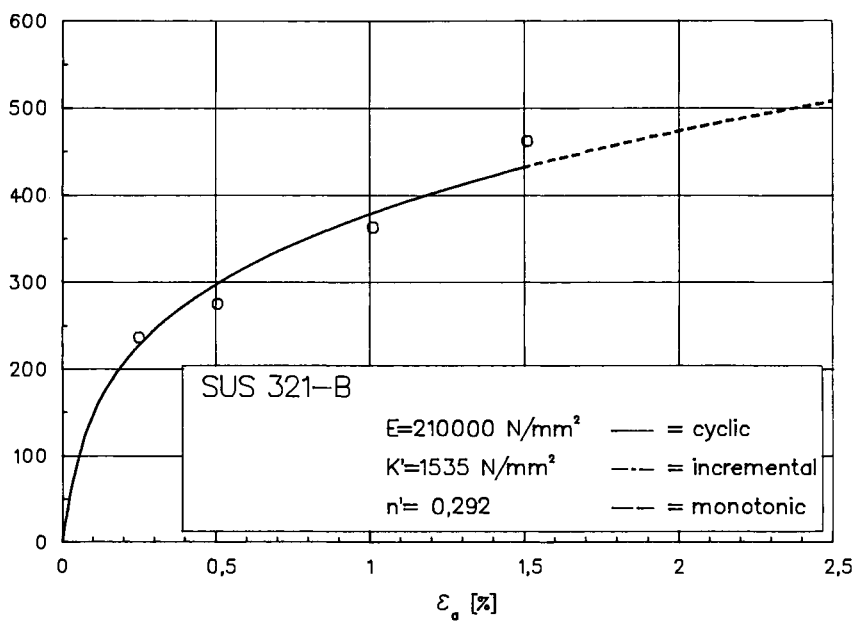
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 4.0 (%/min)
Waveform : triangular

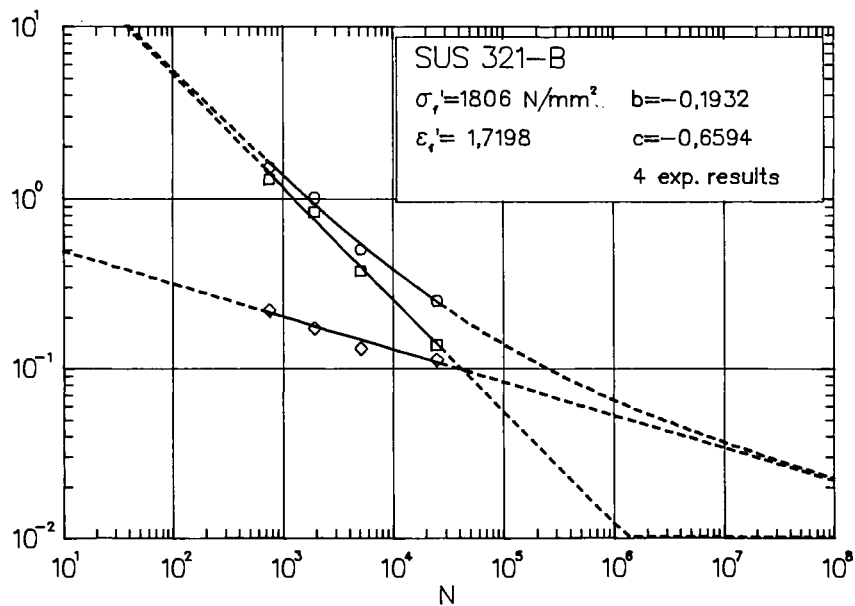
Remarks :

300

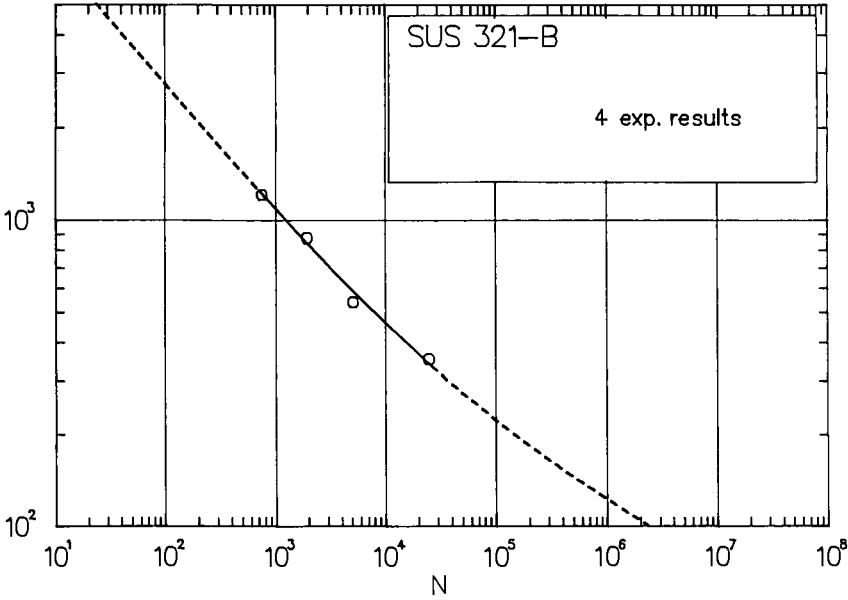
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 321-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	462.5	0.0	1.5100	750.0
2.0000	363.0	0.0	1.0100	1936.0
3.0000	275.2	0.0	0.5050	5078.0
4.0000	236.9	0.0	0.2500	24813.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water, 900°C/1h air
Test temperature : +23°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	177	N/mm ²	K	=	N/mm ²
R _m	=	535	N/mm ²	n	=	-
A ₅	=	70	%	σ _f	=	N/mm ²
Z	=	77	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	220	N/mm ²	K'	=	3080	N/mm ²
σ _g	=	66	N/mm ²	n'	=	0.424	-
ε _g	=	0.043	%	σ' _f	=	3079	N/mm ²
N _T	=	114425	cycles	ε' _f	=	0.976	-
T _σ	=	1.062	-	b	=	-0.253	-
T _{εp}	=	1.269	-	c	=	-0.593	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness : HV 10 : 122

Microstructure : JIS G 0551 grain size : 0.9

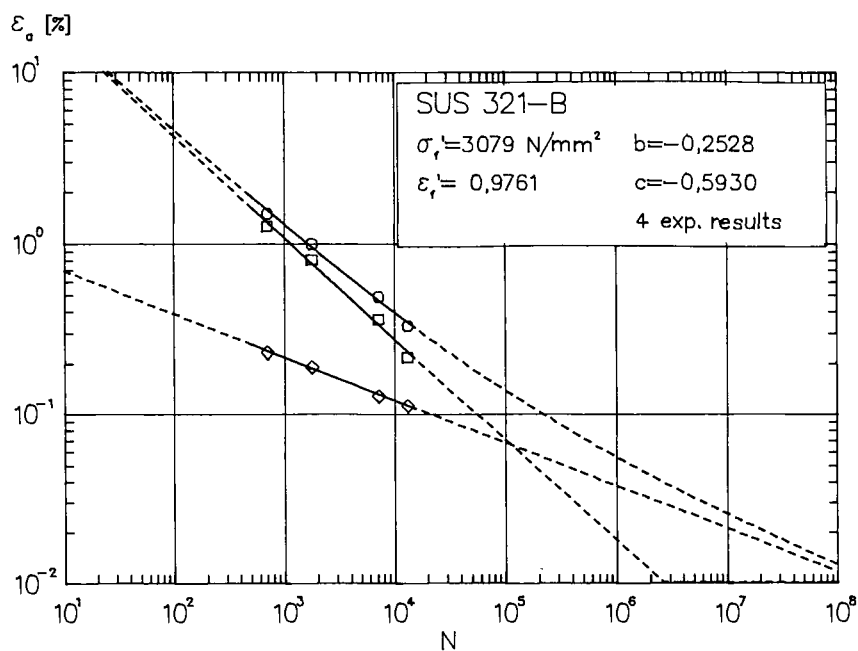
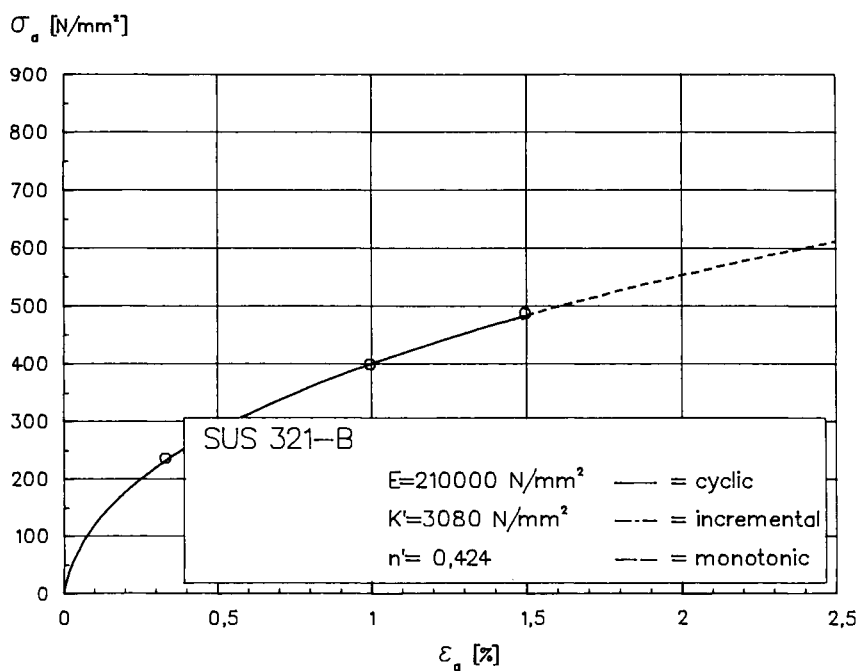
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

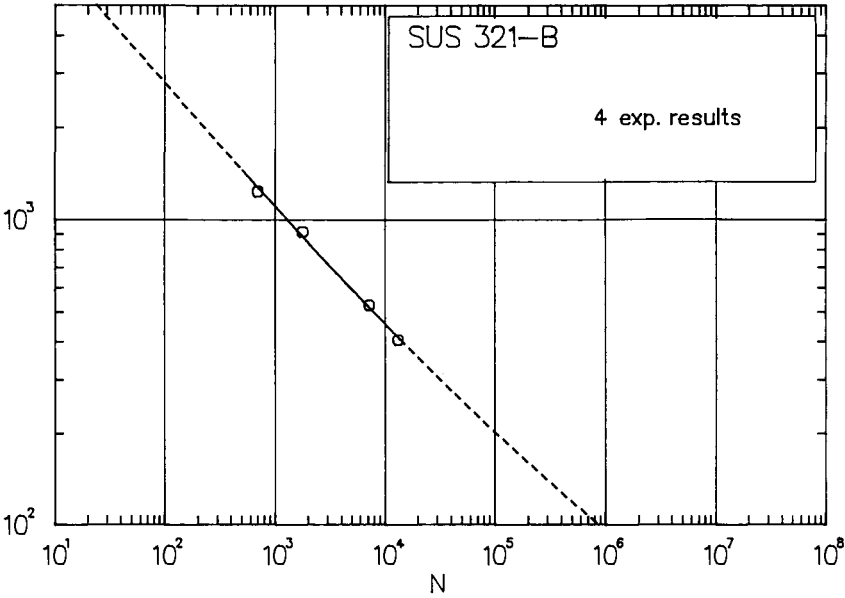
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 321-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	487.1	0.0	1.4950	698.0
2.0000	399.3	0.0	0.9950	1783.0
3.0000	269.8	0.0	0.4900	7153.0
4.0000	236.4	0.0	0.3300	13105.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water, 900°C/1h air
Test temperature : +23°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	210000	N/mm ²	v	=	-
R _{p0.2}	=	177	N/mm ²	K	=	N/mm ²
R _m	=	535	N/mm ²	n	=	-
A ₅	=	70	%	σ _f	=	N/mm ²
Z	=	77	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	241	N/mm ²	K'	=	2097	N/mm ²
σ' _g	=	98	N/mm ²	n'	=	0.348	-
ε' _g	=	0.060	%	σ' _f	=	1868	N/mm ²
N _f	=	78878	cycles	ε' _f	=	0.803	-
T _σ	=	1.497	-	b	=	-0.194	-
T _{εp}	=	1.184	-	c	=	-0.570	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture

σ/ε-values valid for : half failure life

Remarks : Young's modulus estimated

Hardness : HV 10 : 122

Microstructure : JIS G 0551 grain size : 0.9

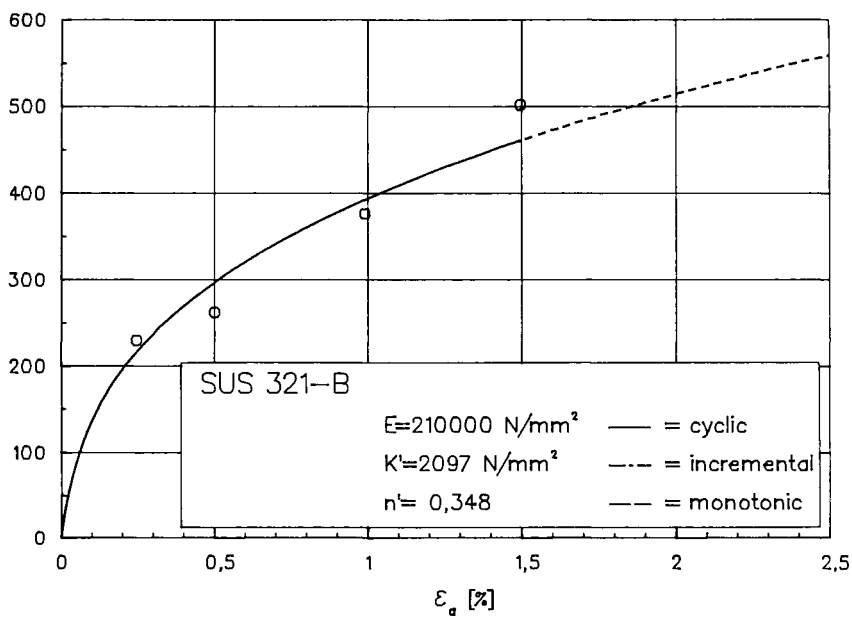
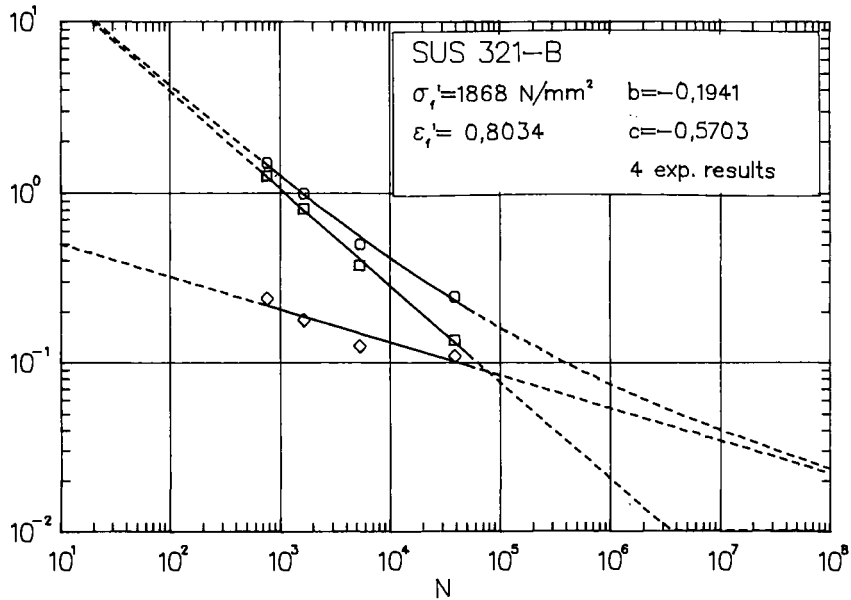
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

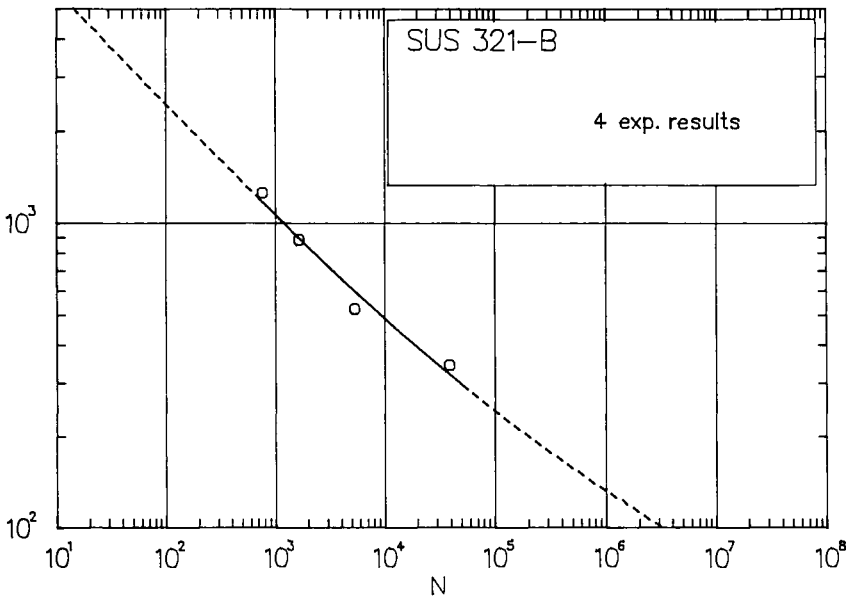
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 4.0 (%/min)
Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUS 321-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	501.8	0.0	1.4950	761.0
2.0000	375.7	0.0	0.9900	1643.0
3.0000	261.9	0.0	0.5000	5314.0
4.0000	230.0	0.0	0.2450	38763.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water, 750°C/24h air
 Test temperature : +23°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.3]
 Year : 1978

Hardness : HV 10 : 122

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Microstructure : JIS G 0551 grain size : 0.9

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	214	N/mm ²	K	=	N/mm ²
R _m	=	529	N/mm ²	n	=	-
A ₅	=	63	%	σ_f	=	N/mm ²
Z	=	74	%	ϵ_f	=	-

Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

Cyclic properties

R' _{p0.2}	=	228	N/mm ²	K'	=	2086	N/mm ²
σ_g	=	90	N/mm ²	n'	=	0.357	-
ϵ_g	=	0.057	%	σ'_f	=	1858	N/mm ²
N _T	=	103906	cycles	ϵ'_f	=	0.713	-
T _{σ}	=	1.081	-	b	=	-0.199	-
T _{ep}	=	1.110	-	c	=	-0.558	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Cyclic test

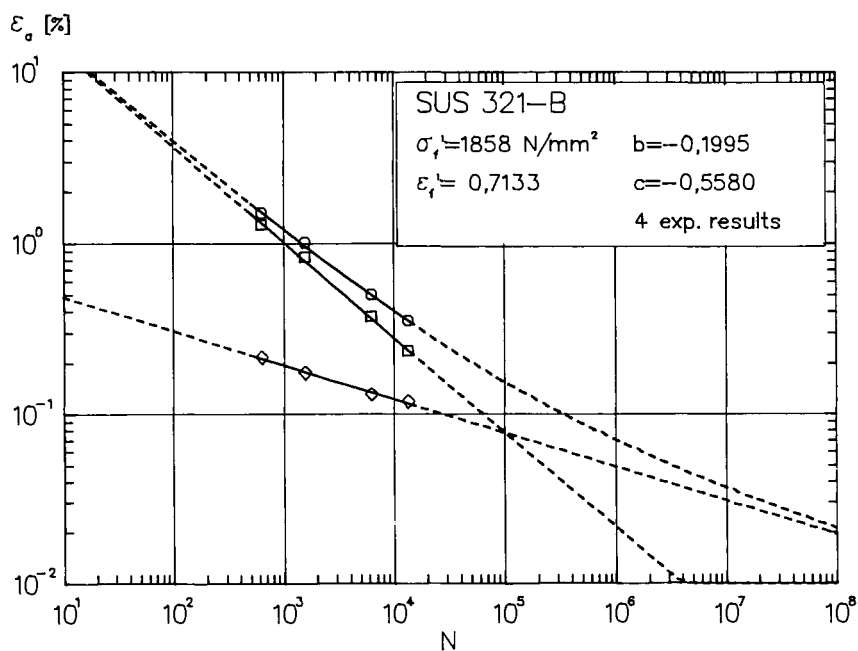
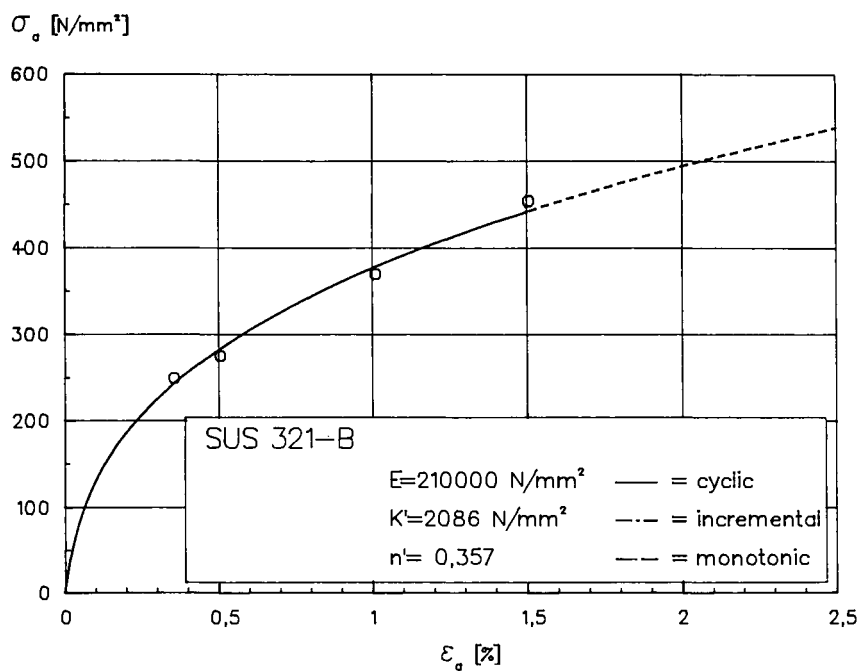
Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Failure criterion : complete rupture

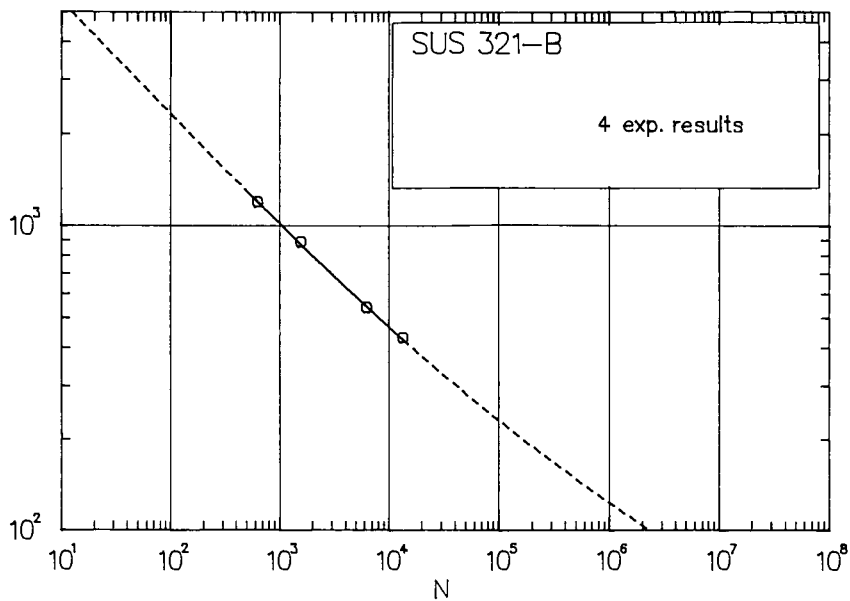
σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Remarks :



PSWT [N/mm²]



Material : SUS 321-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	454.2	0.0	1.5050	628.0
2.0000	369.4	0.0	1.0100	1561.0
3.0000	275.2	0.0	0.5050	6229.0
4.0000	249.2	0.0	0.3550	13410.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water, 750°C/24h air
 Test temperature : +23°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	214	N/mm ²	K	=	N/mm ²
R _m	=	529	N/mm ²	n	=	-
A ₅	=	63	%	σ _f	=	N/mm ²
Z	=	74	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	251	N/mm ²	K'	=	1682	N/mm ²
σ _g	=	103	N/mm ²	n'	=	0.306	-
ε _g	=	0.060	%	σ' _f	=	1740	N/mm ²
N _T	=	57117	cycles	ε' _f	=	1.136	-
T _σ	=	1.209	-	b	=	-0.186	-
T _{εp}	=	1.124	-	c	=	-0.608	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ε-values valid for : half failure life

Remarks : Young's modulus estimated

Hardness : HV 10 : 122

Microstructure : JIS G 0551 grain size : 0.9

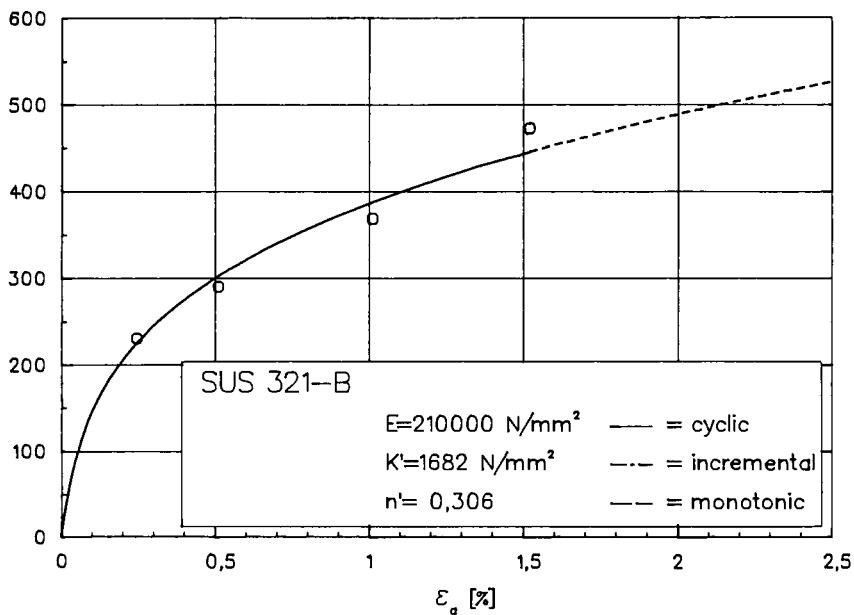
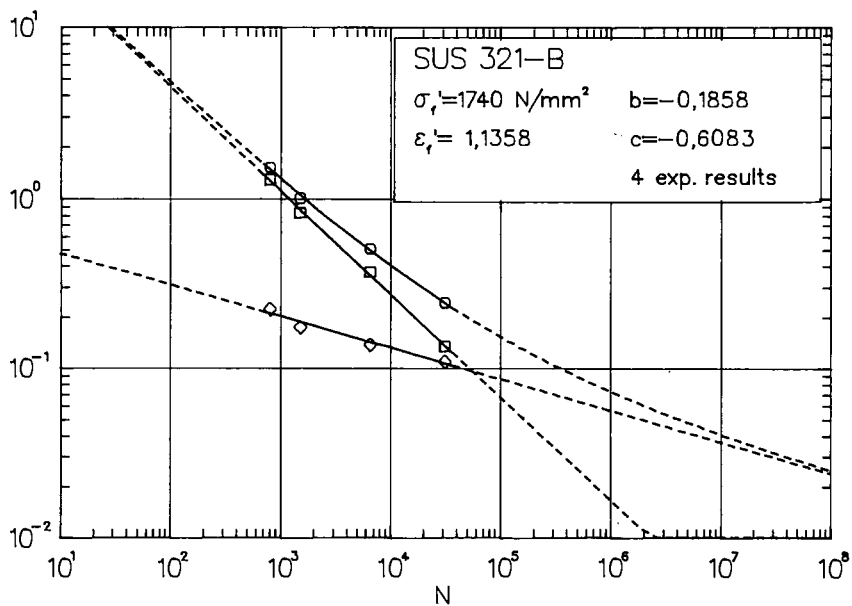
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

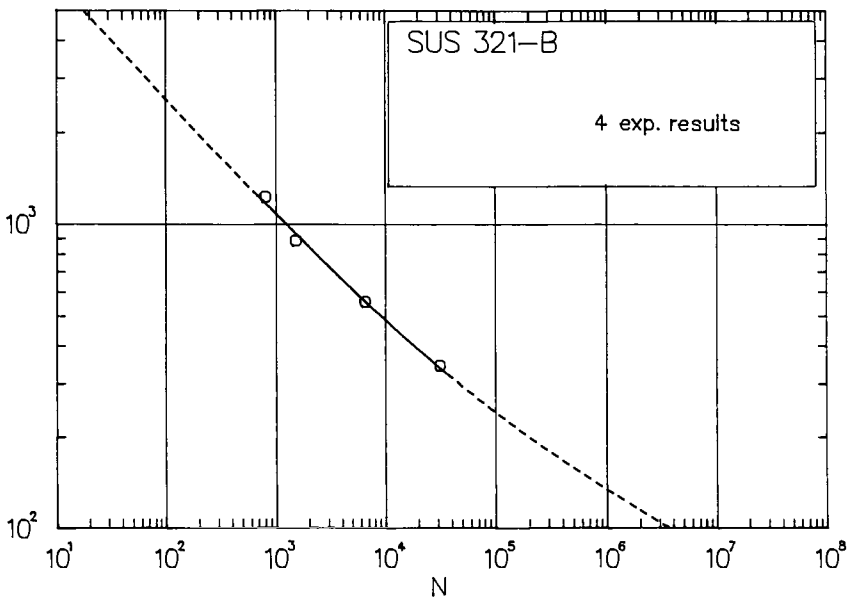
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 4.0 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUS 321-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	472.4	0.0	1.5200	803.0
2.0000	368.4	0.0	1.0100	1504.0
3.0000	289.9	0.0	0.5100	6518.0
4.0000	230.5	0.0	0.2450	31241.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C/30' water
 Test temperature : +450°C
 Semifinished material : bar, Ø 25 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.54	1.08	0.041	0.018	8.52	16.50	0.28

Monotonic properties

E	=	194000	N/mm ²	ν	=	-
R _{p0.2}	=	135	N/mm ²	K	=	N/mm ²
R _m	=	416	N/mm ²	n	=	-
A ₅	=	39	%	σ_f	=	N/mm ²
Z	=	62	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	189	N/mm ²	K'	=	2329	N/mm ²
σ_g	=	104	N/mm ²	n'	=	0.404	-
ϵ_g	=	0.100	%	σ'_f	=	917	N/mm ²
N _T	=	982321	cycles	ϵ'_f	=	0.097	-
T _{σ}	=	1.090	-	b	=	-0.143	-
T _{ep}	=	1.156	-	c	=	-0.351	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

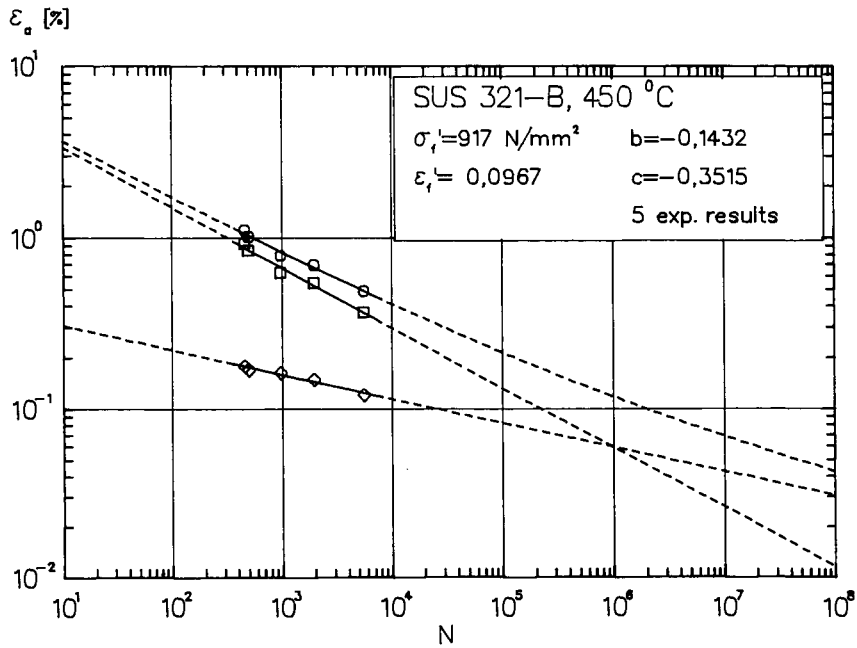
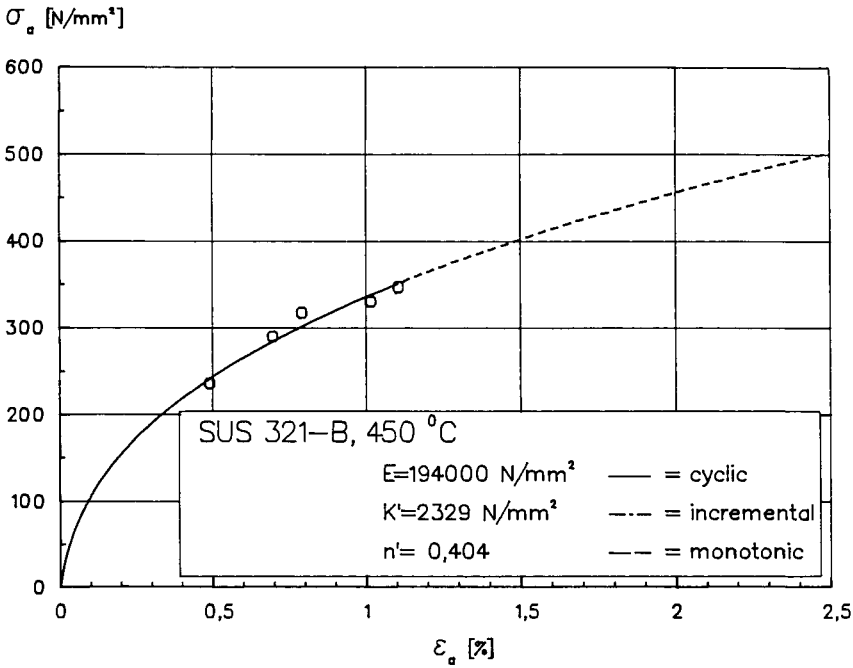
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

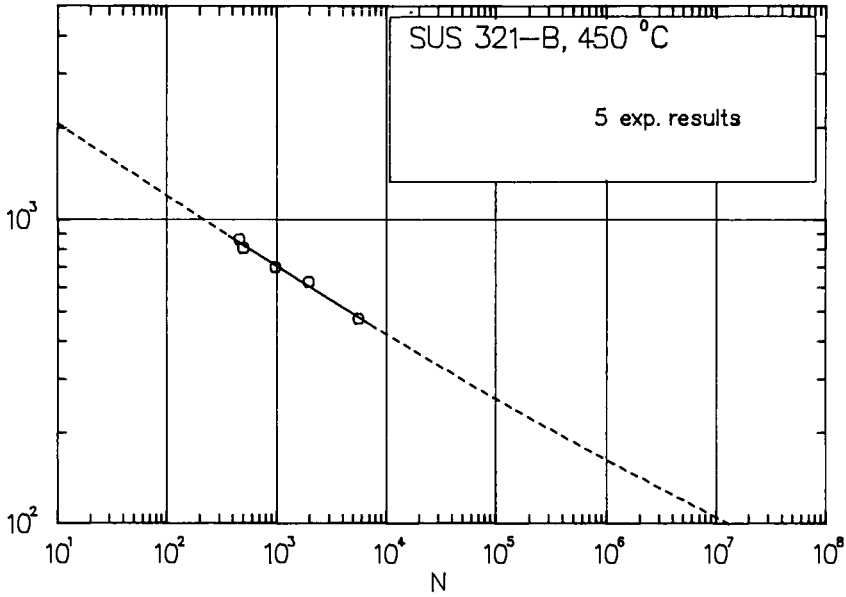
Cyclic test

Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 321-B, 450 °C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	346.8	0.0	1.1050	457.0
2.0000	330.1	0.0	1.0150	497.0
3.0000	317.4	0.0	0.7900	973.0
4.0000	289.9	0.0	0.6950	1949.0
5.0000	235.9	0.0	0.4900	5560.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C/30' water
 Test temperature : +450°C
 Semifinished material : bar, Ø 25 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.54	1.08	0.041	0.018	8.52	16.50	0.28

Monotonic properties

E	=	194000	N/mm ²	ν	=	-
R _{p0.2}	=	135	N/mm ²	K	=	N/mm ²
R _m	=	416	N/mm ²	n	=	-
A ₅	=	39	%	σ_f	=	N/mm ²
Z	=	62	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	220	N/mm ²	K'	=	2211	N/mm ²
σ'_g	=	86	N/mm ²	n'	=	0.371	-
ϵ_g	=	0.061	%	σ'_f	=	1140	N/mm ²
N _T	=	62155	cycles	ϵ'_f	=	0.160	-
T _{σ}	=	1.059	-	b	=	-0.170	-
T _{ϵ}	=	1.350	-	c	=	-0.452	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

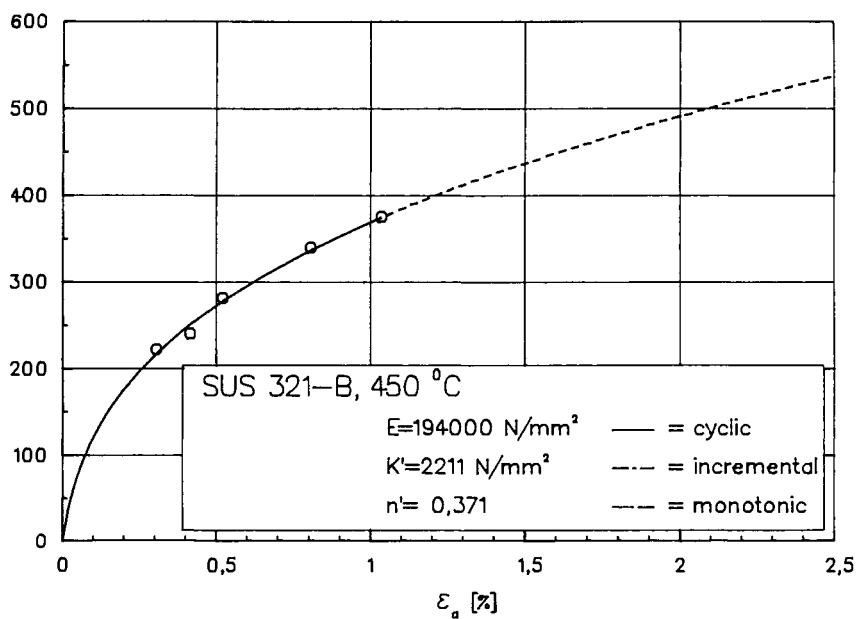
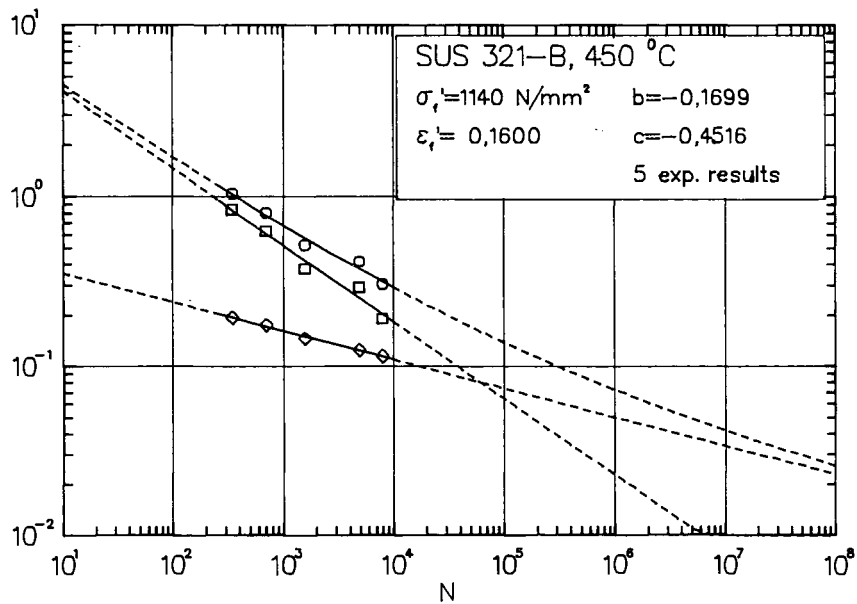
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

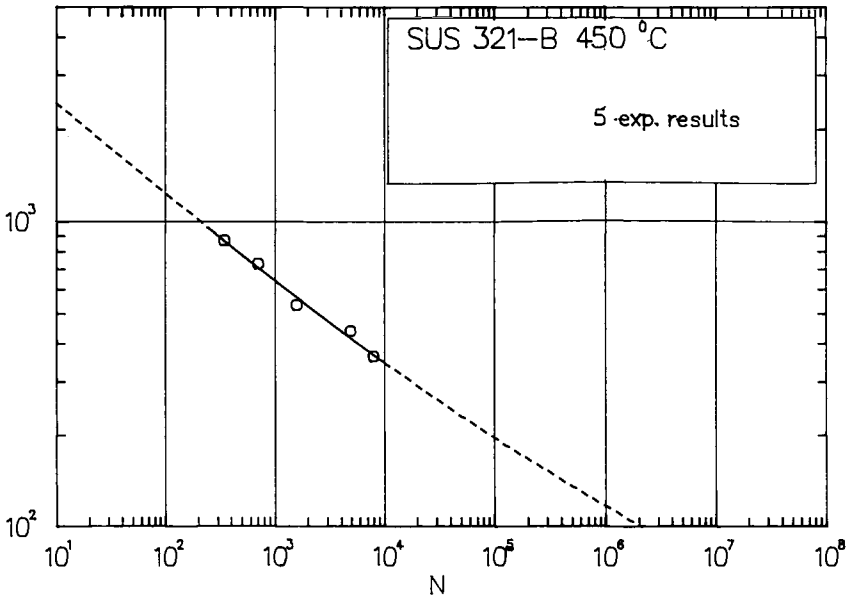
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.41 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUS 321-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	375.2	0.0	1.0350	345.0
2.0000	339.9	0.0	0.8050	700.0
3.0000	281.5	0.0	0.5200	1567.0
4.0000	240.4	0.0	0.4150	4884.0
5.0000	222.2	0.0	0.3050	7883.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C/30' water, 1100°C/1h water
Test temperature : +450°C
Semifinished material : bar, Ø 25 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.54	1.08	0.041	0.018	8.52	16.50	0.28

Monotonic properties

E	=	201250	N/mm ²	ν	=	-
R _{p0.2}	=	117	N/mm ²	K	=	N/mm ²
R _m	=	404	N/mm ²	n	=	-
A ₅	=	42	%	σ _f	=	N/mm ²
Z	=	66	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	166	N/mm ²	K'	=	4290	N/mm ²
σ _g	=	68	N/mm ²	n'	=	0.523	-
ε _g	=	0.071	%	σ' _f	=	1713	N/mm ²
N _T	=	3069923	cycles	ε' _f	=	0.172	-
T _σ	=	1.134	-	b	=	-0.212	-
T _{εp}	=	1.306	-	c	=	-0.404	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

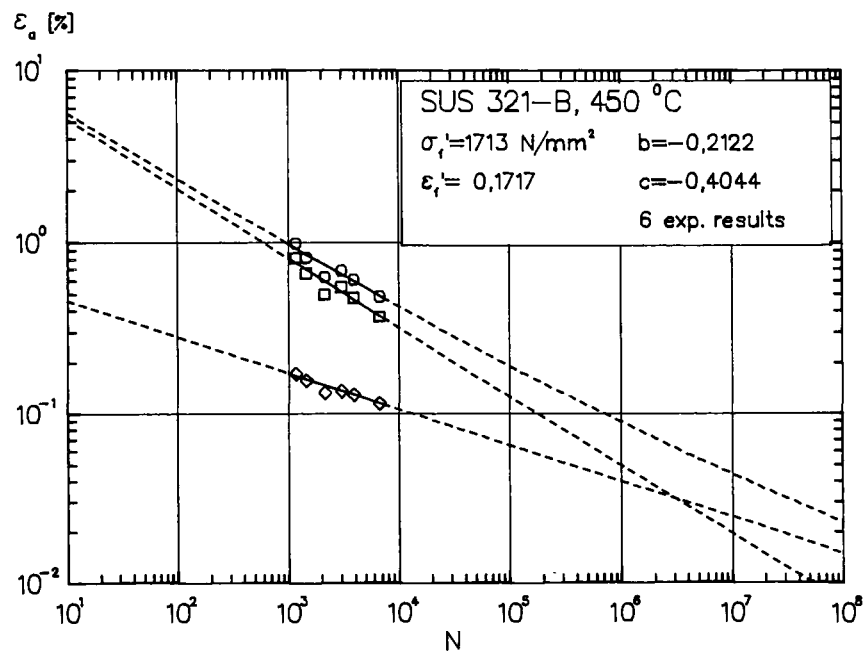
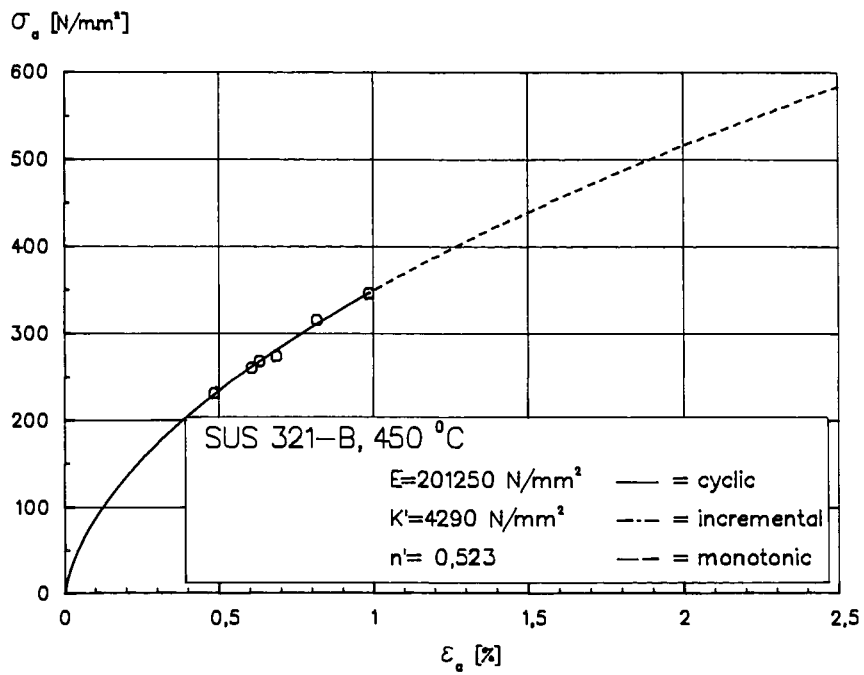
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

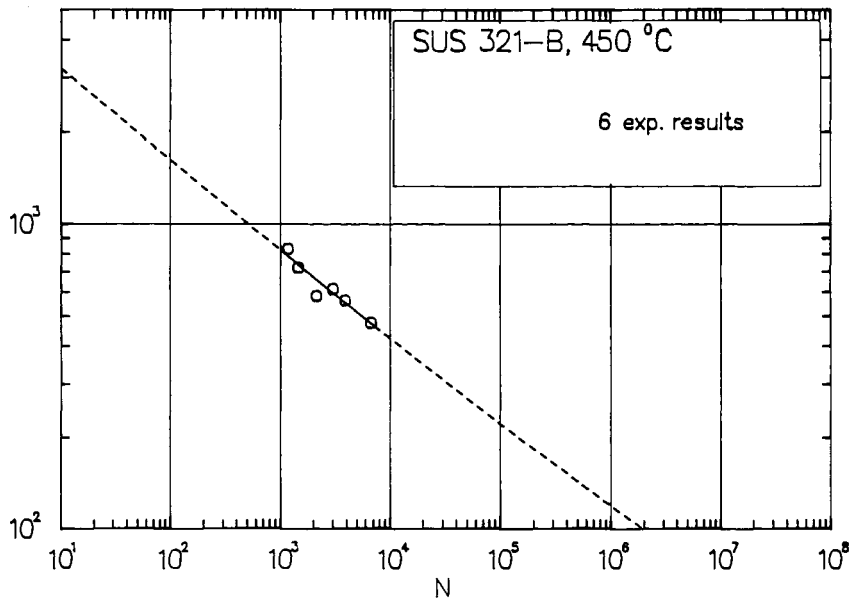
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 321-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	345.8	0.0	0.9850	1165.0
2.0000	315.4	0.0	0.8150	1454.0
4.0000	267.8	0.0	0.6300	2131.0
3.0000	273.7	0.0	0.6850	3009.0
5.0000	260.0	0.0	0.6050	3878.0
6.0000	231.5	0.0	0.4850	6688.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C/30' water, 1100°C/1h water
Test temperature : +450°C
Semifinished material : bar, Ø 25 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.54	1.08	0.041	0.018	8.52	16.50	0.28

Monotonic properties

E*	=	201250	N/mm ²	ν	=	-
R _{p0.2}	=	117	N/mm ²	K	=	N/mm ²
R _m	=	404	N/mm ²	n	=	-
A ₅	=	42	%	σ _f	=	N/mm ²
Z	=	66	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	218	N/mm ²	K'	=	2917	N/mm ²
σ _g	=	50	N/mm ²	n'	=	0.417	-
ε _g	=	0.031	%	σ' _f	=	2763	N/mm ²
N _T	=	42126	cycles	ε' _f	=	0.844	-
T _σ	=	1.090	-	b	=	-0.263	-
T _{εp}	=	1.344	-	c	=	-0.626	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
σ/s-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

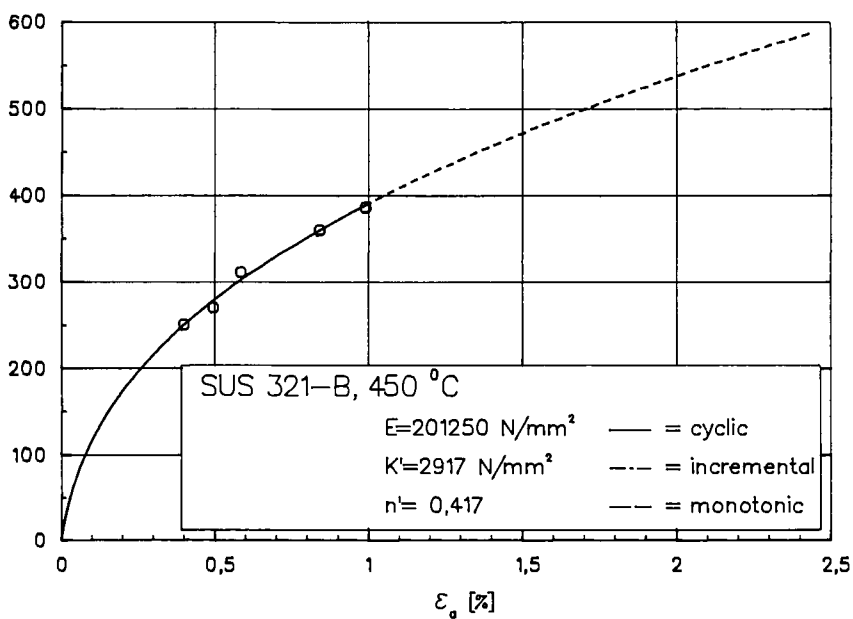
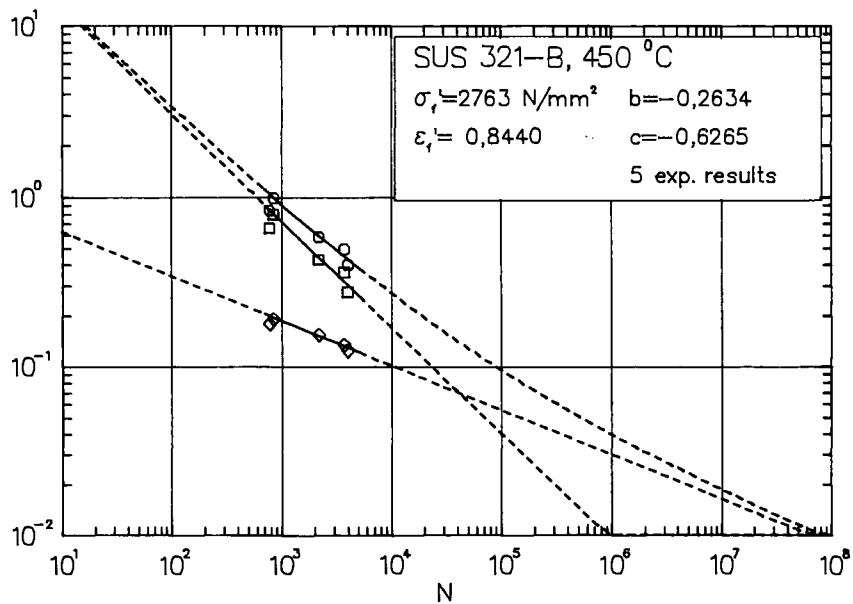
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

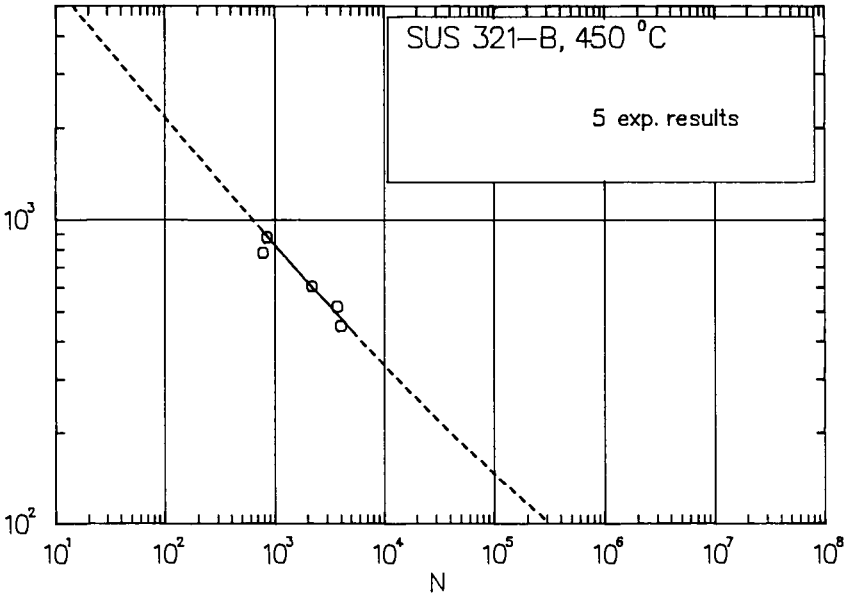
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.40 (%/min)
Waveform : triangular

Remarks :

σ_e [N/mm²] ϵ_e [%]

PSWT [N/mm²]



Material : SUS 321-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
2.0000	359.5	0.0	0.8400	777.0
1.0000	386.0	0.0	0.9900	848.0
3.0000	311.0	0.0	0.5850	2178.0
4.0000	270.3	0.0	0.4950	3702.0
5.0000	250.6	0.0	0.4000	3996.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water
Test temperature : +450°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic Properties

E	=	168750	N/mm ²	ν	=	-
R _{p0.2}	=	108	N/mm ²	K	=	N/mm ²
R _m	=	379	N/mm ²	n	=	-
A ₅	=	46	%	σ_f	=	N/mm ²
Z	=	72	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	188	N/mm ²	K'	=	2223	N/mm ²
σ_g	=	79	N/mm ²	n'	=	0.398	-
ϵ_g	=	0.069	%	σ'_f	=	1219	N/mm ²
N _T	=	131338	cycles	ϵ'_f	=	0.227	-
T _{σ}	=	1.185	-	b	=	-0.180	-
T _{ep}	=	1.410	-	c	=	-0.456	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness : HV 10 : 108

Microstructure : JIS G 0551 grain size : 0.9

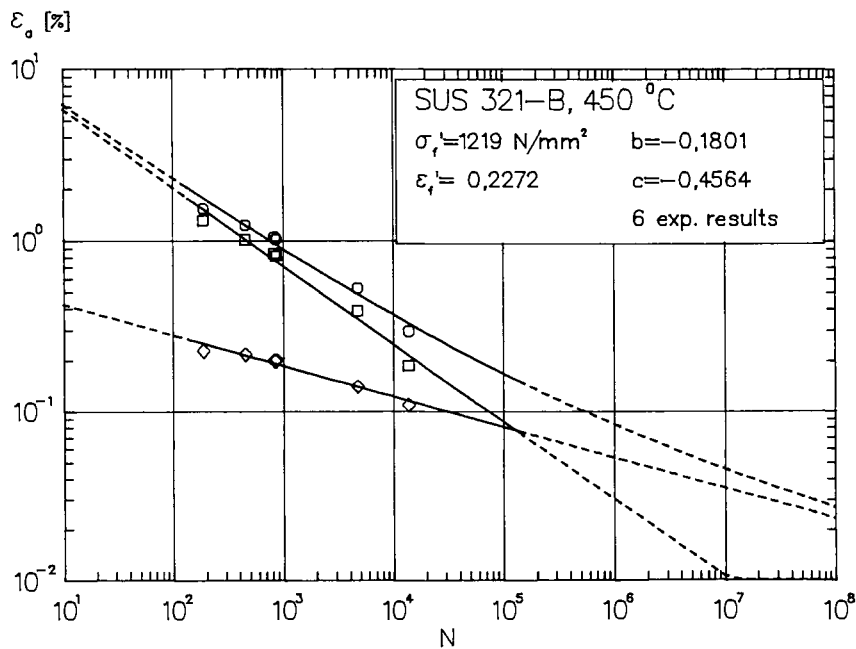
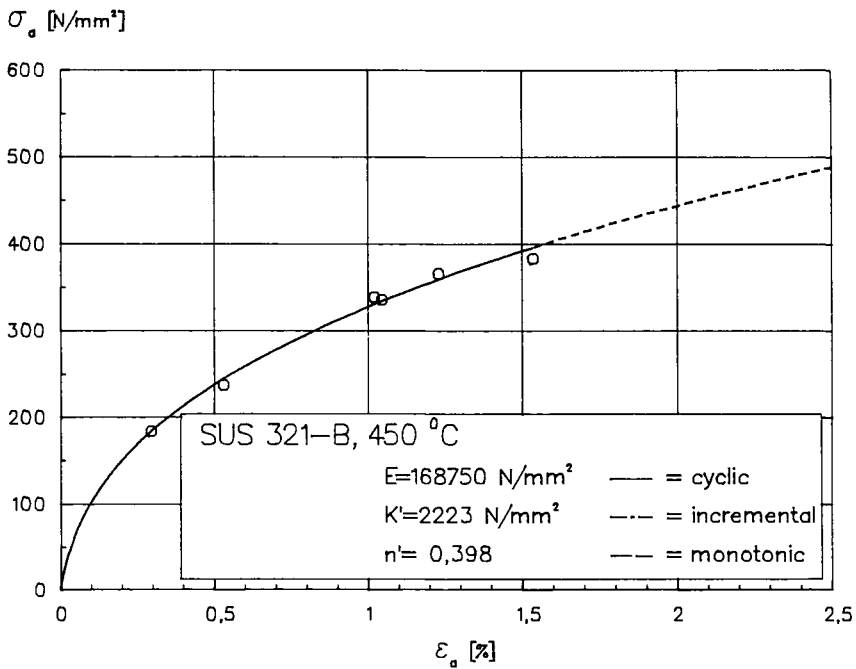
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

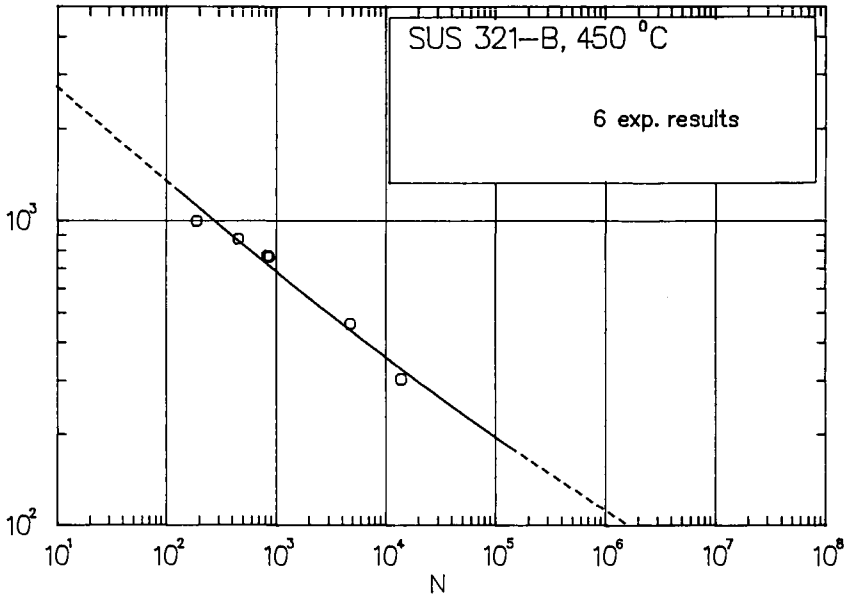
Cyclic test

Loading condition : total strain control, R_e = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 321-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	383.1	0.0	1.5350	188.0
2.0000	365.4	0.0	1.2300	454.0
3.0000	335.5	0.0	1.0450	833.0
4.0000	338.5	0.0	1.0200	866.0
5.0000	237.4	0.0	0.5300	4731.0
6.0000	183.9	0.0	0.2950	13735.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water
 Test temperature : +450°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.31]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	168750	N/mm ²	ν	=	-
R _{p0.2}	=	108	N/mm ²	K	=	N/mm ²
R _m	=	379	N/mm ²	n	=	-
A _g	=	46	%	σ _f	=	N/mm ²
Z	=	72	%	ε _f	=	-

Cyclic properties

R'p0.2	=	243	N/mm ²	K'	=	1419	N/mm ²
σ _g	=	96	N/mm ²	n'	=	0.284	-
ε _g	=	0.065	%	σ' _f	=	1151	N/mm ²
N _T	=	16019	cycles	ε' _f	=	0.431	-
T _σ	=	1.109	-	b	=	-0.163	-
T _{εp}	=	1.318	-	c	=	-0.563	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ε-values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

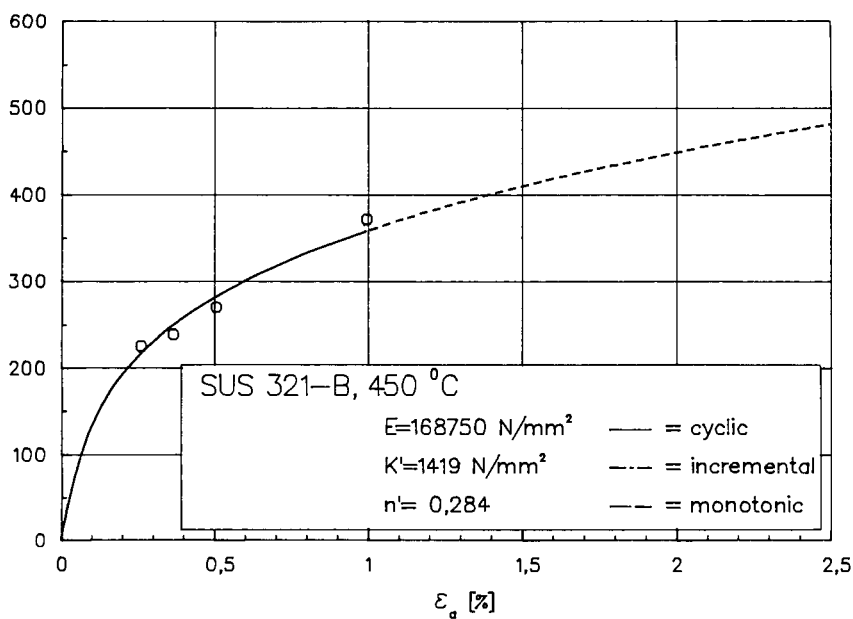
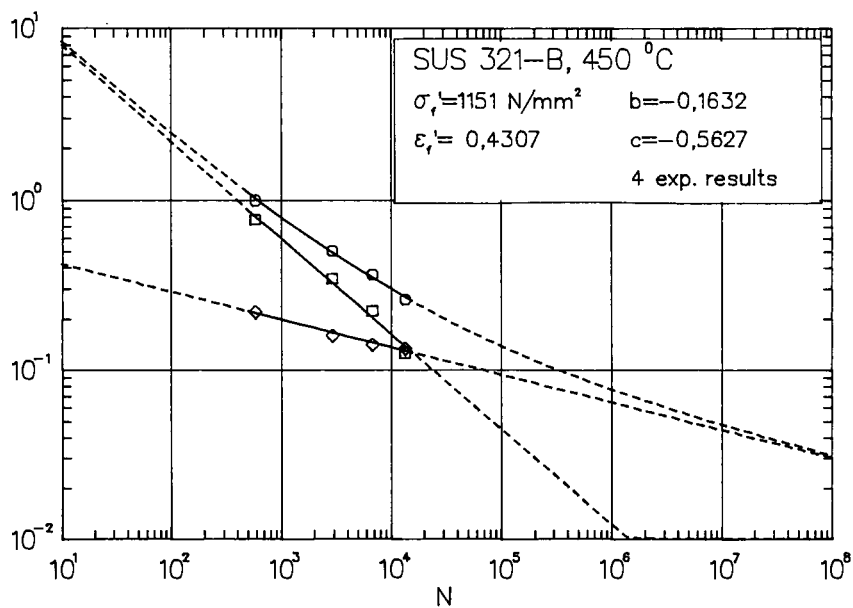
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

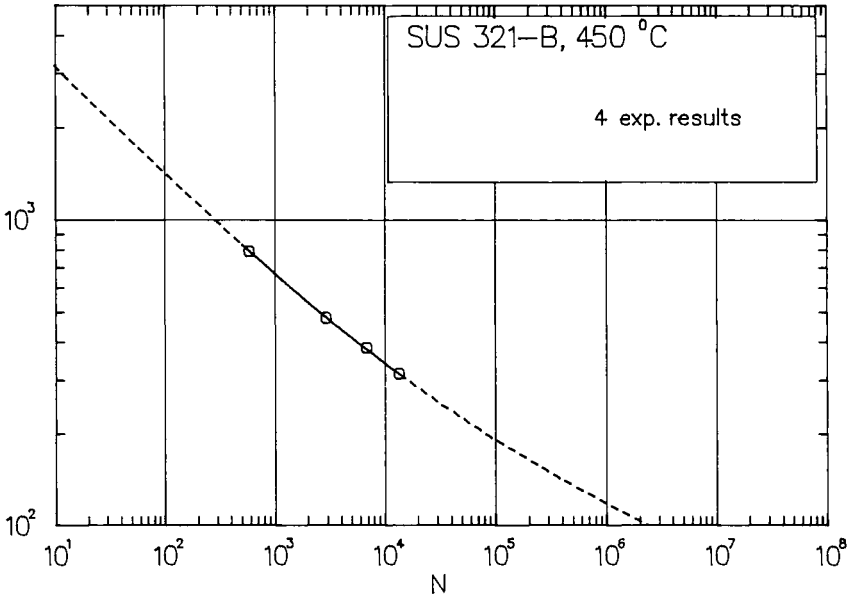
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.4 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUS 321-B, 450 °C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	371.8	0.0	0.9950	579.0
2.0000	270.3	0.0	0.5050	2918.0
3.0000	238.9	0.0	0.3650	6761.0
4.0000	225.6	0.0	0.2600	13370.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water, 900°C/1h air
Test temperature : +450°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	149700	N/mm ²	ν	=	-
R _{p0.2}	=	116	N/mm ²	K	=	N/mm ²
R _m	=	367	N/mm ²	n	=	-
A ₅	=	40	%	σ _f	=	N/mm ²
Z	=	72	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	169	N/mm ²	K'	=	1710	N/mm ²
σ _g	=	80	N/mm ²	n'	=	0.373	-
ε _g	=	0.079	%	σ' _f	=	946	N/mm ²
N _T	=	152205	cycles	ε' _f	=	0.210	-
T _σ	=	1.171	-	b	=	-0.163	-
T _{εp}	=	1.430	-	c	=	-0.440	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

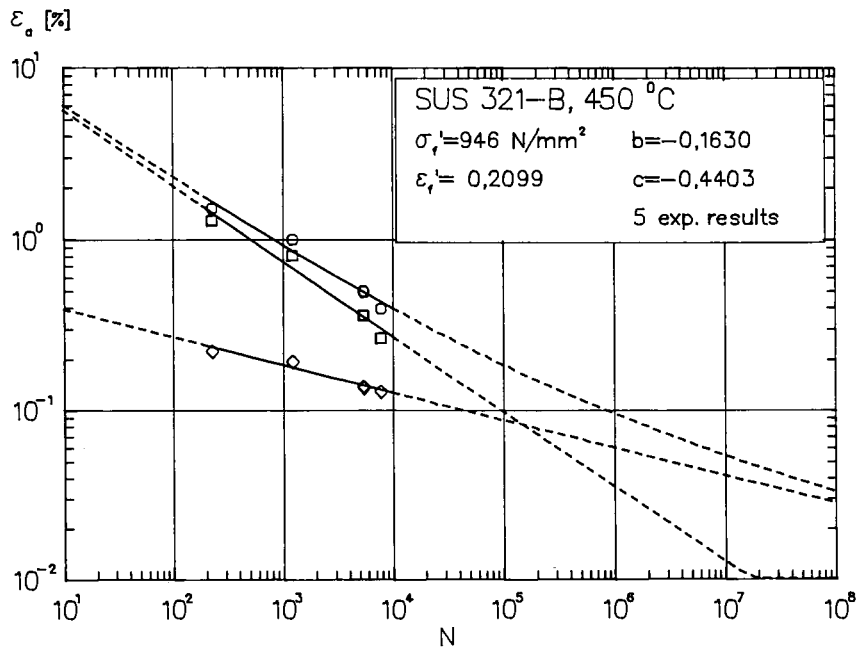
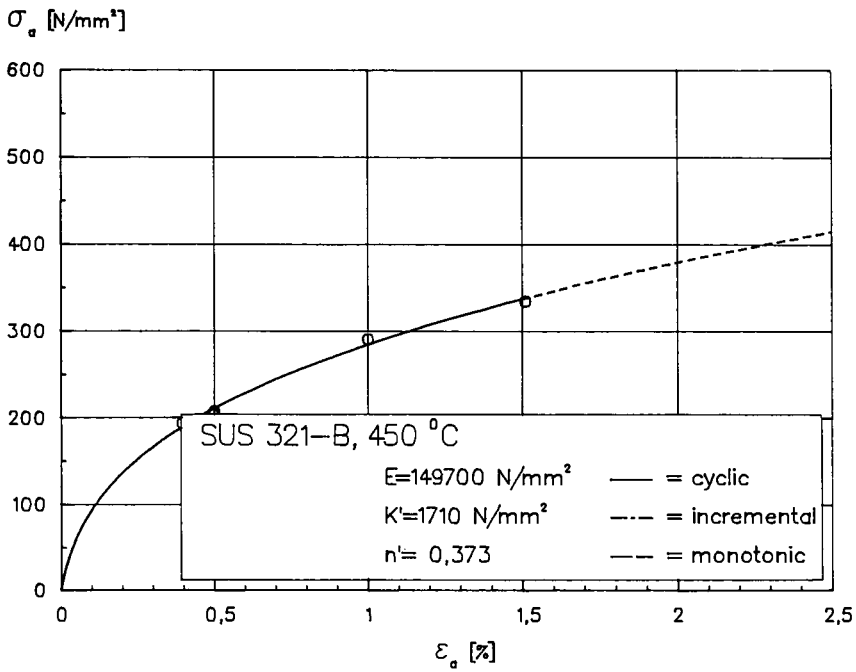
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

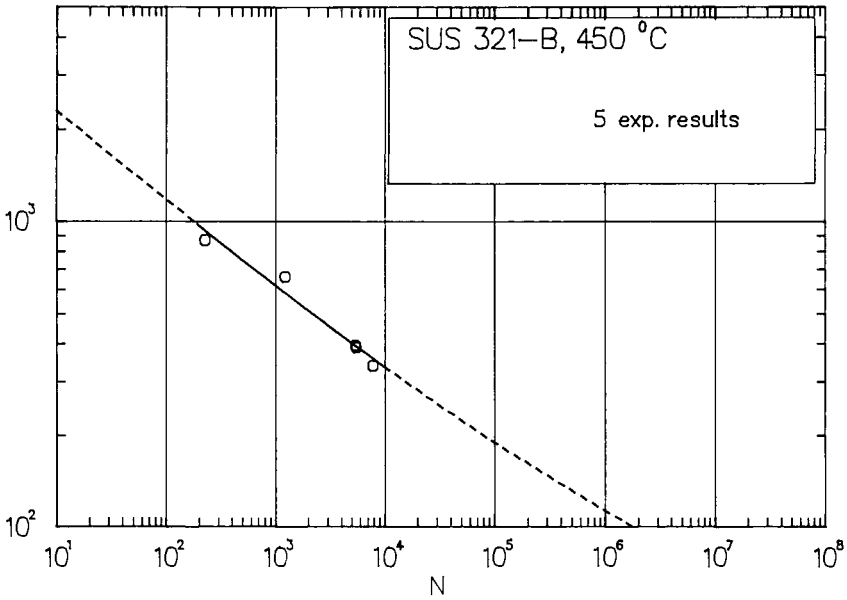
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 321-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	334.5	0.0	1.5100	225.0
2.0000	290.9	0.0	1.0000	1220.0
3.0000	207.0	0.0	0.5000	5382.0
4.0000	204.1	0.0	0.4950	5416.0
5.0000	193.3	0.0	0.3950	7731.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water, 900°C/1h air
 Test temperature : +450°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.31]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	149700	N/mm ²	v	=	-
R _{p0.2}	=	116	N/mm ²	K	=	N/mm ²
R _m	=	367	N/mm ²	n	=	-
A ₅	=	40	%	σ _f	=	N/mm ²
Z	=	72	%	ε _f	=	-

Cyclic properties

R _{p0.2}	=	209	N/mm ²	K'	=	1474	N/mm ²
σ _g	=	78	N/mm ²	n'	=	0.314	-
ε _g	=	0.061	%	σ' _f	=	1096	N/mm ²
N _T	=	18392	cycles	ε' _f	=	0.381	-
T _σ	=	1.033	-	b	=	-0.173	-
T _{εp}	=	1.216	-	c	=	-0.549	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

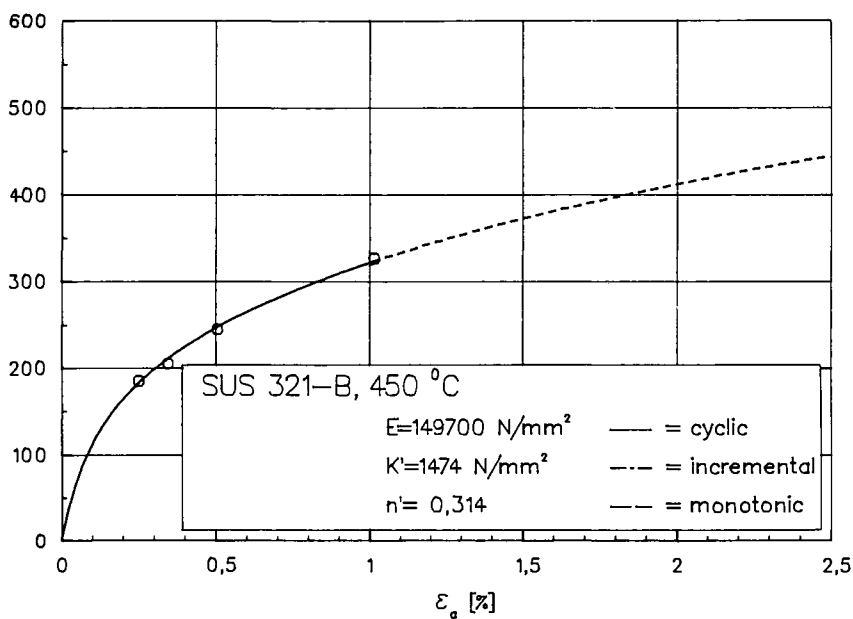
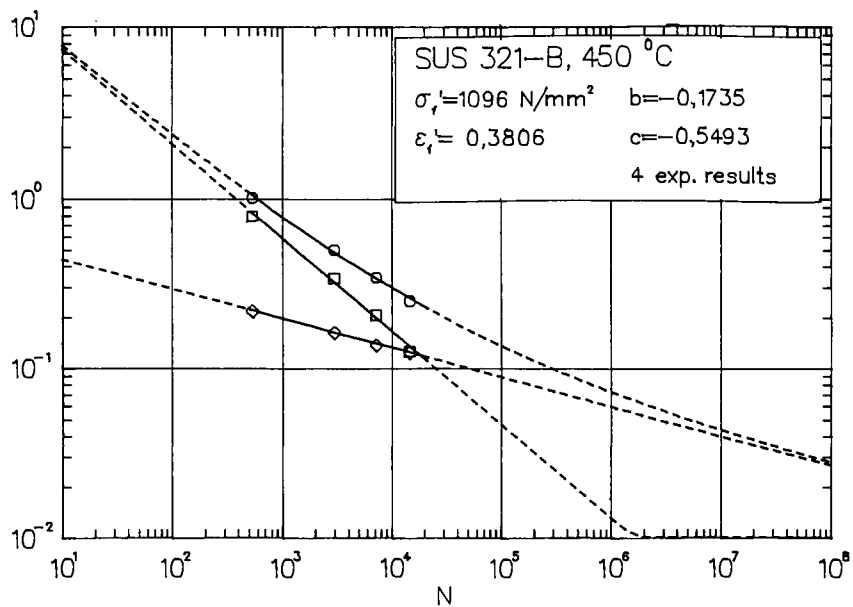
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

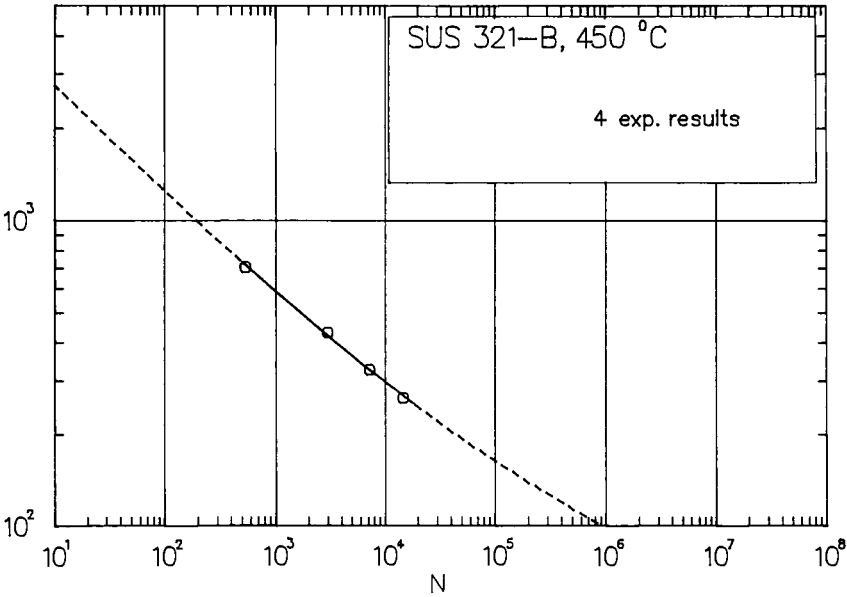
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.40 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUS 321-B, 450 °C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	326.7	0.0	1.0150	531.0
2.0000	245.3	0.0	0.5050	2962.0
3.0000	205.5	0.0	0.3450	7186.0
4.0000	185.4	0.0	0.2500	14496.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water, 750°C/24h air
 Test temperature : +450°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	171000	N/mm ²	ν	=	-
R _{p0.2}	=	148	N/mm ²	K	=	N/mm ²
R _m	=	375	N/mm ²	n	=	-
A ₅	=	37	%	σ_f	=	N/mm ²
Z	=	68	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	184	N/mm ²	K'	=	1636	N/mm ²
σ_g	=	81	N/mm ²	n'	=	0.352	-
ϵ_g	=	0.067	%	σ'_f	=	1054	N/mm ²
N _T	=	110271	cycles	ϵ'_f	=	0.293	-
T _{σ}	=	1.167	-	b	=	-0.169	-
T _{ϵ_p}	=	1.480	-	c	=	-0.482	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

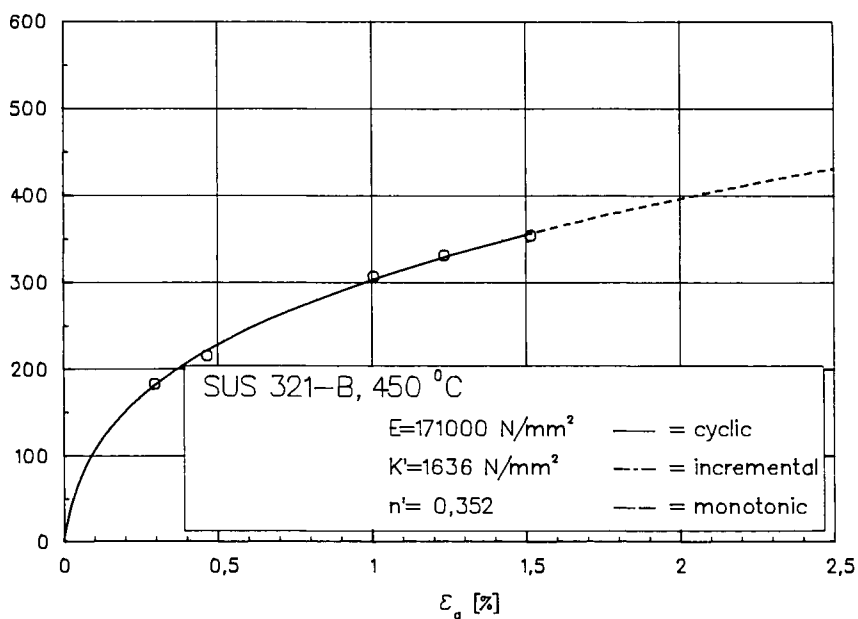
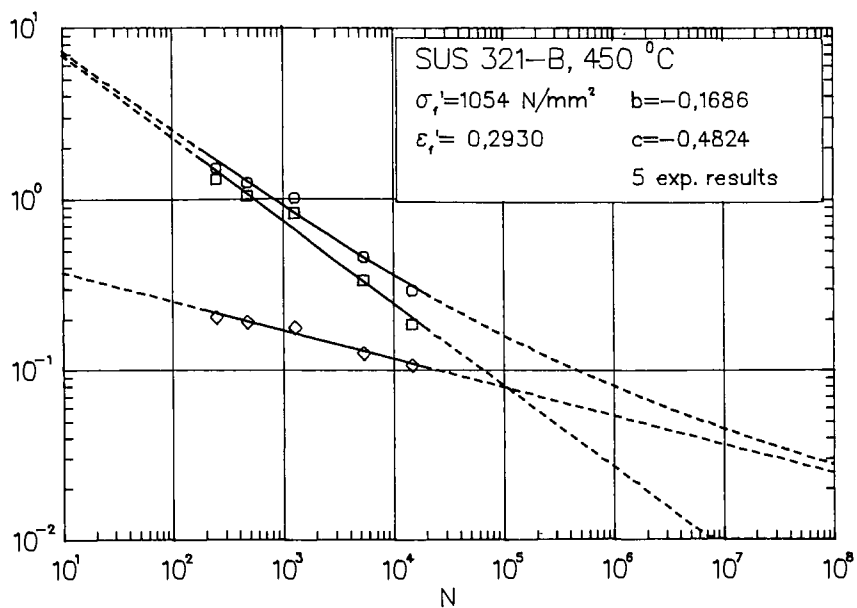
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

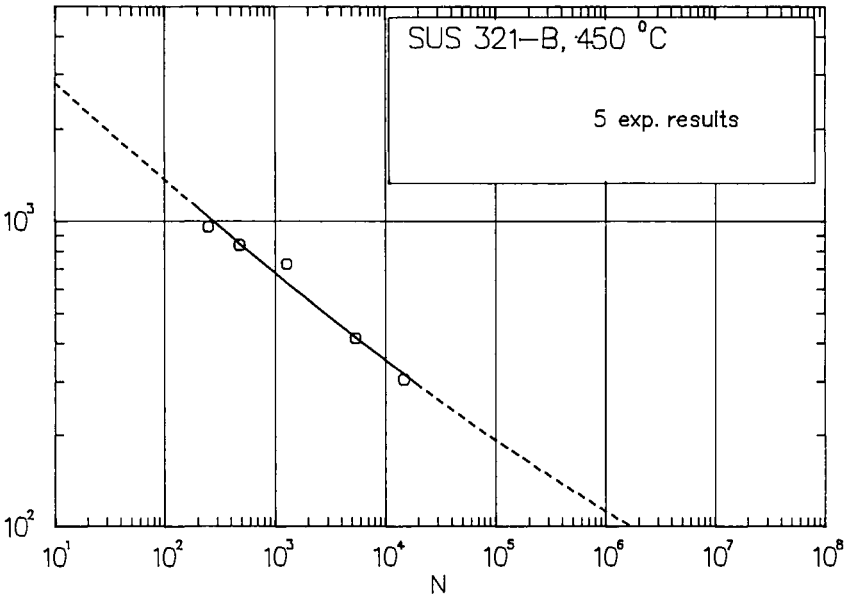
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²]

 ε_a [%]


PSWT [N/mm²]



Material : SUS 321-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	353.6	0.0	1.5150	248.0
2.0000	331.6	0.0	1.2350	476.0
3.0000	306.6	0.0	1.0050	1277.0
4.0000	215.8	0.0	0.4650	5347.0
5.0000	183.0	0.0	0.2950	14665.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
------------------	--------	-----------

Heat treatment : 1050°C water, 1200°C/30' water, 750°C/24h air
 Test temperature : +450°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.3]
 Year : 1978

Hardness :

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Microstructure :

Monotonic properties

E	=	171000	N/mm ²	ν	=	-
R _{p0.2}	=	148	N/mm ²	K	=	N/mm ²
R _m	=	375	N/mm ²	n	=	-
A ₅	=	37	%	σ_f	=	N/mm ²
Z	=	68	%	ϵ_f	=	-

Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

Cyclic properties

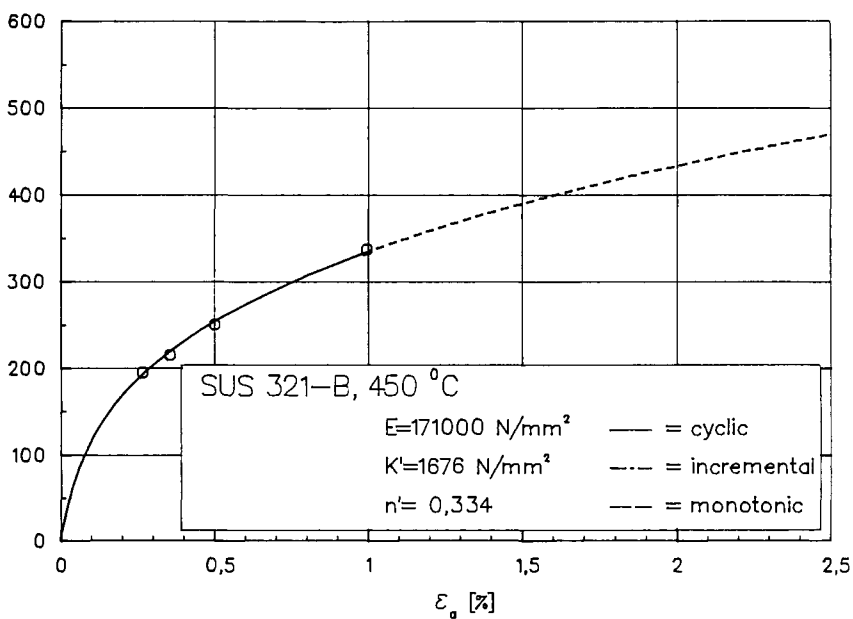
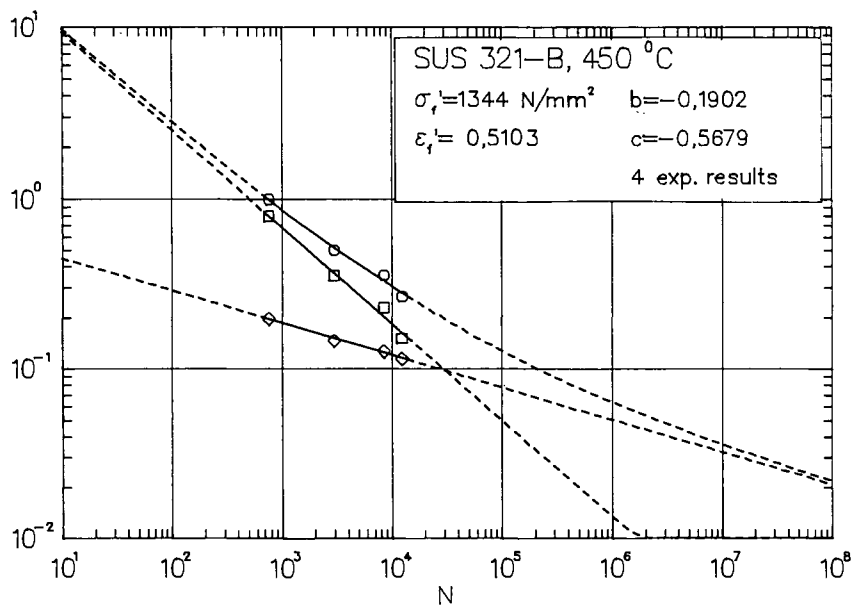
R' _{p0.2}	=	210	N/mm ²	K'	=	1676	N/mm ²
σ_g	=	75	N/mm ²	n'	=	0.334	-
ϵ_g	=	0.053	%	σ'_f	=	1344	N/mm ²
N _T	=	31479	cycles	ϵ'_f	=	0.510	-
T _{σ}	=	1.070	-	b	=	-0.190	-
T _{ep}	=	1.315	-	c	=	-0.568	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

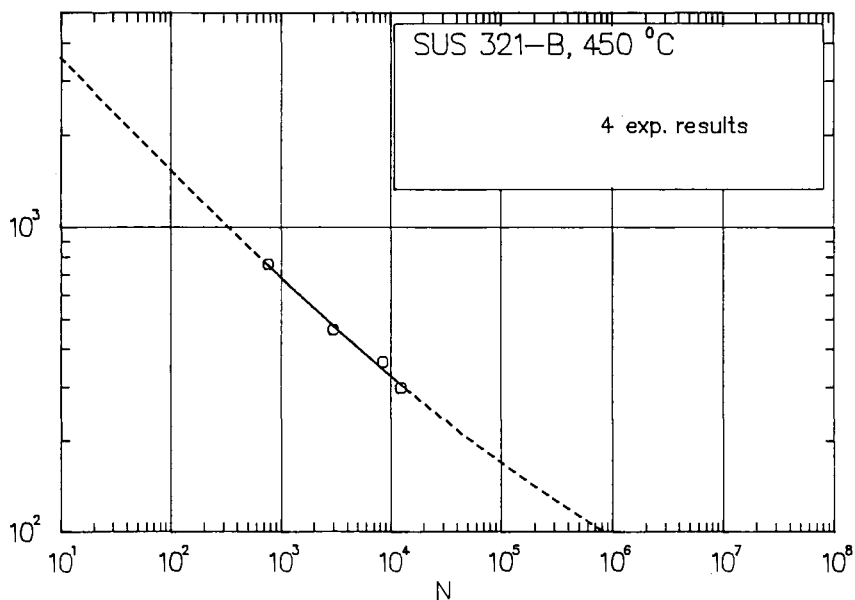
Cyclic test

Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.40 (%/min)
 Waveform : triangular

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
 Remarks : Young's modulus estimated

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]

Material : SUS 321-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	337.5	0.0	0.9950	757.0
2.0000	250.6	0.0	0.5000	2971.0
3.0000	215.8	0.0	0.3550	8426.0
4.0000	195.2	0.0	0.2650	12339.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C/30' water
 Test temperature : +600°C
 Semifinished material : bar, Ø 25 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.54	1.08	0.041	0.018	8.52	16.50	0.28

Monotonic properties

E	=	196200	N/mm ²	ν	=	-
R _{p0.2}	=	129	N/mm ²	K	=	N/mm ²
R _m	=	349	N/mm ²	n	=	-
A ₅	=	39	%	σ _f	=	N/mm ²
Z	=	66	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	207	N/mm ²	K'	=	891	N/mm ²
σ _g	=	119	N/mm ²	n'	=	0.235	-
ε _g	=	0.080	%	σ' _f	=	587	N/mm ²
N _T	=	67822	cycles	ε' _f	=	0.169	-
T _σ	=	1.094	-	b	=	-0.105	-
T _{εp}	=	1.150	-	c	=	-0.446	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

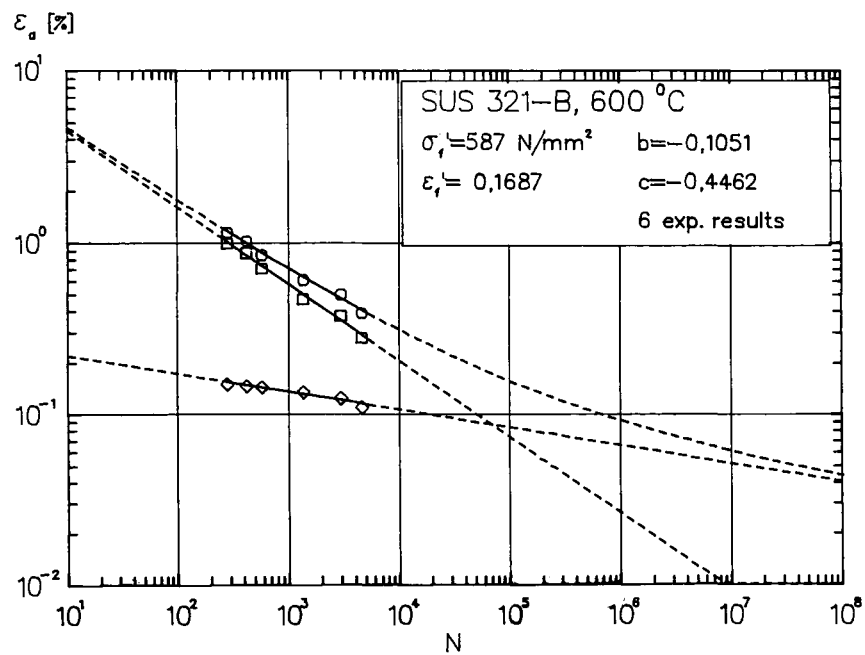
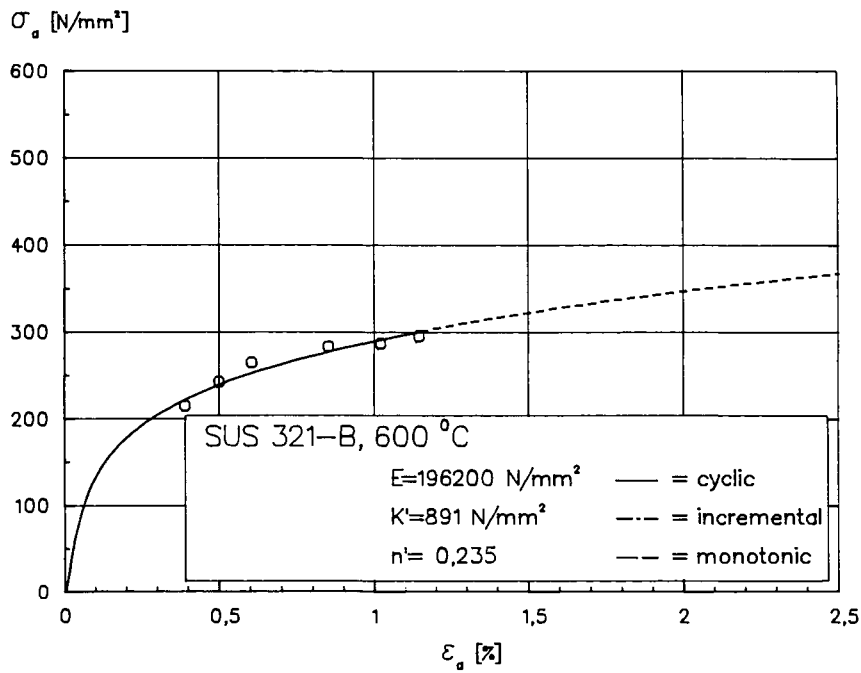
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

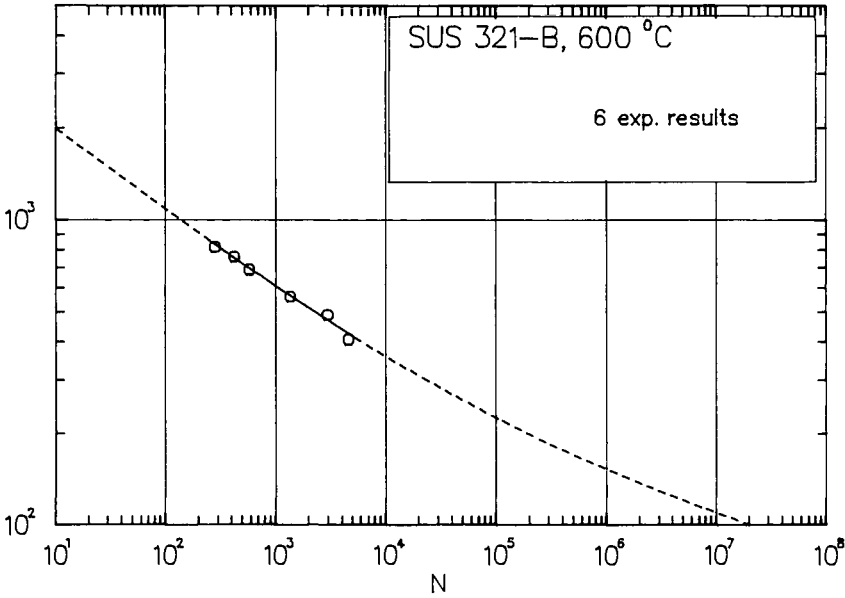
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 321-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	295.8	0.0	1.1450	281.0
2.0000	286.9	0.0	1.0200	420.0
3.0000	283.5	0.0	0.8500	576.0
4.0000	264.9	0.0	0.6050	1358.0
5.0000	242.8	0.0	0.5000	2957.0
6.0000	215.3	0.0	0.3900	4563.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C/30' water
 Test temperature : +600°C
 Semifinished material : bar, Ø 25 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.54	1.08	0.041	0.018	8.52	16.50	0.28

Monotonic properties

E	=	196200	N/mm ²	ν	=	-
R _{p0.2}	=	129	N/mm ²	K	=	N/mm ²
R _m	=	349	N/mm ²	n	=	-
A ₅	=	39	%	σ_f	=	N/mm ²
Z	=	66	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	204	N/mm ²	K'	=	804	N/mm ²
σ_g	=	124	N/mm ²	n'	=	0.221	-
ϵ_g	=	0.084	%	σ'_f	=	486	N/mm ²
N _T	=	60618	cycles	ϵ'_f	=	0.104	-
T _{σ}	=	1.057	-	b	=	-0.090	-
T _{ep}	=	1.242	-	c	=	-0.410	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

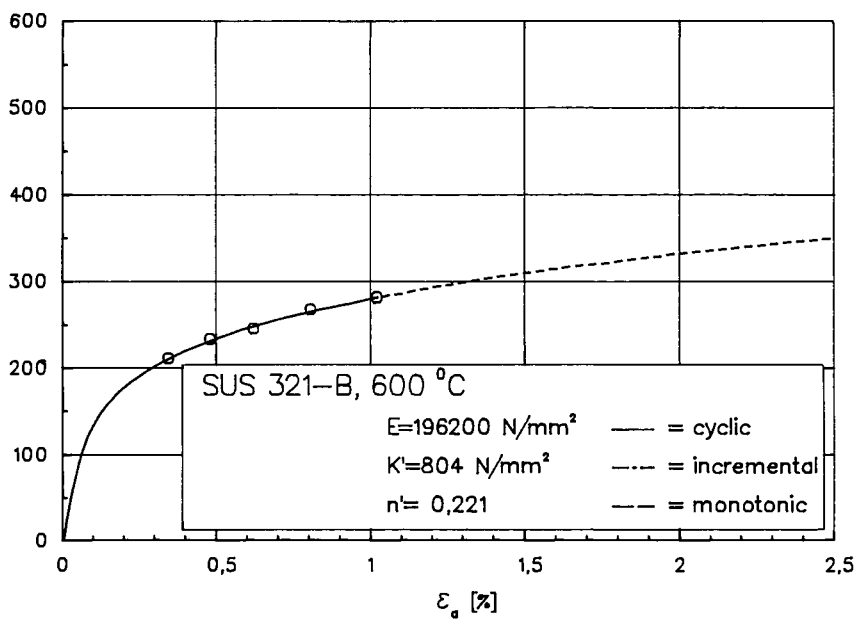
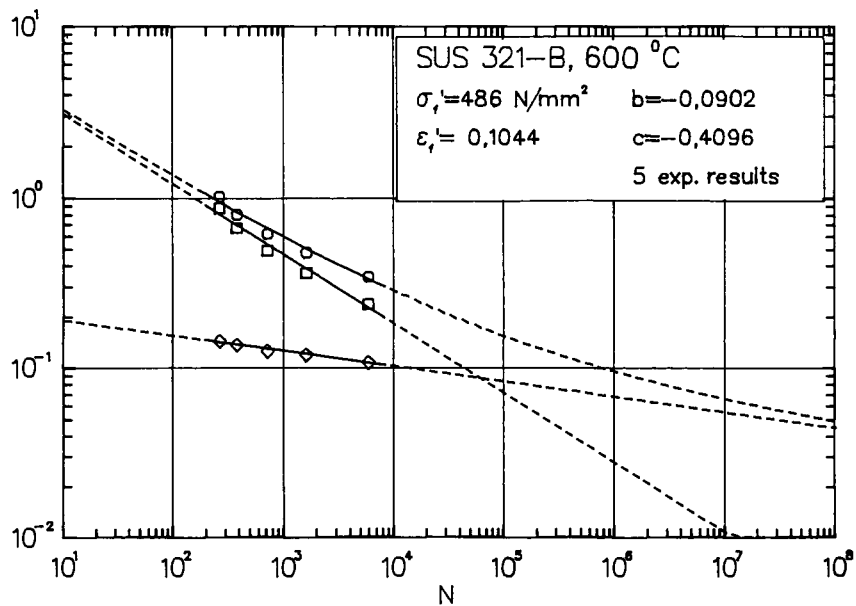
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

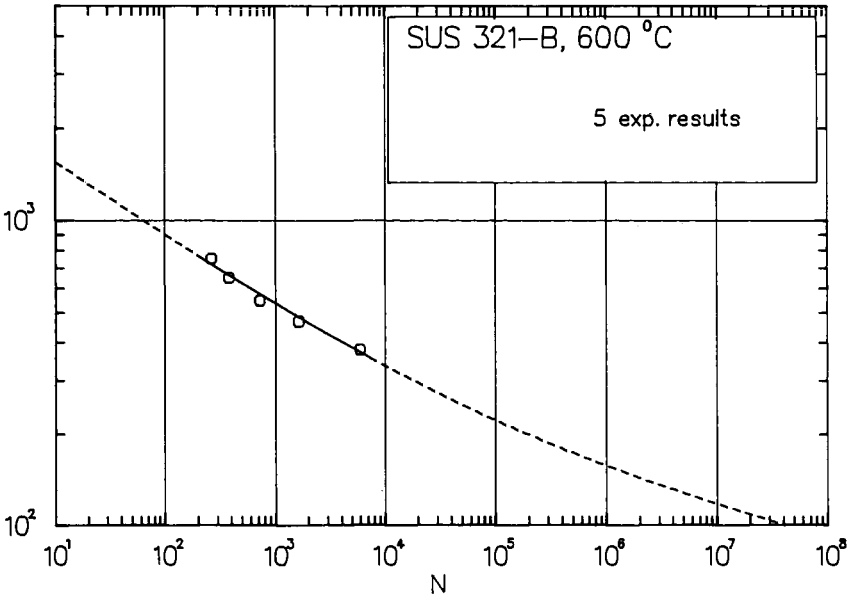
Cyclic test

Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.40 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUS 321-B, 600 °C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	282.0	0.0	1.0200	266.0
2.0000	267.8	0.0	0.8050	381.0
3.0000	245.7	0.0	0.6200	720.0
4.0000	233.5	0.0	0.4800	1620.0
5.0000	211.4	0.0	0.3450	5935.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050⁰C/30' water, 1100⁰C/1h water
Test temperature : +600⁰C
Semifinished material : bar, Ø 25 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.54	1.08	0.041	0.018	8.52	16.50	0.28

Monotonic properties

E	=	207850	N/mm ²	ν	=	-
R _{p0.2}	=	113	N/mm ²	K	=	N/mm ²
R _m	=	353	N/mm ²	n	=	-
A ₅	=	42	%	σ _f	=	N/mm ²
Z	=	66	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	207	N/mm ²	K'	=	1293	N/mm ²
σ _g	=	95	N/mm ²	n'	=	0.295	-
ε _g	=	0.059	%	σ' _f	=	893	N/mm ²
N _T	=	68110	cycles	ε' _f	=	0.309	-
T _σ	=	1.104	-	b	=	-0.147	-
T _{εp}	=	1.182	-	c	=	-0.509	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

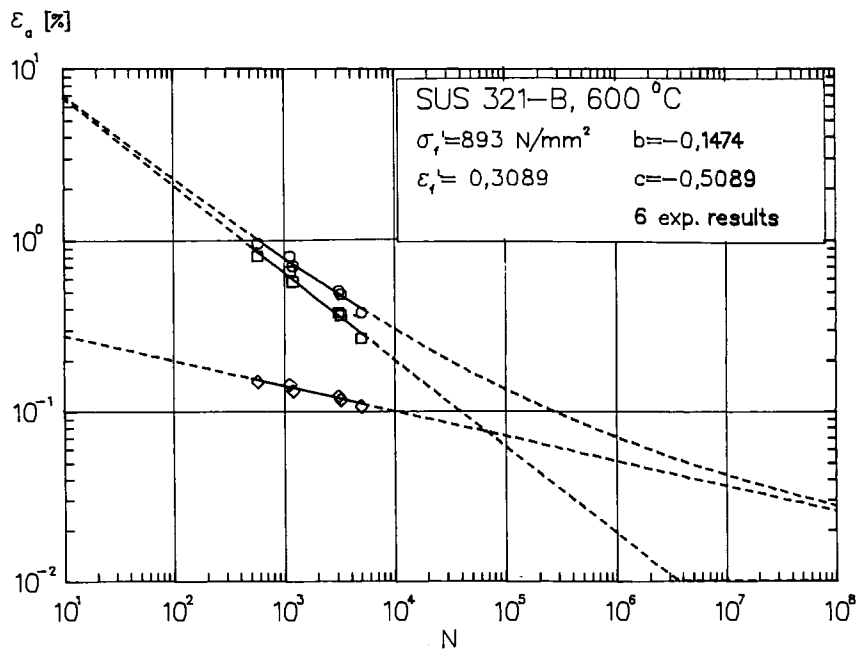
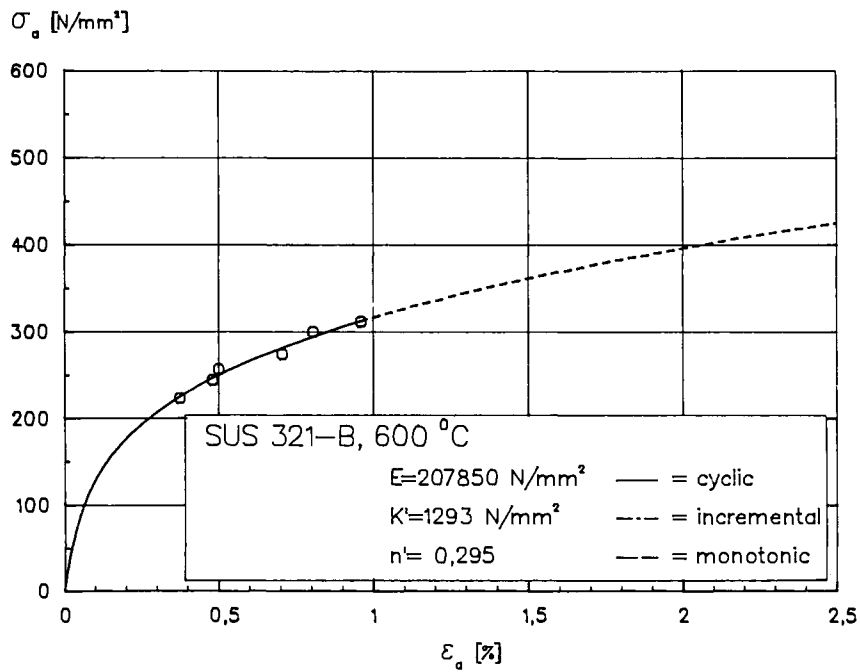
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

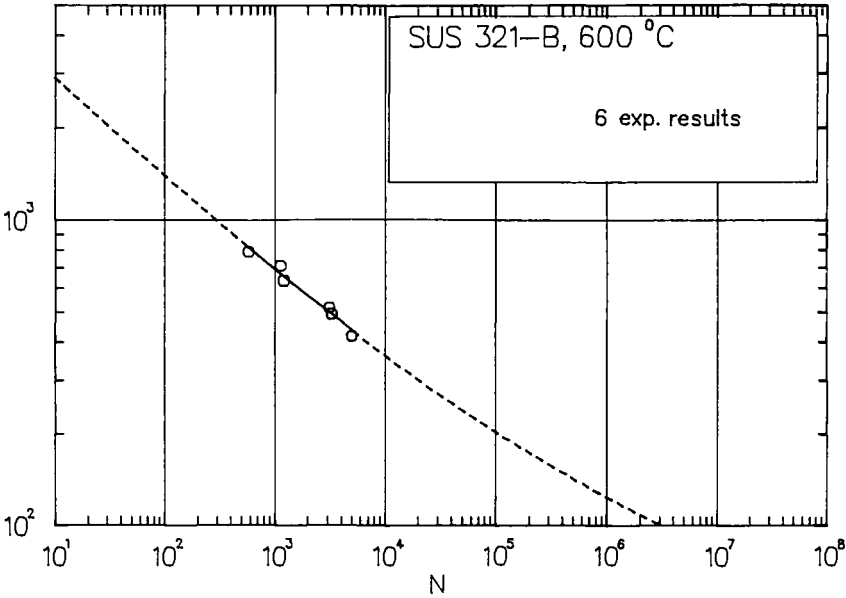
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 321-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	311.5	0.0	0.9600	573.0
2.0000	299.7	0.0	0.8050	1123.0
3.0000	274.2	0.0	0.7050	1200.0
4.0000	256.5	0.0	0.5000	3104.0
5.0000	243.8	0.0	0.4800	3253.0
6.0000	223.7	0.0	0.3750	4995.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C/30' water, 1100°C/1h water
 Test temperature : +600°C
 Semifinished material : bar, Ø 25 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.54	1.08	0.041	0.018	8.52	16.50	0.28

Monotonic properties

E	=	207850	N/mm ²	v	=	-
R _{p0.2}	=	113	N/mm ²	K	=	N/mm ²
R _m	=	353	N/mm ²	n	=	-
A ₅	=	42	%	σ _f	=	N/mm ²
Z	=	66	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	233	N/mm ²	K'	=	776	N/mm ²
σ' _g	=	151	N/mm ²	n'	=	0.194	-
ε' _g	=	0.093	%	σ' _f	=	471	N/mm ²
N _T	=	37004	cycles	ε' _f	=	0.081	-
T _σ	=	1.112	-	b	=	-0.075	-
T _{εp}	=	1.237	-	c	=	-0.394	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

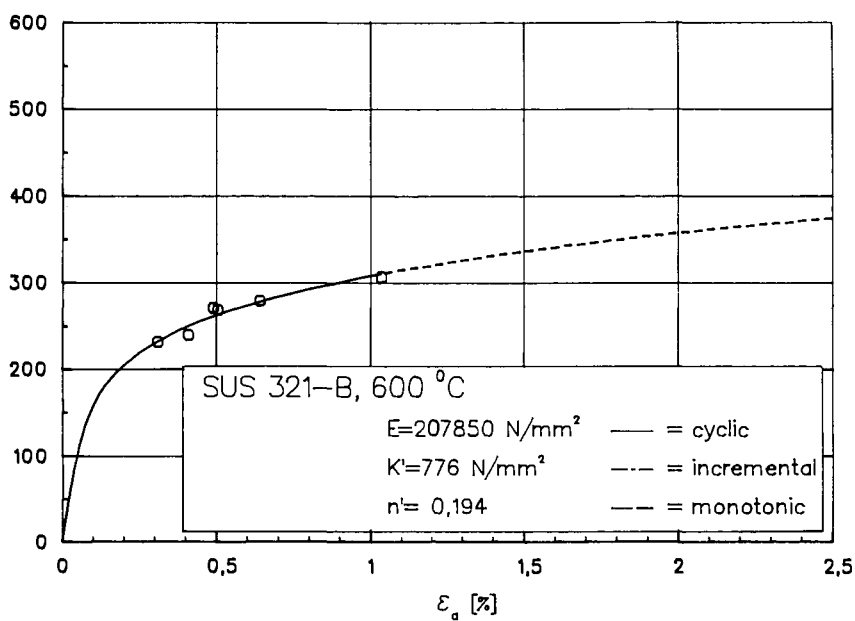
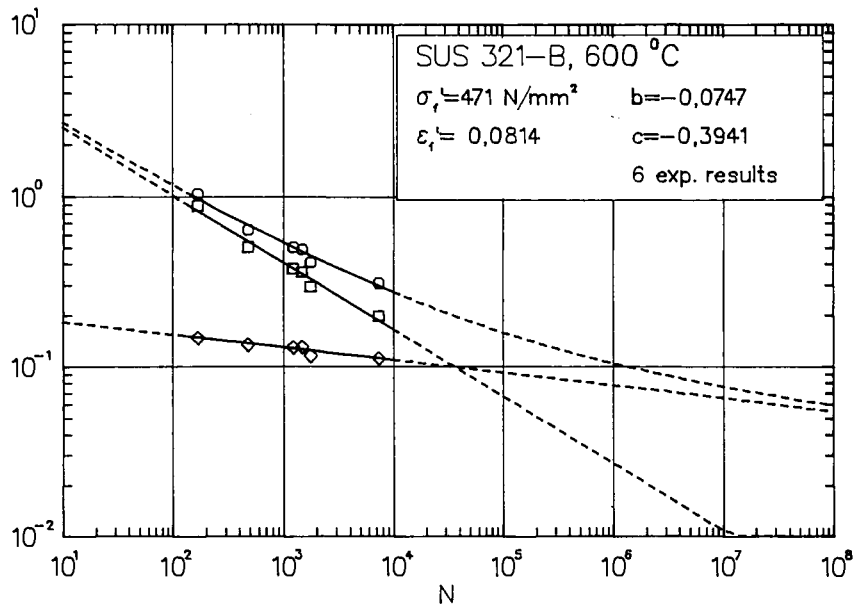
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

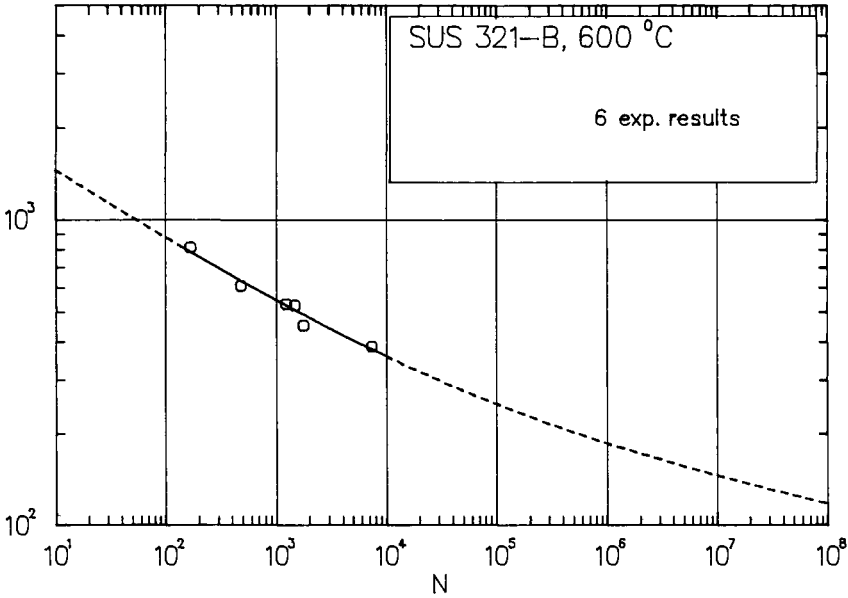
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.40 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUS 321-B, 600 °C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	306.6	0.0	1.0350	168.0
2.0000	279.1	0.0	0.6400	477.0
3.0000	268.3	0.0	0.5050	1227.0
4.0000	270.8	0.0	0.4900	1481.0
5.0000	239.9	0.0	0.4100	1766.0
6.0000	232.0	0.0	0.3100	7349.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water
 Test temperature : +600°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	167800	N/mm ²	ν	=	-
R _{p0.2}	=	97	N/mm ²	K	=	N/mm ²
R _m	≈	333	N/mm ²	n	=	-
A ₅	=	43	%	σ_f	=	N/mm ²
Z	=	71	%	ϵ_f	=	-

Cyclic Properties

R' _{p0.2}	=	208	N/mm ²	K'	=	1116	N/mm ²
σ_g	=	95	N/mm ²	n'	=	0.270	-
ϵ_g	=	0.067	%	σ'_f	=	784	N/mm ²
N _T	=	24178	cycles	ϵ'_f	=	0.285	-
T _σ	=	1.167	-	b	=	-0.139	-
T _{εp}	=	1.527	-	c	=	-0.520	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

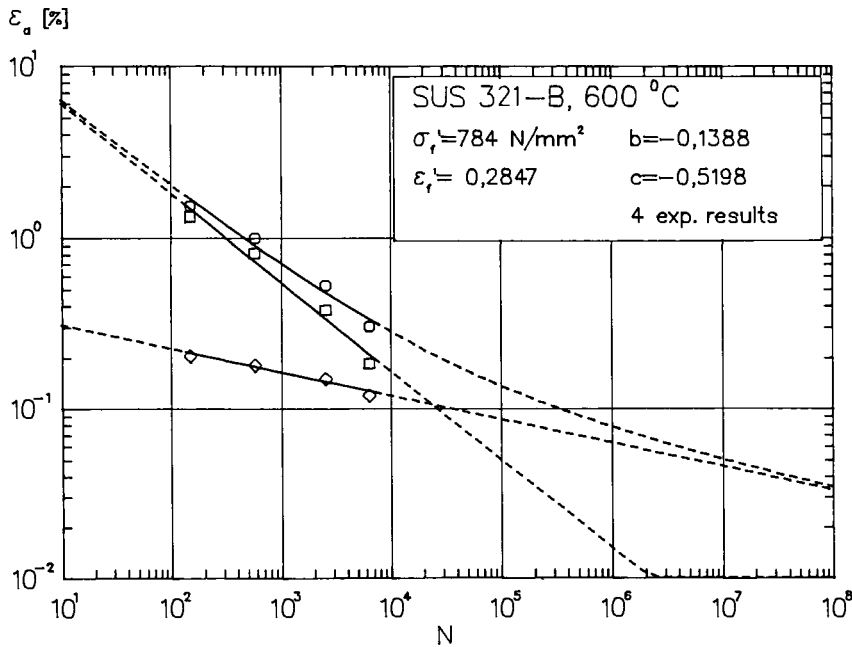
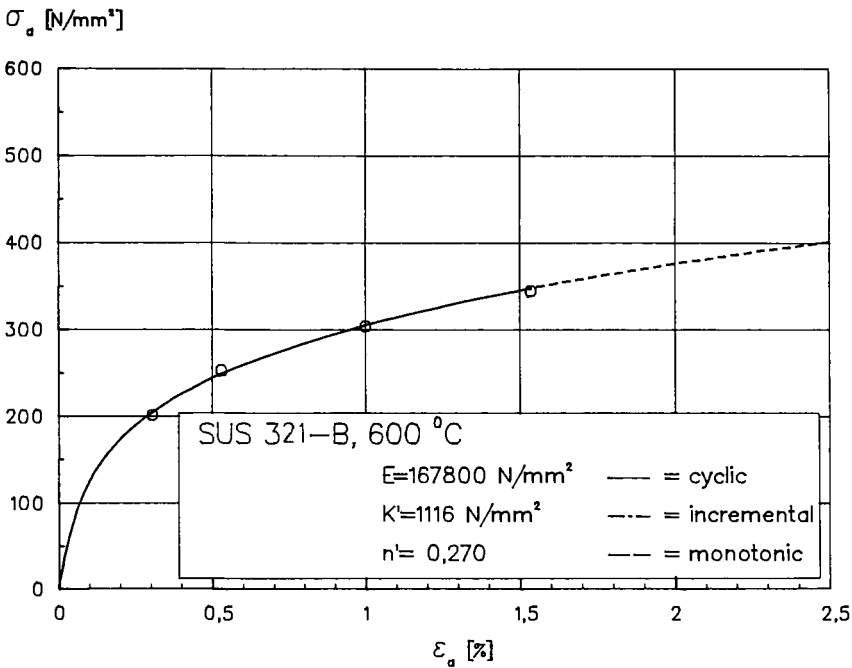
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

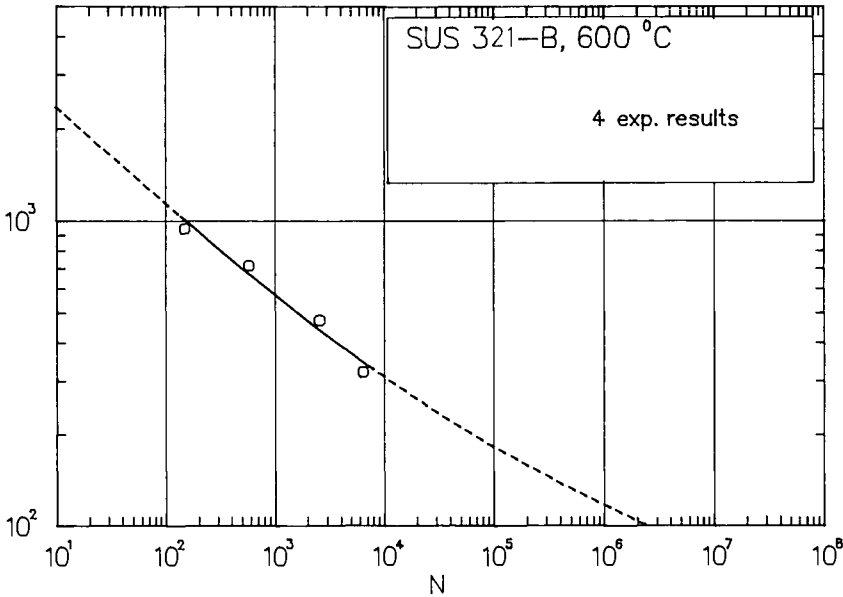
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 321-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	344.8	0.0	1.5350	148.0
2.0000	304.1	0.0	1.0000	573.0
3.0000	252.6	0.0	0.5300	2541.0
4.0000	201.1	0.0	0.3050	6355.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water
Test temperature : +600°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	167800	N/mm ²	ν	=	-
R _{p0.2}	=	97	N/mm ²	K	=	N/mm ²
R _m	=	333	N/mm ²	n	=	-
A ₅	=	43	%	σ_f	=	N/mm ²
Z	=	71	%	ε_f	=	-

Cyclic properties

R' _{p0.2}	=	265	N/mm ²	K'	=	630	N/mm ²
σ_g	=	147	N/mm ²	n'	=	0.140	-
ε_g	=	0.091	%	σ'_f	=	522	N/mm ²
N _T	=	2749	cycles	ε'_f	=	0.263	-
T _{σ}	=	1.072	-	b	=	-0.083	-
T _{ε_p}	=	1.141	-	c	=	-0.598	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture

σ/ε -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

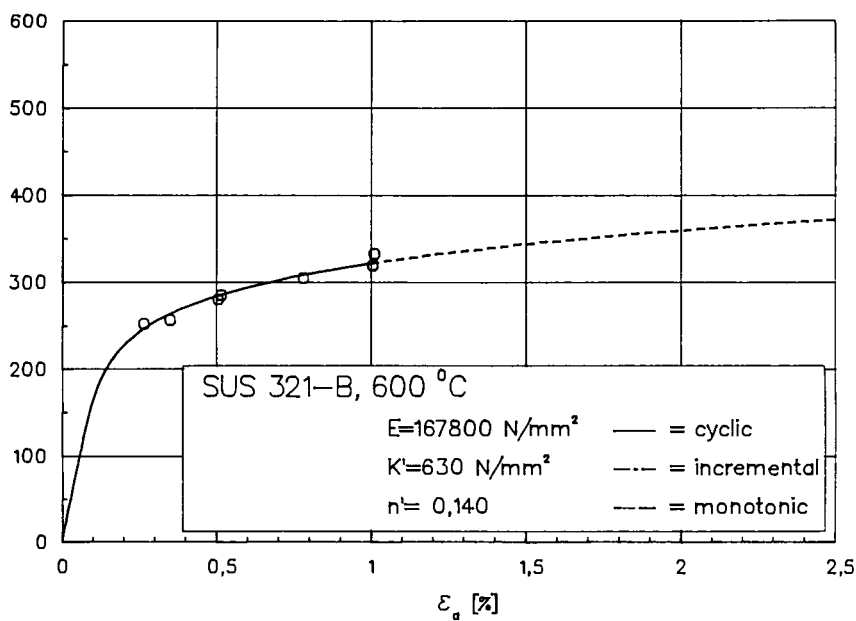
Cyclic test

Loading condition : total strain control, R_e = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.40 (%/min)
Waveform : triangular

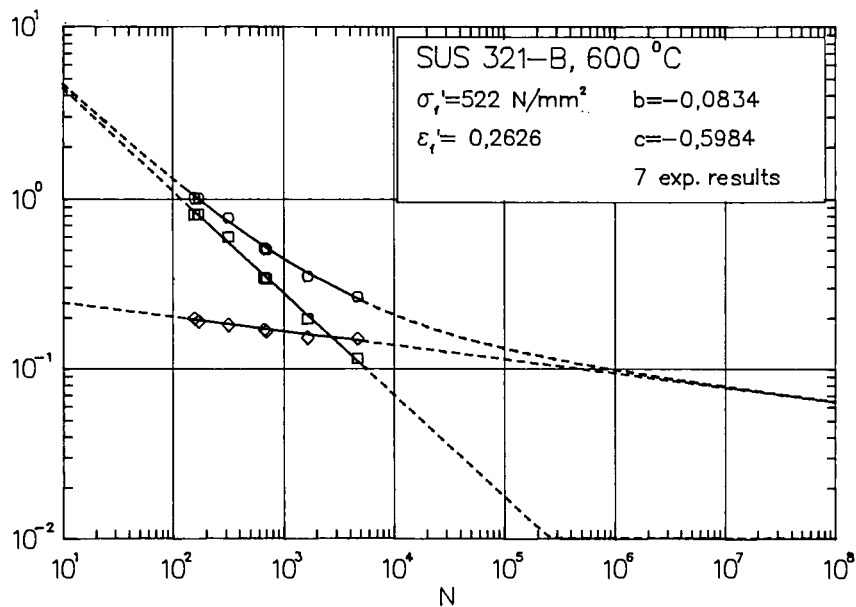
Remarks :

360

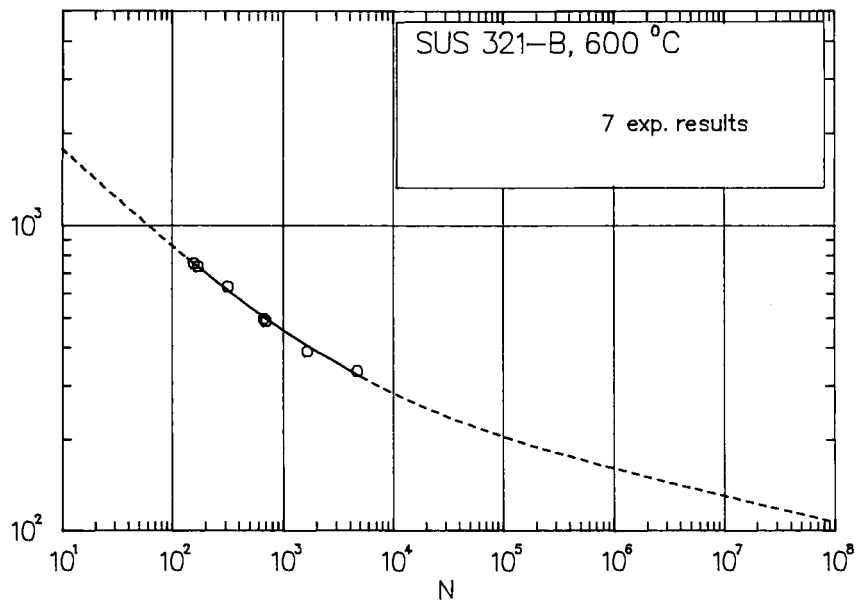
σ_a [N/mm²]



ϵ_a [%]



PSWT [N/mm²]



Material : SUS 321-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	332.6	0.0	1.0100	156.0
2.0000	319.3	0.0	1.0050	170.0
3.0000	305.1	0.0	0.7800	318.0
4.0000	285.5	0.0	0.5150	663.0
5.0000	280.6	0.0	0.5050	698.0
6.0000	256.5	0.0	0.3500	1645.0
7.0000	252.1	0.0	0.2650	4659.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water, 900°C/1h air
 Test temperature : +600°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.3]
 Year : 1978

Hardness :

Chemical composition

Microstructure :

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

Monotonic test

E	=	151700	N/mm ²	ν	=	-
R _{p0.2}	=	101	N/mm ²	K	=	N/mm ²
R _m	=	312	N/mm ²	n	=	-
A ₅	=	40	%	σ_f	=	N/mm ²
Z	=	72	%	e_f	=	-

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

Cyclic properties

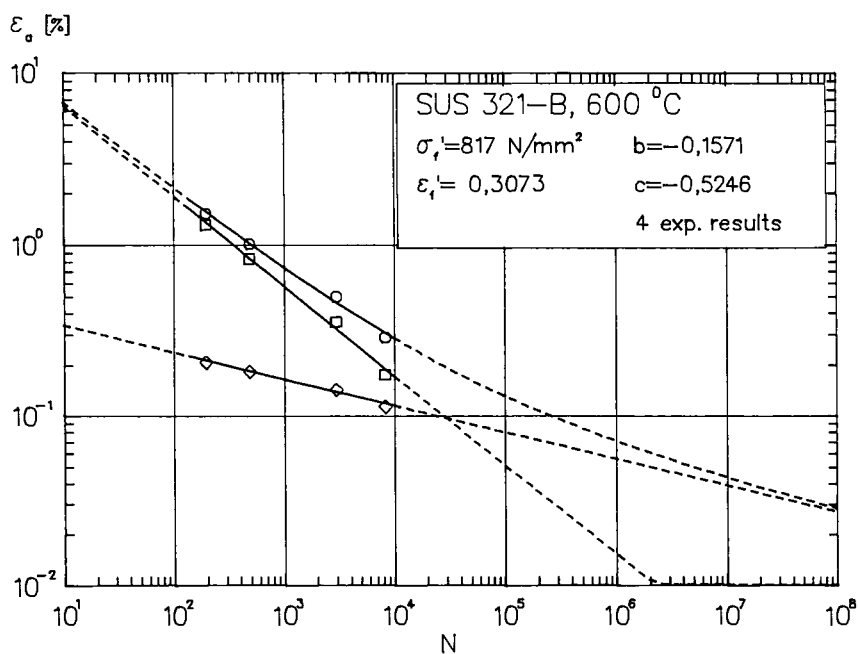
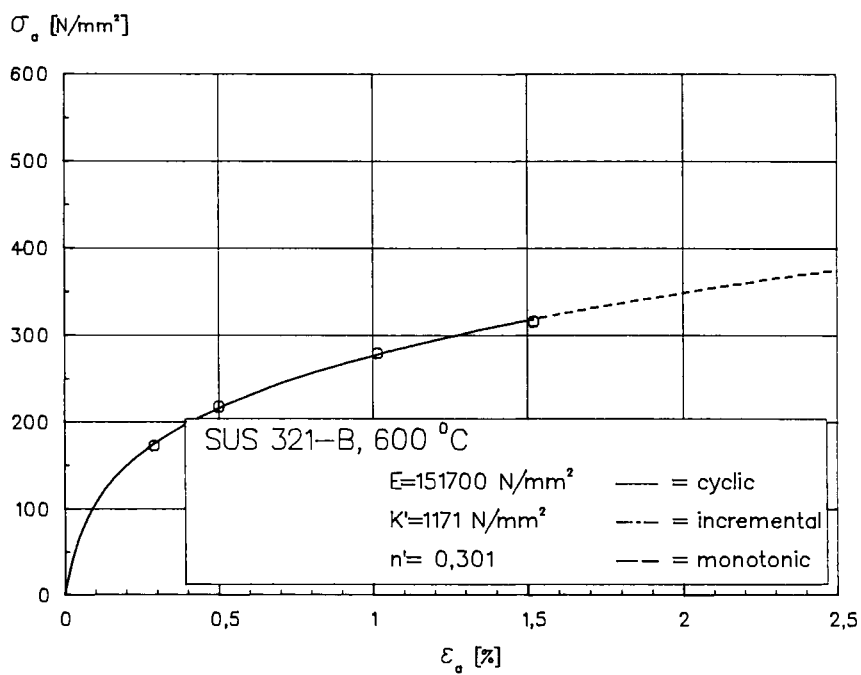
Cyclic test

R' _{p0.2}	=	181	N/mm ²	K'	=	1171	N/mm ²
σ_g	=	75	N/mm ²	n'	=	0.301	-
ϵ_g	=	0.060	%	σ'_f	=	817	N/mm ²
N _T	=	29956	cycles	ϵ'_f	=	0.307	-
T _{σ}	=	1.103	-	b	=	-0.157	-
T _{ϵ_p}	=	1.255	-	c	=	-0.525	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

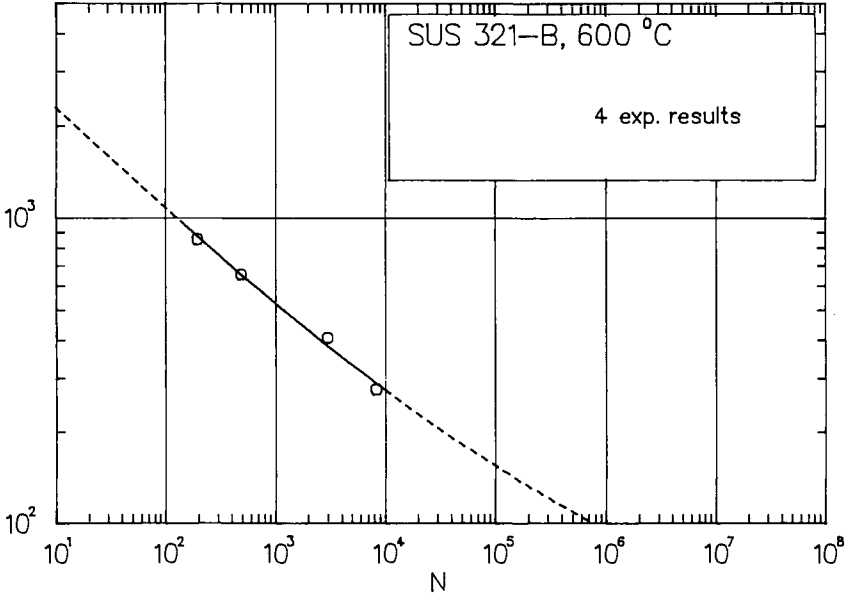
Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max, 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
 Remarks : Young's modulus estimated

Remarks :



PSWT [N/mm²]



Material : SUS 321-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	315.9	0.0	1.5200	194.0
2.0000	279.1	0.0	1.0150	485.0
3.0000	217.8	0.0	0.5000	2953.0
4.0000	172.7	0.0	0.2900	8212.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water, 900°C/1h air
Test temperature : +600°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	151700	N/mm ²	ν	=	-
R _{p0.2}	=	101	N/mm ²	K	=	N/mm ²
R _m	=	312	N/mm ²	n	=	-
A _g	=	40	%	σ_f	=	N/mm ²
Z	=	72	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	212	N/mm ²	K'	=	533	N/mm ²
σ_g	=	135	N/mm ²	n'	=	0.148	-
ϵ_g	=	0.098	%	σ'_f	=	384	N/mm ²
N _T	=	6695	cycles	ϵ'_f	=	0.122	-
T _{σ}	=	1.166	-	b	=	-0.069	-
T _{ϵp}	=	1.551	-	c	=	-0.476	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

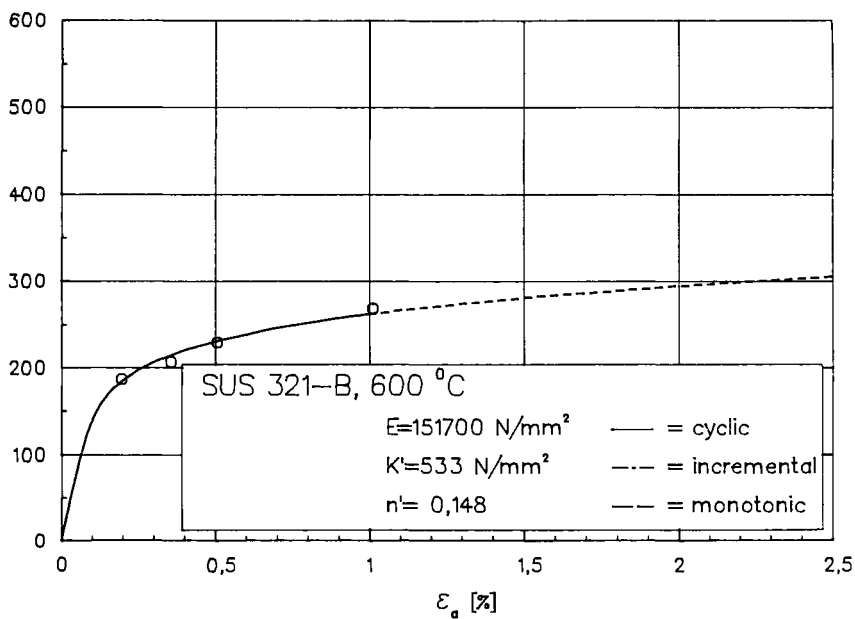
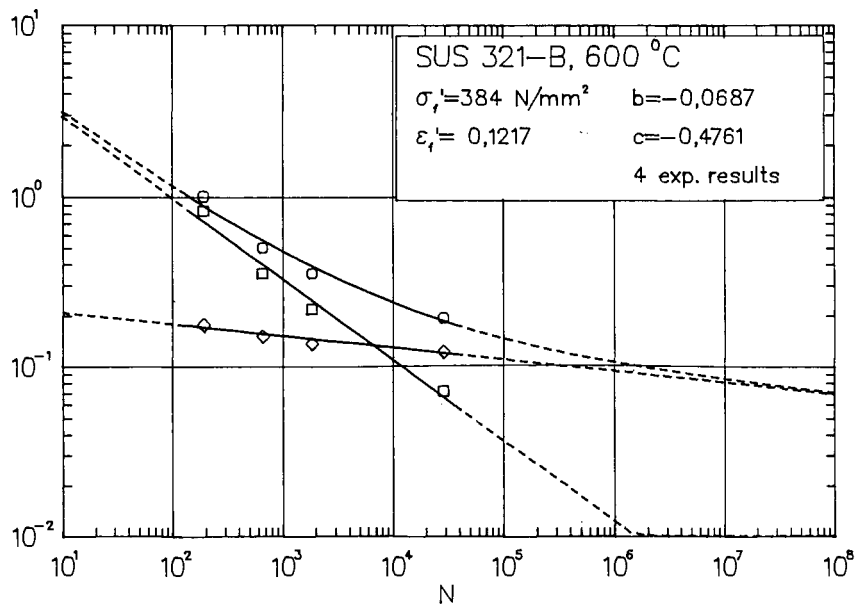
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

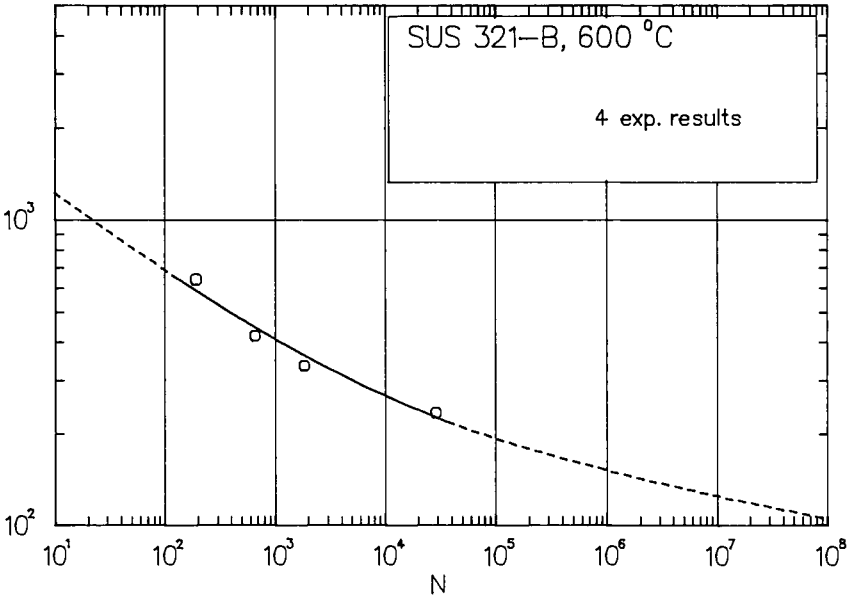
Cyclic test

Loading condition : total strain control, R_g = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.40 (%/min)
Waveform : triangular

Remarks :

σ_a [N/mm²] ϵ_a [%]

PSWT [N/mm²]



Material : SUS 321-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	268.3	0.0	1.0100	191.0
2.0000	229.6	0.0	0.5050	656.0
3.0000	207.0	0.0	0.3550	1828.0
4.0000	186.9	0.0	0.1950	28776.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water, 750°C/24h air
Test temperature : +600°C
Semifinished material : bar, Ø 22 mm
Reference : [4,3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	158000	N/mm ²	ν	=	-
R _{p0.2}	=	127	N/mm ²	K	=	N/mm ²
R _m	=	319	N/mm ²	n	=	-
A ₅	=	40	%	σ_f	=	N/mm ²
Z	=	73	%	ε_f	=	-

Cyclic properties

R' _{p0.2}	=	193	N/mm ²	K'	=	1041	N/mm ²
σ_g	=	86	N/mm ²	n'	=	0.271	-
ε_g	=	0.065	%	σ'_f	=	763	N/mm ²
N _T	=	25660	cycles	e'_f	=	0.327	-
T _{σ}	=	1.119	-	b	=	-0.143	-
T _{ε_p}	=	1.205	-	c	=	-0.532	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ε -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

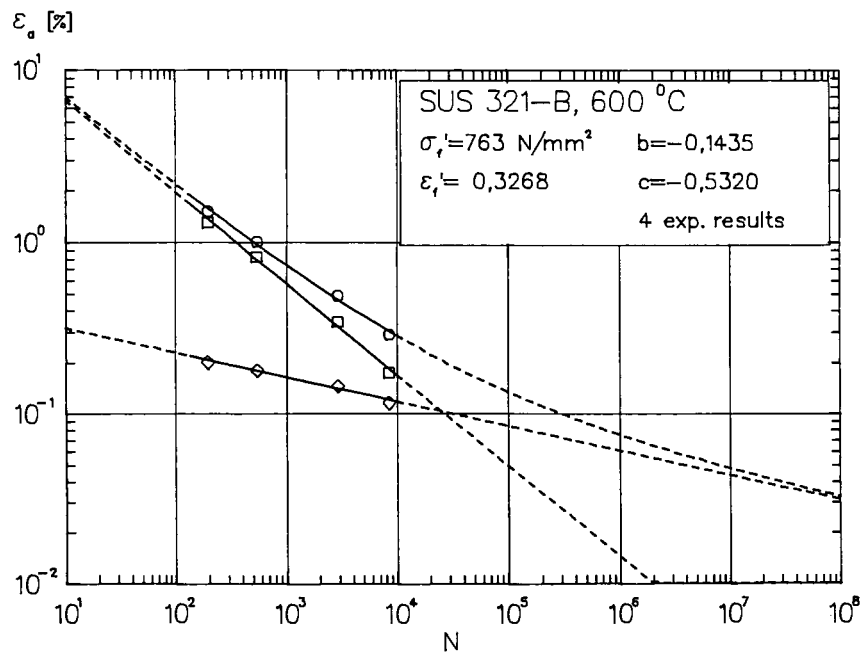
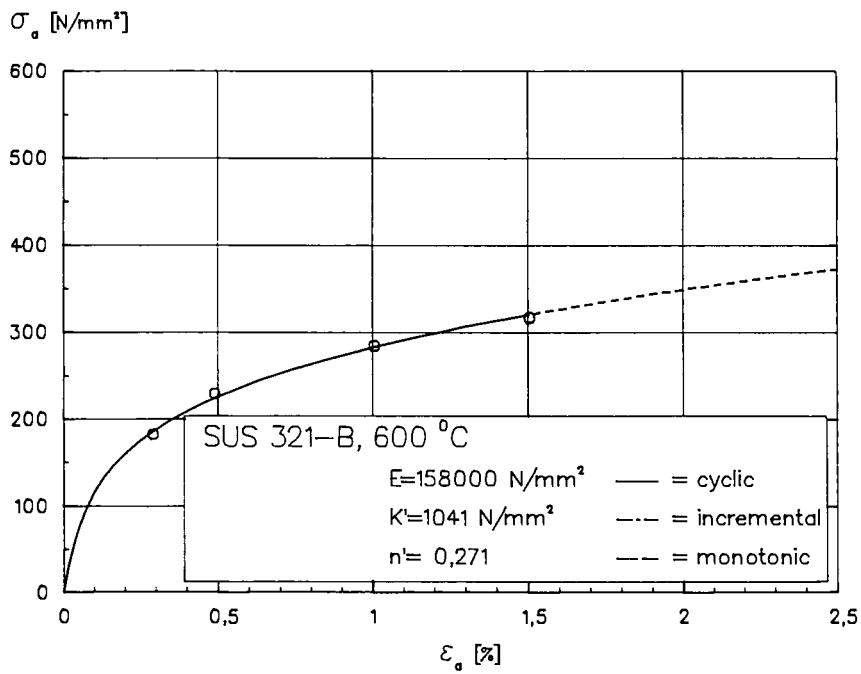
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

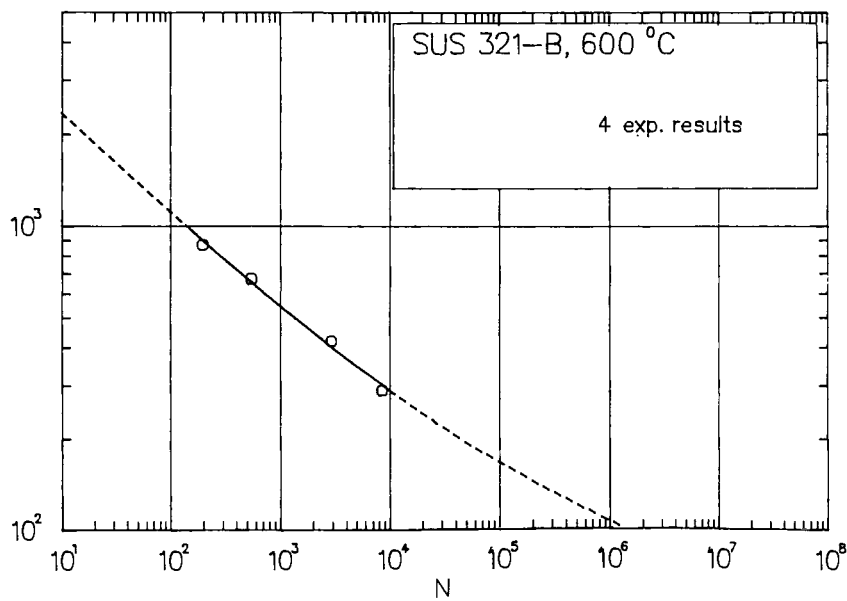
Cyclic test

Loading condition : total strain control, R_e = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 321-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	316.9	0.0	1.5050	195.0
2.0000	284.5	0.0	1.0050	542.0
3.0000	229.6	0.0	0.4900	2914.0
4.0000	182.5	0.0	0.2900	8447.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water, 750°C/24h air
 Test temperature : +600°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.3]
 Year : 1978

Hardness :

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Microstructure :

Monotonic properties

E	=	158000	N/mm ²	ν	=	-
R _{p0.2}	=	127	N/mm ²	K	=	N/mm ²
R _m	=	319	N/mm ²	n	=	-
A ₅	=	40	%	σ_f	=	N/mm ²
Z	=	73	%	ϵ_f	=	-

Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

Cyclic properties

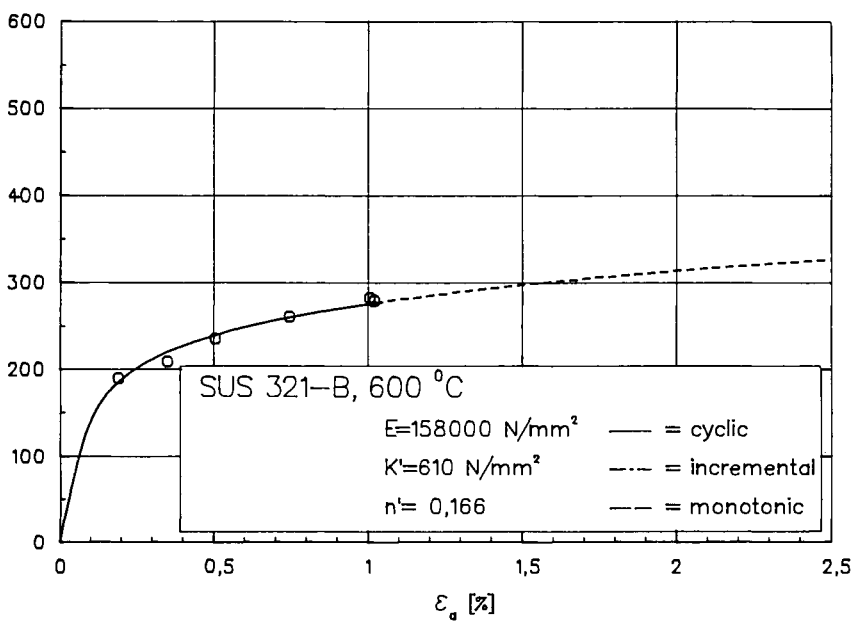
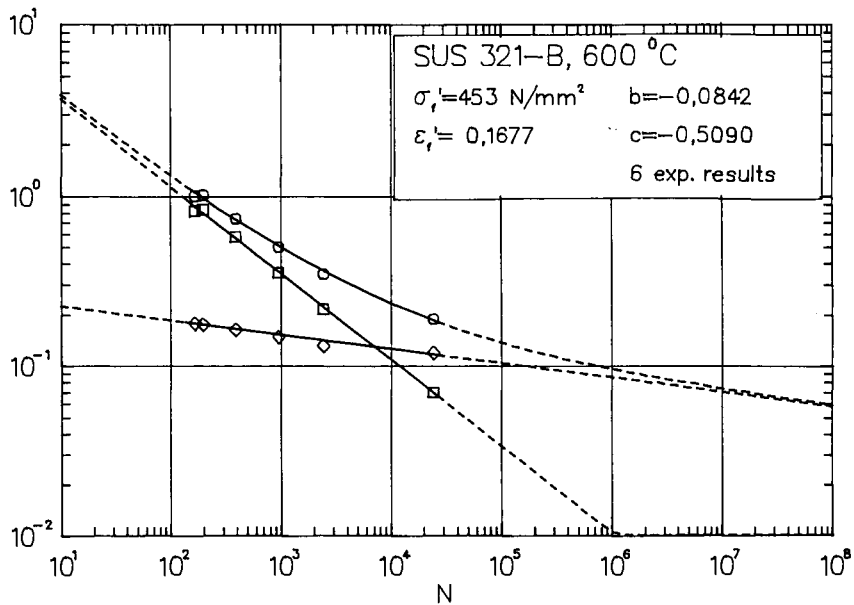
R' _{p0.2}	=	218	N/mm ²	K'	=	610	N/mm ²
σ_g	=	126	N/mm ²	n'	=	0.166	-
ϵ_g	=	0.087	%	σ'_f	=	453	N/mm ²
N _T	=	7203	cycles	ϵ'_f	=	0.168	-
T _{σ}	=	1.106	-	b	=	-0.084	-
T _{ep}	=	1.116	-	c	=	-0.509	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Cyclic test

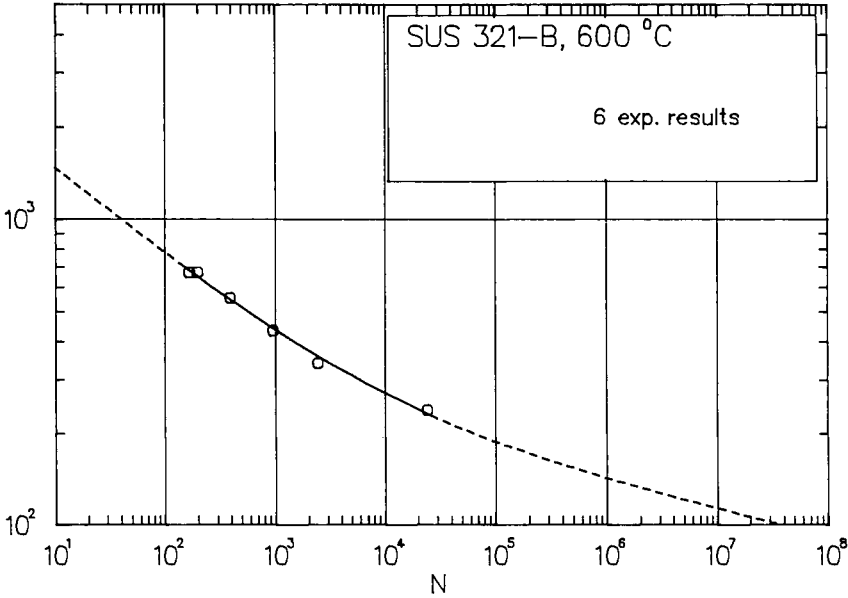
Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.40 (%/min)
 Waveform : triangular

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
 Remarks : Young's modulus estimated

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUS 321-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	283.0	0.0	1.0050	166.0
2.0000	279.1	0.0	1.0200	197.0
3.0000	260.5	0.0	0.7450	389.0
4.0000	235.4	0.0	0.5050	954.0
5.0000	208.9	0.0	0.3500	2426.0
6.0000	189.8	0.0	0.1900	24183.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C/30' water
 Test temperature : +700°C
 Semifinished material : bar, Ø 25 mm
 Reference : [4,3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.54	1.08	0.041	0.018	8.52	16.50	0.28

Monotonic properties

E	=	198900	N/mm ²	ν	=	-
R _{p0.2}	=	120	N/mm ²	K	=	N/mm ²
R _m	=	261	N/mm ²	n	=	-
A ₅	=	50	%	σ _f	=	N/mm ²
Z	=	80	%	ε _f	=	-

Cyclic properties

R'p0.2	=	180	N/mm ²	K'	=	496	N/mm ²
σ _g	=	121	N/mm ²	n'	=	0.163	-
ε _g	=	0.077	%	σ'f	=	360	N/mm ²
N _T	=	62705	cycles	ε'f	=	0.151	-
T _σ	=	1.156	-	b	=	-0.072	-
T _{εp}	=	1.122	-	c	=	-0.448	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

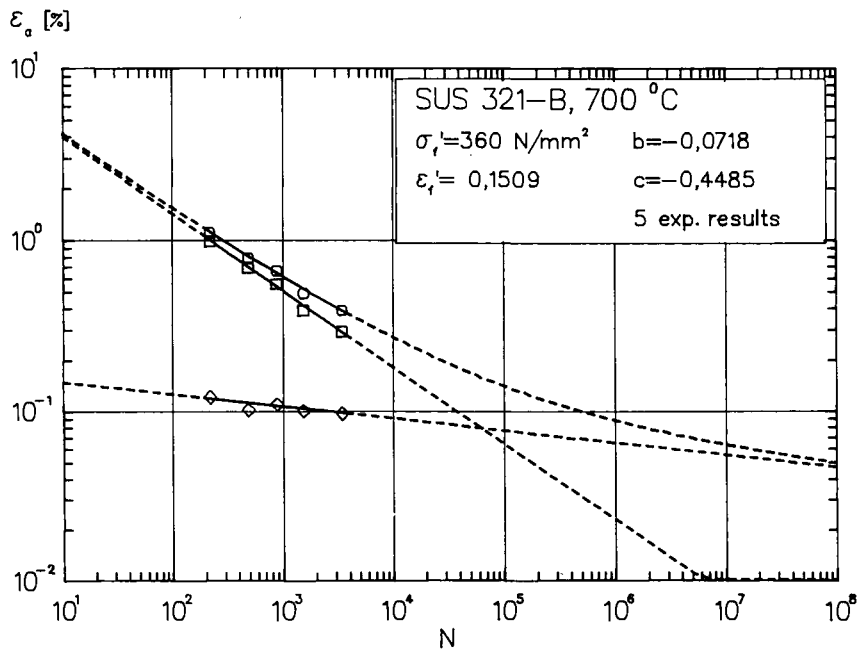
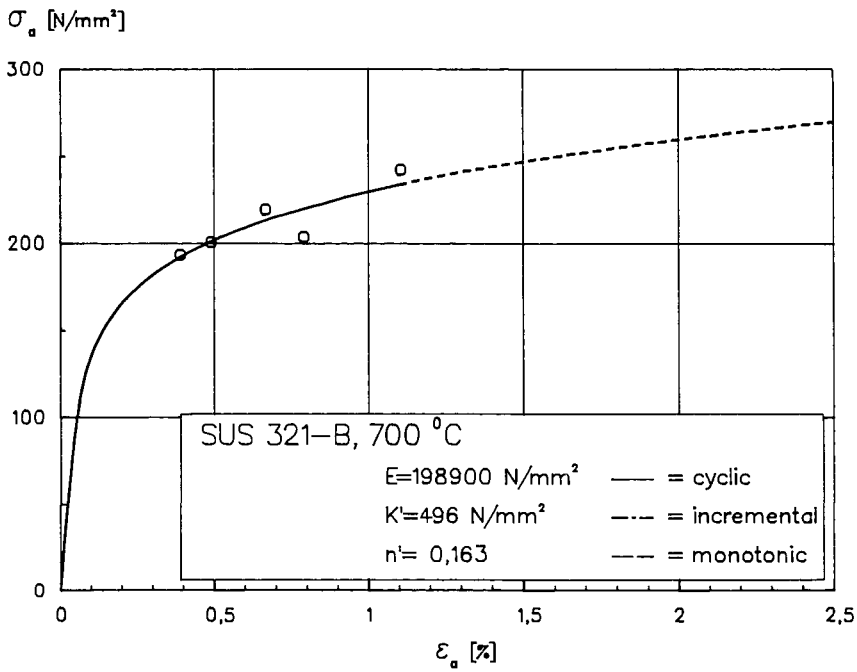
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

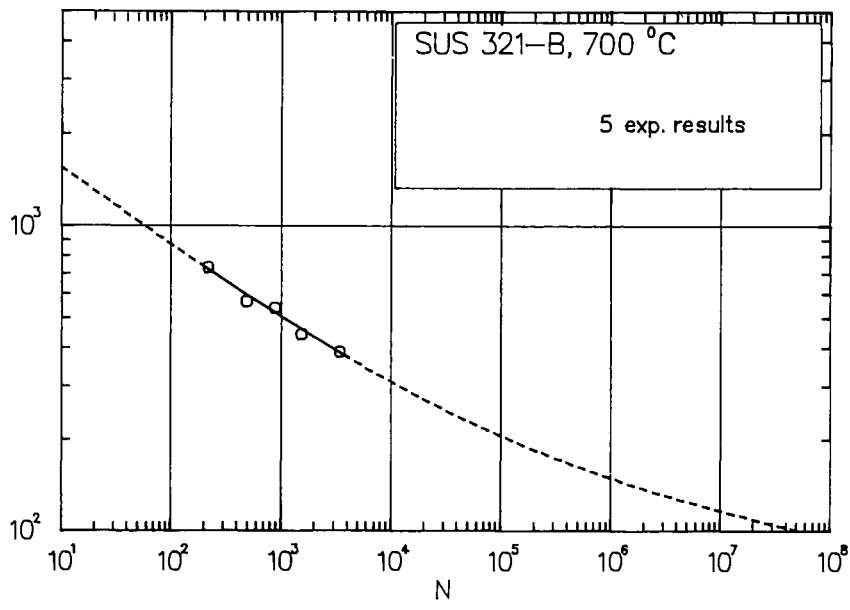
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 321-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	242.3	0.0	1.1050	218.0
2.0000	203.6	0.0	0.7900	486.0
3.0000	219.3	0.0	0.6650	879.0
4.0000	200.6	0.0	0.4900	1535.0
5.0000	193.3	0.0	0.3900	3420.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C/30' water
 Test temperature : 700°C
 Semifinished material : bar, Ø 25 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.54	1.08	0.041	0.018	8.52	16.50	0.28

Monotonic properties

E	=	198900	N/mm ²	ν	=	-
R _{p0.2}	=	120	N/mm ²	K	=	N/mm ²
R _m	=	261	N/mm ²	n	=	-
A ₅	=	50	%	σ_f	=	N/mm ²
Z	=	80	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	172	N/mm ²	K'	=	368	N/mm ²
σ'_g	=	115	N/mm ²	n'	=	0.122	-
ϵ'_g	=	0.067	%	σ'_f	=	297	N/mm ²
N _T	=	25082	cycles	ϵ'_f	=	0.143	-
T _{σ}	=	1.058	-	b	=	-0.062	-
T _{ϵ_p}	=	1.348	-	c	=	-0.483	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

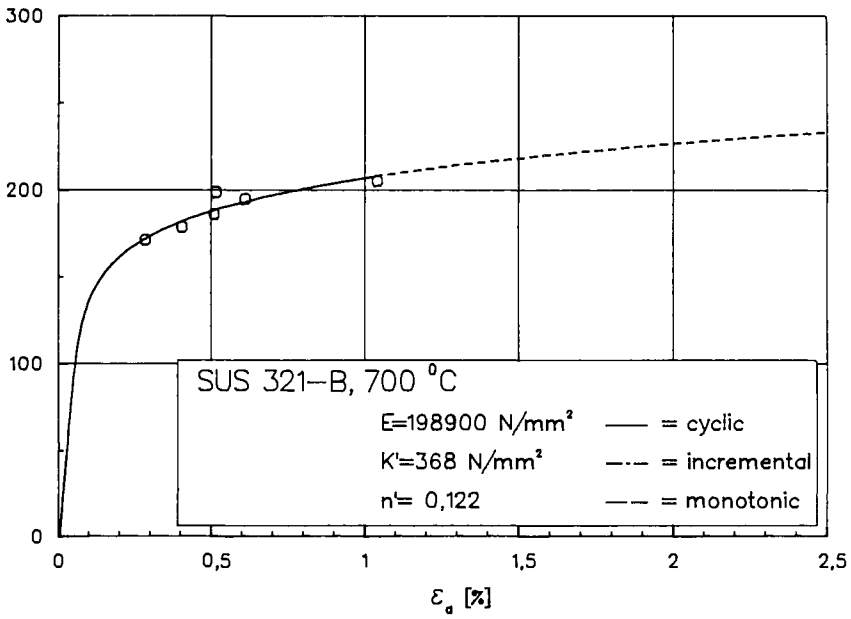
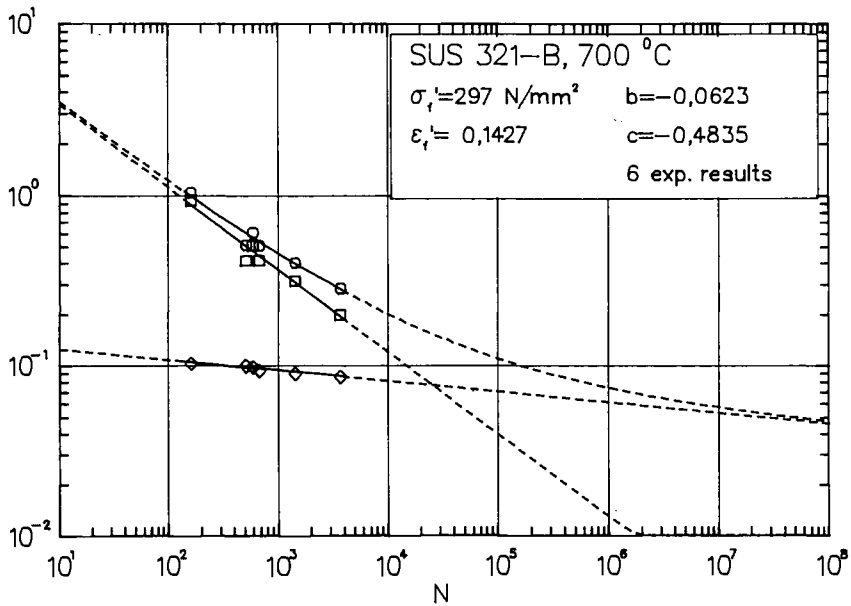
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

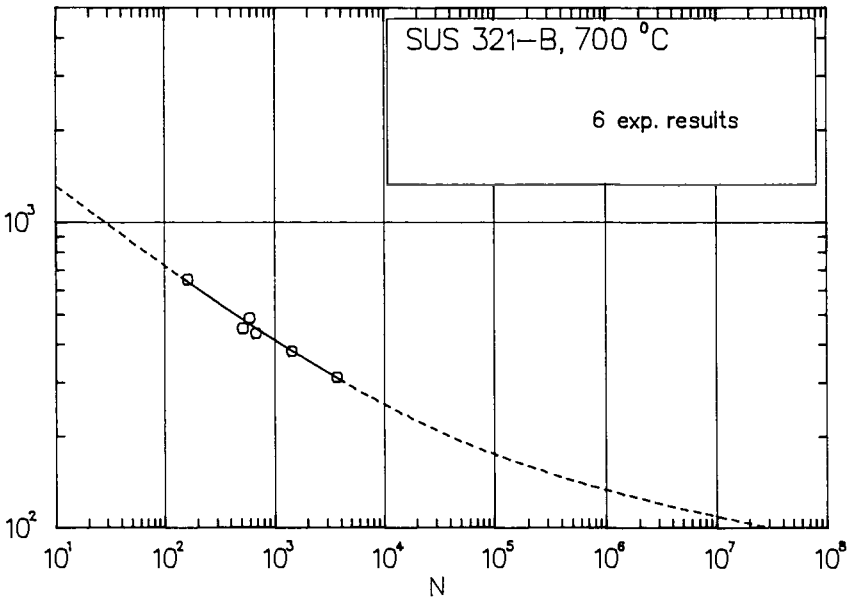
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.41 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²] ϵ_a [%]

PSWT [N/mm²]



Material : SUS 321-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	205.0	0.0	1.0400	162.0
3.0000	198.6	0.0	0.5150	513.0
2.9000	194.7	0.0	0.6100	591.0
4.0000	185.9	0.0	0.5100	676.0
5.0000	178.5	0.0	0.4050	1431.0
6.0000	171.2	0.0	0.2850	3697.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C/30' water, 1100°C/1h water
Test temperature : +700°C
Semifinished material : bar, Ø 25 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.54	1.08	0.041	0.018	8.52	16.50	0.28

Monotonic properties

E	=	202050	N/mm ²	ν	=	-
R _{p0.2}	=	115	N/mm ²	K	=	N/mm ²
R _m	=	267	N/mm ²	n	=	-
A ₅	=	53	%	σ _f	=	N/mm ²
Z	=	72	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	194	N/mm ²	K'	=	508	N/mm ²
σ _g	=	115	N/mm ²	n'	=	0.155	-
ε _g	=	0.066	%	σ' _f	=	440	N/mm ²
N _T	=	31076	cycles	ε' _f	=	0.311	-
T _σ	=	1.123	-	b	=	-0.088	-
T _{sp}	=	1.160	-	c	=	-0.538	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

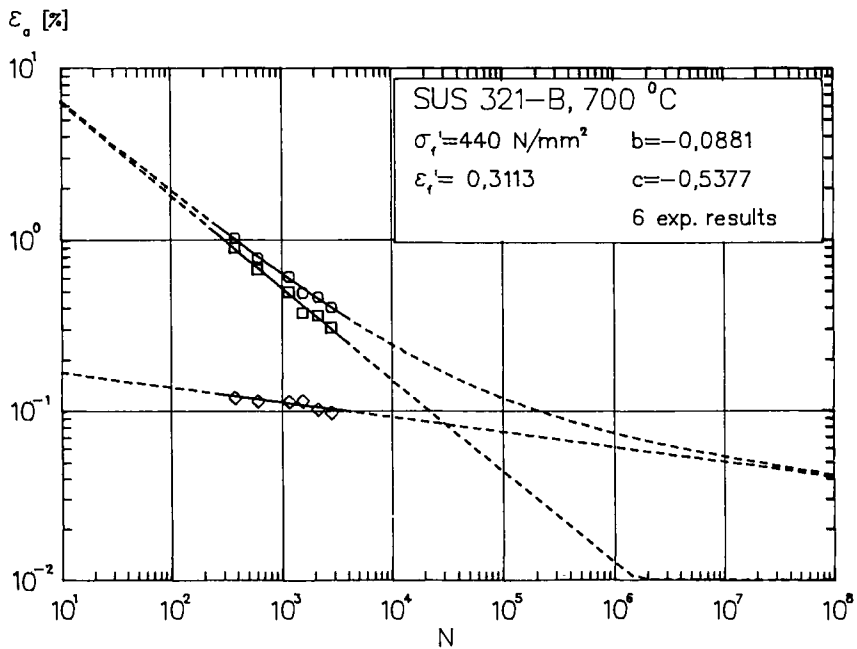
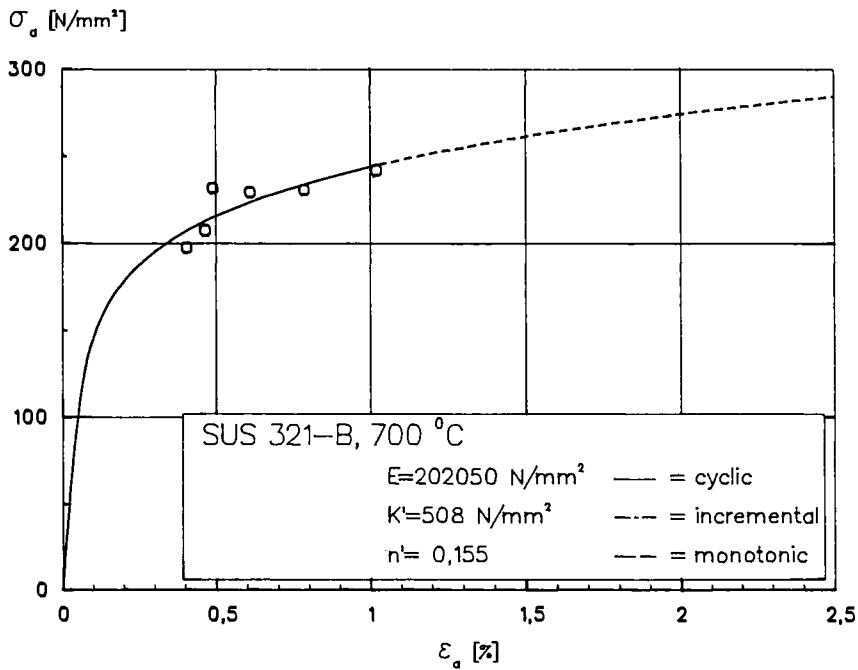
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

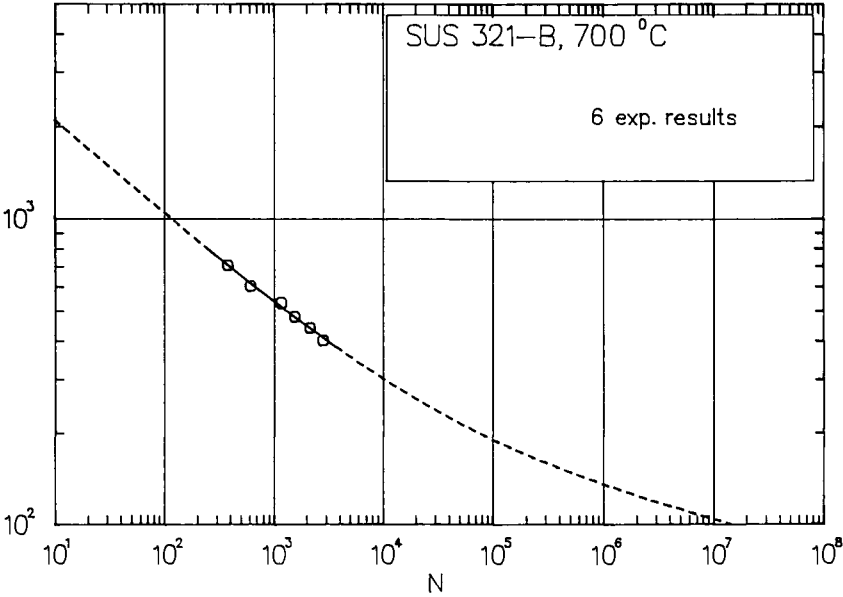
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 321-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	241.8	0.0	1.0200	378.0
2.0000	230.5	0.0	0.7850	608.0
3.0000	229.1	0.0	0.6100	1163.0
4.0000	231.5	0.0	0.4900	1548.0
5.0000	207.0	0.0	0.4650	2124.0
6.0000	197.2	0.0	0.4050	2804.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C/30' water, 1100°C/1h water
 Test temperature : +700°C
 Semifinished material : bar, Ø 25 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.54	1.08	0.041	0.018	8.52	16.50	0.28

Monotonic properties

E	=	202050	N/mm ²	ν	=	-
R _{p0.2}	=	115	N/mm ²	K	=	N/mm ²
R _m	=	267	N/mm ²	n	=	-
A ₅	=	53	%	σ_f	=	N/mm ²
Z	=	72	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	185	N/mm ²	K'	=	523	N/mm ²
σ'_g	=	105	N/mm ²	n'	=	0.168	-
ϵ'_g	=	0.060	%	σ'_f	=	369	N/mm ²
N _T	=	16030	cycles	ϵ'_f	=	0.109	-
T _{σ}	=	1.136	-	b	=	-0.083	-
T _{ϵ_p}	=	1.225	-	c	=	-0.477	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

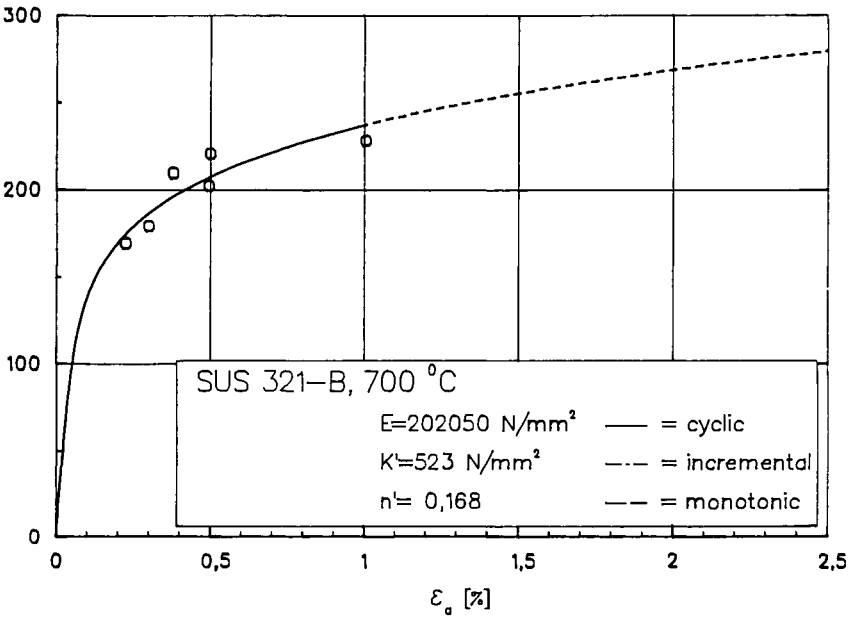
Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

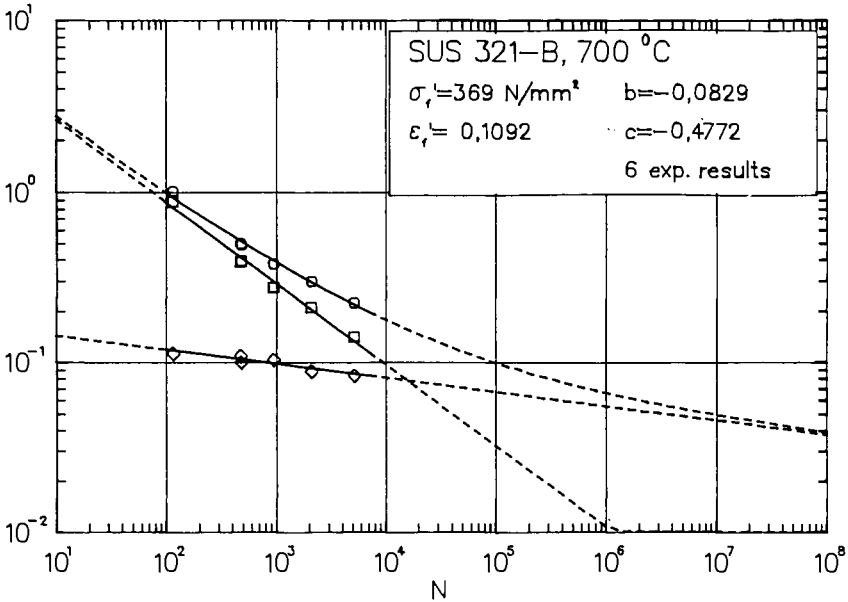
Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.40(%/min)
 Waveform : triangular

Remarks :

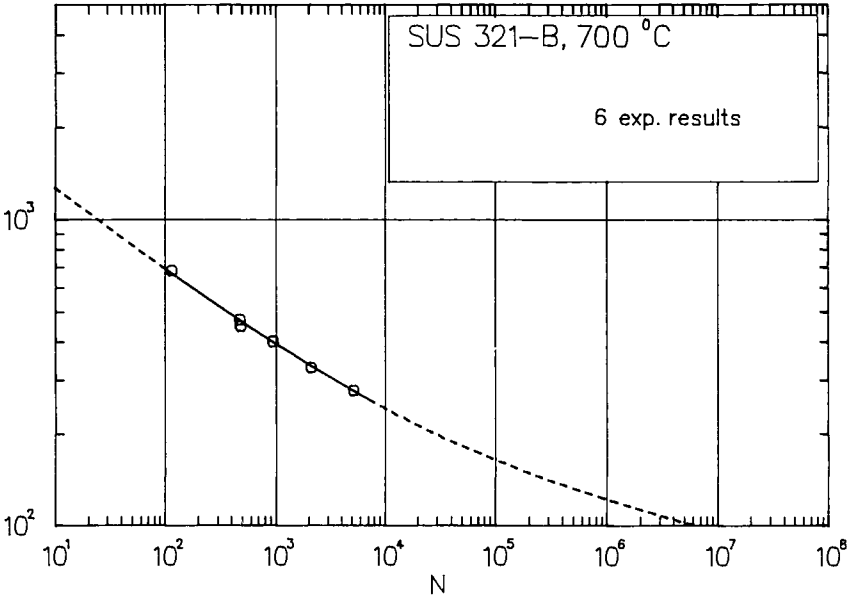
σ_e [N/mm²]



ϵ_e [%]



PSWT [N/mm²]



Material : SUS 321-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	228.1	0.0	1.0050	115.0
2.0000	220.7	0.0	0.5000	473.0
3.0000	202.1	0.0	0.4950	479.0
4.0000	209.4	0.0	0.3800	945.0
5.0000	179.0	0.0	0.3000	2085.0
6.0000	169.2	0.0	0.2250	5136.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water
 Test temperature : +700°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	170900	N/mm ²	ν	=	-
R _{p0.2}	=	94	N/mm ²	K	=	N/mm ²
R _m	=	250	N/mm ²	n	=	-
A ₅	=	28	%	σ _f	=	N/mm ²
Z	=	32	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	195	N/mm ²	K'	=	609	N/mm ²
σ _g	=	96	N/mm ²	n'	=	0.184	-
ε _g	=	0.060	%	σ' _f	=	510	N/mm ²
N _T	=	10200	cycles	ε' _f	=	0.377	-
T _σ	=	1.013	-	b	=	-0.110	-
T _{εp}	=	1.053	-	c	=	-0.597	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture

σ/ε-values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

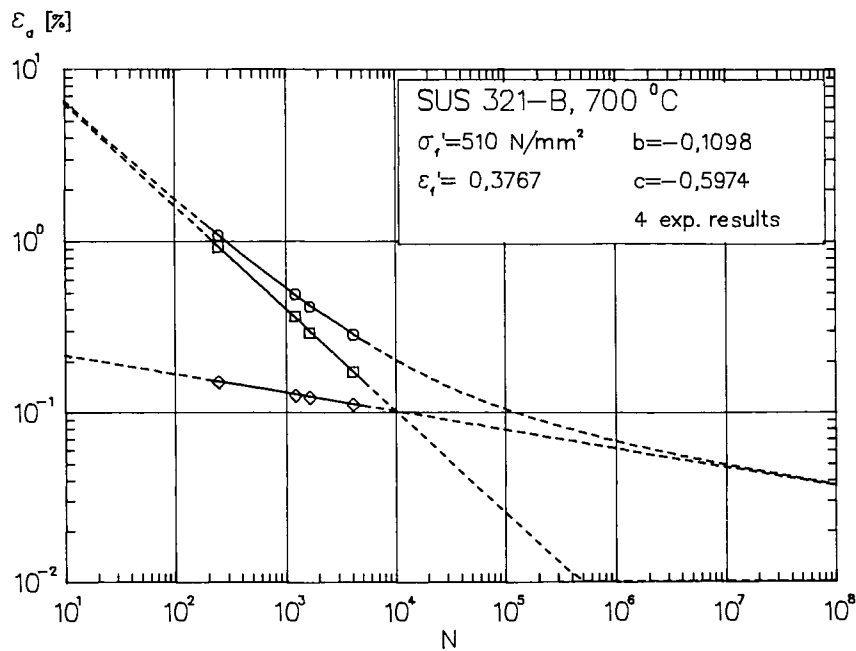
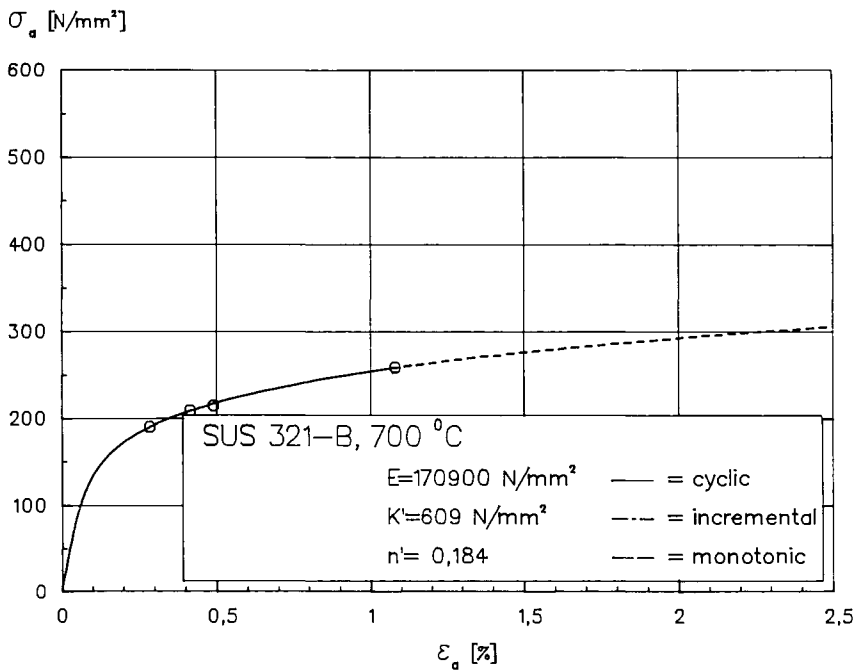
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

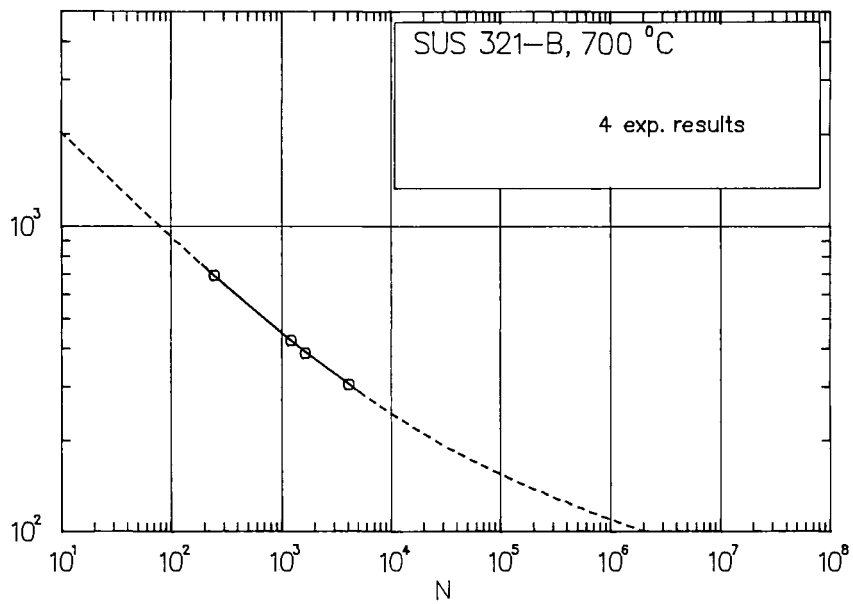
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 321-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	259.0	0.0	1.0800	245.0
2.0000	215.3	0.0	0.4900	1221.0
3.0000	209.4	0.0	0.4150	1649.0
4.0000	190.3	0.0	0.2850	4083.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water
 Test temperature : +700°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	170900	N/mm ²	ν	=	-
R _{p0.2}	=	94	N/mm ²	K	=	N/mm ²
R _m	=	250	N/mm ²	n	=	-
A ₅	=	28	%	σ_f	=	N/mm ²
Z	=	32	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	185	N/mm ²	K'	=	421	N/mm ²
σ_g	=	104	N/mm ²	n'	=	0.133	-
ϵ_g	=	0.064	%	σ'_f	=	312	N/mm ²
N _T	=	2970	cycles	ϵ'_f	=	0.092	-
T _{σ}	=	1.086	-	b	=	-0.072	-
T _{ϵ_p}	=	1.324	-	c	=	-0.523	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

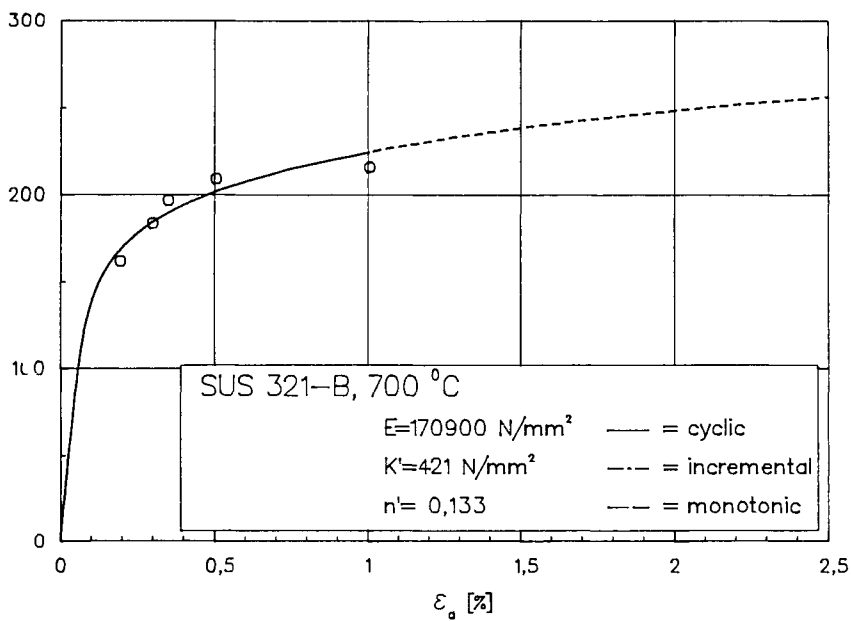
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.40 (%/min)
 Waveform : triangular

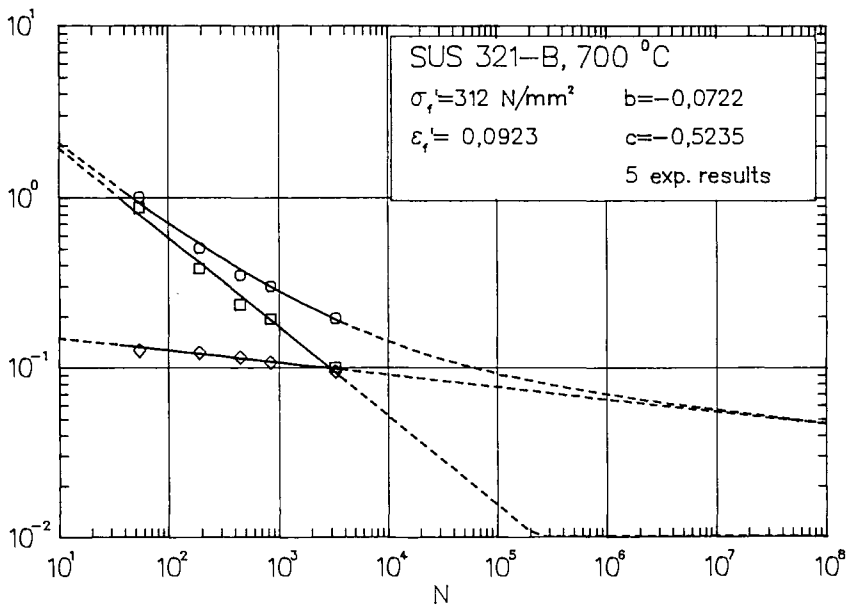
Remarks :

390

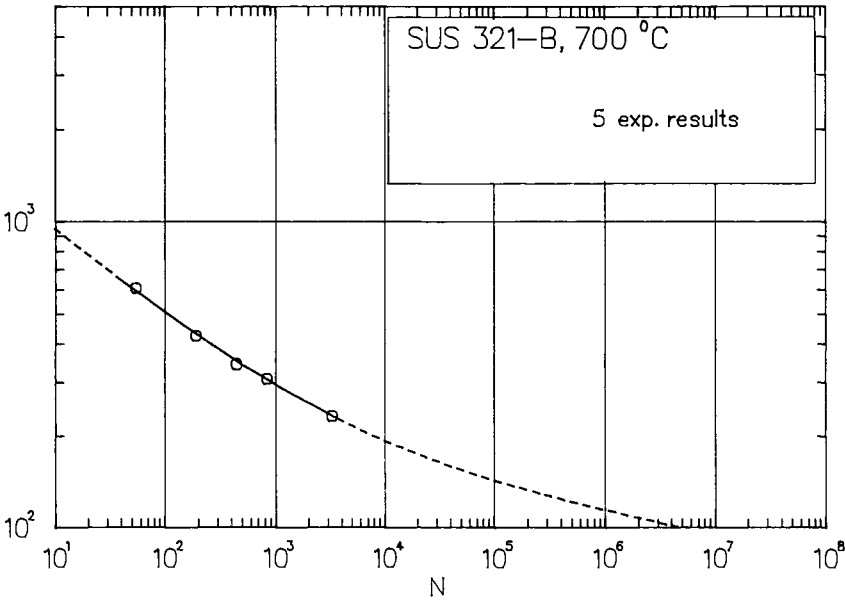
σ_a [N/mm²]



ϵ_a [%]



PSWT [N/mm²]



Material : SUS 321-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	215.8	0.0	1.0050	54.0
2.0000	208.9	0.0	0.5050	190.0
3.0000	196.7	0.0	0.3500	444.0
4.0000	183.4	0.0	0.3000	838.0
5.0000	161.9	0.0	0.1950	3259.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water, 900°C/1h air
 Test temperature : +700°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.3]
 Year : 1978

Hardness :

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Microstructure :

Monotonic properties

E	=	168500	N/mm ²	ν	=	-
R _{p0.2}	=	109	N/mm ²	K	=	N/mm ²
R _m	=	247	N/mm ²	n	=	-
A ₅	=	46	%	σ_f	=	N/mm ²
Z	=	59	%	ϵ_f	=	-

Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

Cyclic properties

R _{p0.2}	=	180	N/mm ²	K'	=	665	N/mm ²
σ_b	=	80	N/mm ²	n'	=	0.210	-
ϵ_b	=	0.052	%	σ'_f	=	577	N/mm ²
N _T	=	14483	cycles	ϵ'_f	=	0.493	-
T _{σ}	=	1.016	-	b	=	-0.130	-
T _{ep}	=	1.215	-	c	=	-0.614	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Cyclic test

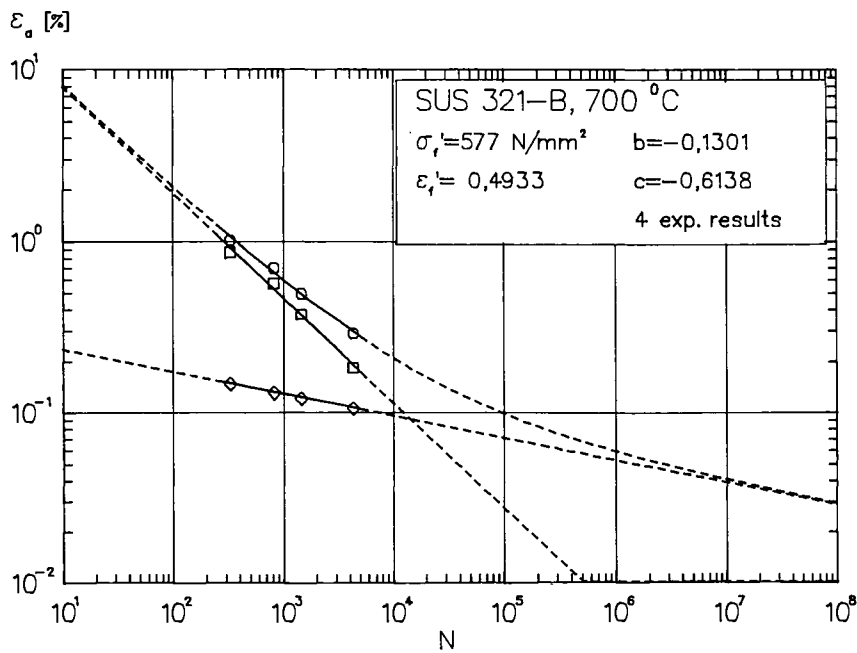
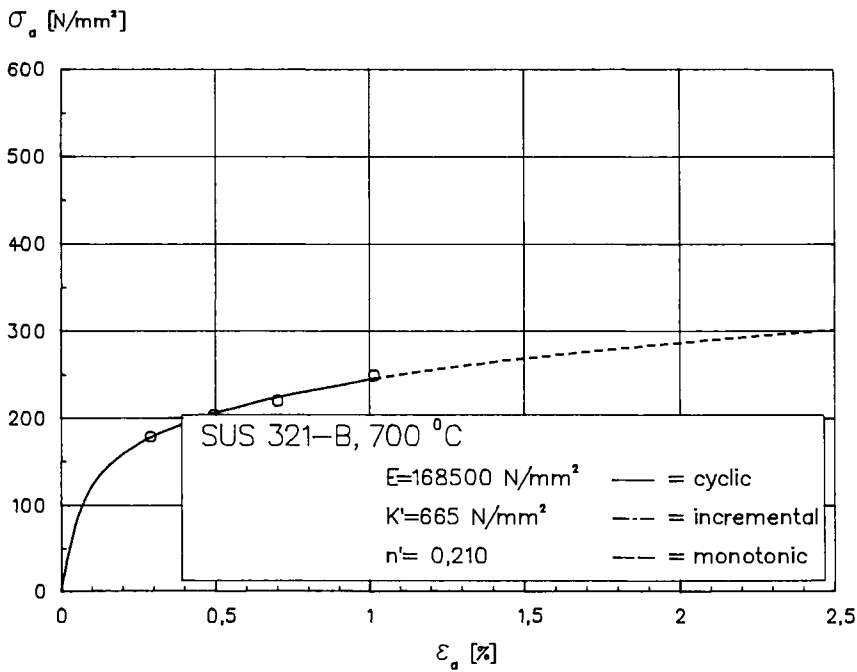
Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Failure criterion : complete rupture

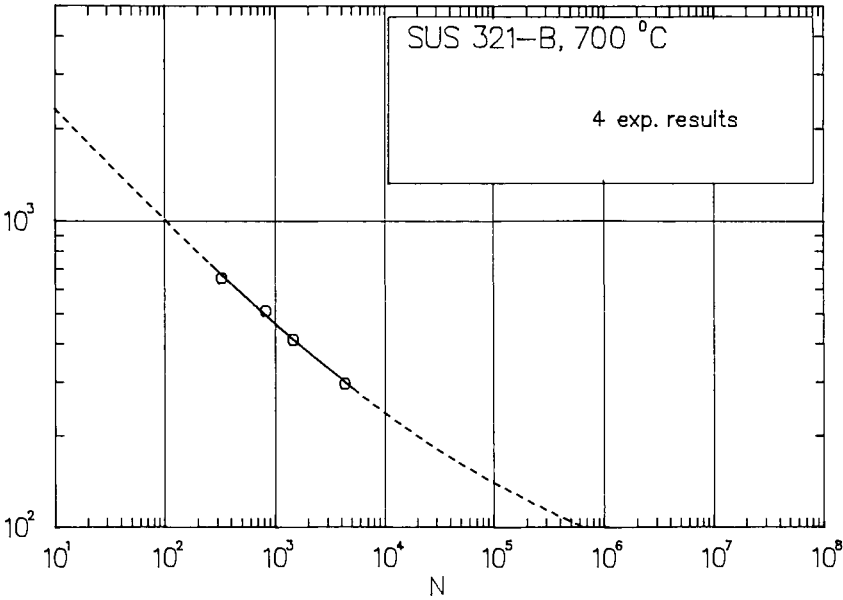
σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Remarks :



PSWT [N/mm²]



Material : SUS 321-B, 700⁰C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	249.2	0.0	1.0150	329.0
2.0000	220.2	0.0	0.7000	821.0
3.0000	203.6	0.0	0.4950	1443.0
4.0000	178.5	0.0	0.2900	4291.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water, 900°C/1h air
 Test temperature : +700°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.3]
 Year : 1978

Hardness :

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Microstructure :

Monotonic properties

E	=	168500	N/mm ²	ν	=	-
R _{p0.2}	=	109	N/mm ²	K	=	N/mm ²
R _m	=	247	N/mm ²	n	=	-
A ₅	=	46	%	σ_f	=	N/mm ²
Z	=	59	%	e_f	=	-

Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

Cyclic properties

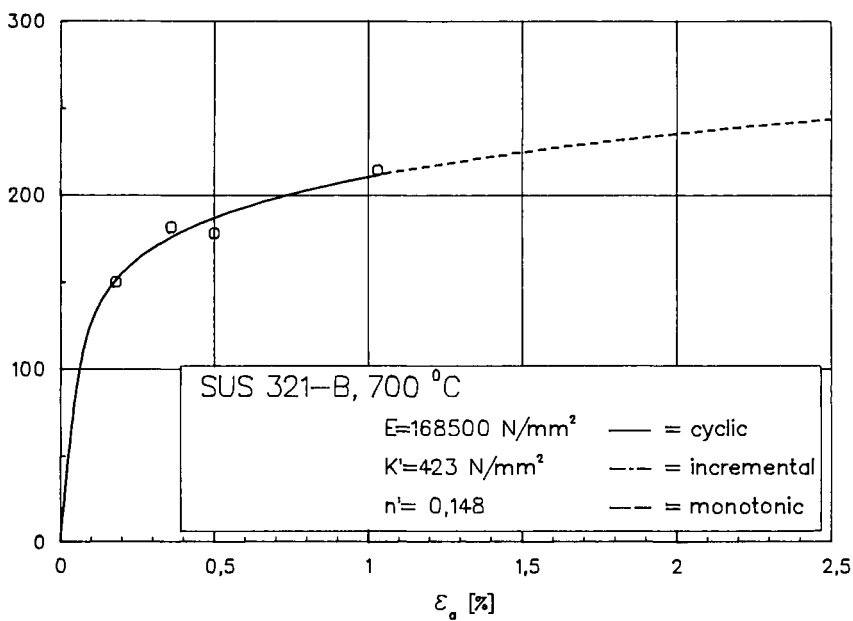
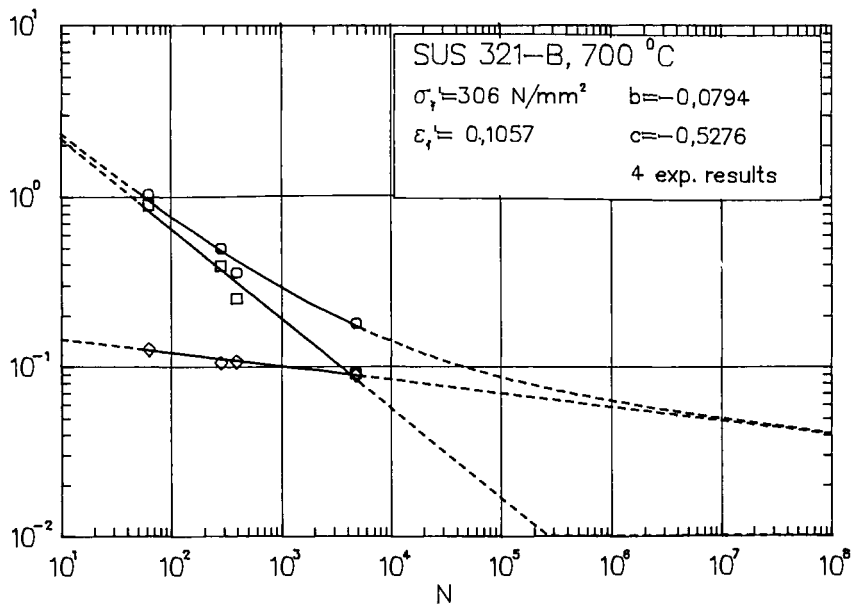
R _{p0.2}	=	169	N/mm ²	K'	=	423	N/mm ²
σ_g	=	92	N/mm ²	n'	=	0.148	-
ϵ_g	=	0.058	%	σ'_f	=	306	N/mm ²
N _r	=	4303	cycles	ϵ'_f	=	0.106	-
T _{σ}	=	1.095	-	b	=	-0.079	-
T _{ϵ_p}	=	1.593	-	c	=	-0.528	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Cyclic test

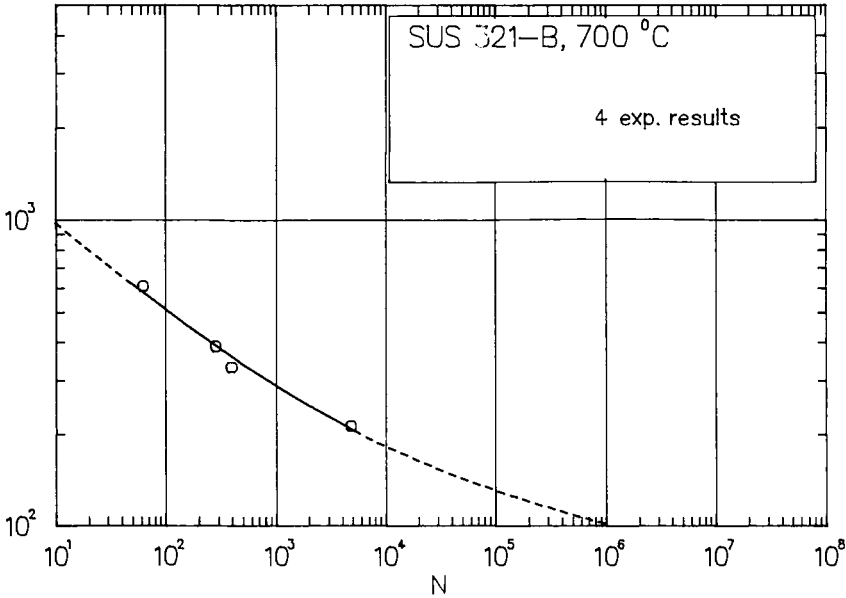
Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.41 (%/min)
 Waveform : triangular

Failure criterion : complete rupture
 σ/s -values valid for : half failure life
 Remarks : Young's modulus estimated

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUS 321-B, 700^oC

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	214.4	0.0	1.0300	62.0
2.0000	178.1	0.0	0.5000	283.0
3.0000	181.5	0.0	0.3600	392.0
4.0000	150.1	0.0	0.1800	4771.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water, 750°C/24h air
Test temperature : +700°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	174000	N/mm ²	ν	=	-
R _{p0.2}	=	129	N/mm ²	K	=	N/mm ²
R _m	=	255	N/mm ²	n	=	-
A ₅	=	48	%	σ_f	=	N/mm ²
Z	=	55	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	182	N/mm ²	K'	=	636	N/mm ²
σ_g	=	85	N/mm ²	n'	=	0.202	-
ϵ_g	=	0.053	%	σ'_f	=	545	N/mm ²
N _T	=	15314	cycles	ϵ'_f	=	0.466	-
T _{σ}	=	1.031	-	b	=	-0.122	-
T _{ep}	=	1.155	-	c	=	-0.606	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

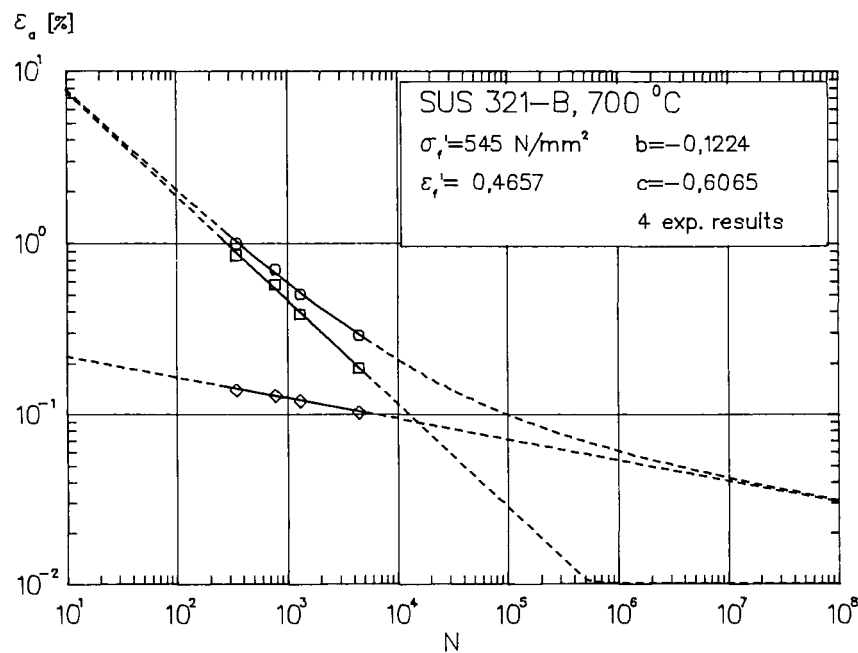
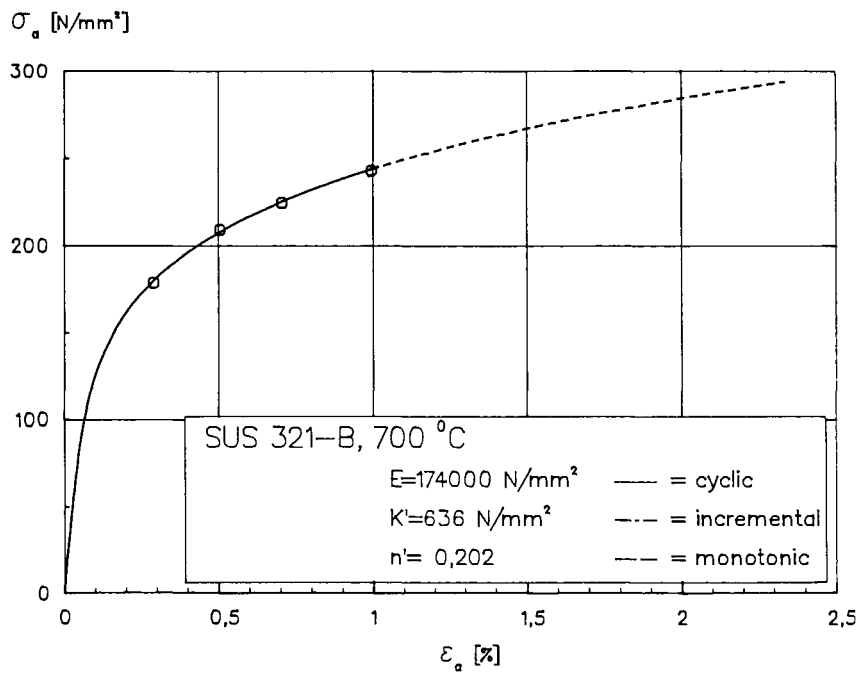
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

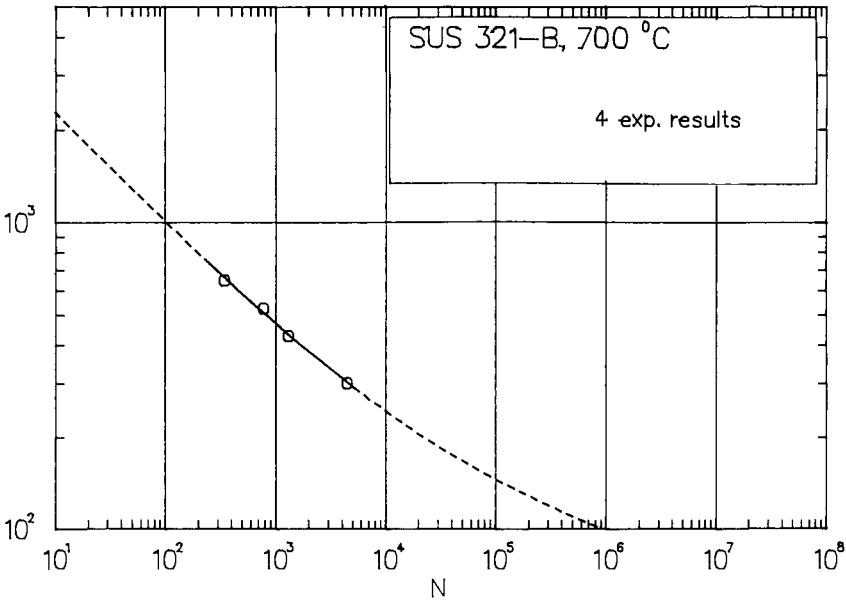
Cyclic test

Loading condition : total strain control, R_c = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 321-B, 700⁰C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	242.8	0.0	0.9950	345.0
2.0000	224.6	0.0	0.7050	779.0
3.0000	208.9	0.0	0.5050	1298.0
4.0000	178.5	0.0	0.2900	4410.0

X 10 CrNiTi 18 9	1.4541	SUS 321-B
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Heat treatment : 1050°C water, 1200°C/30' water, 750°C/24h air
Test temperature : +700°C
Semifinished material : bar, Ø 22 mm
Reference : [4,31]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Ti
<0.05	0.60	1.84	0.024	0.014	10.00	18.95	0.45

Monotonic properties

E	=	174000	N/mm ²	ν	=	-
R _{p0.2}	=	129	N/mm ²	K	=	N/mm ²
R _m	=	255	N/mm ²	n	=	-
A ₅	=	48	%	σ_f	=	N/mm ²
Z	=	55	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	165	N/mm ²	K'	=	355	N/mm ²
σ_g	=	98	N/mm ²	n'	=	0.123	-
ϵ_g	=	0.059	%	σ'_f	=	300	N/mm ²
N _T	=	6930	cycles	ϵ'_f	=	0.252	-
T _{σ}	=	1.051	-	b	=	-0.074	-
T _{ϵ_p}	=	1.602	-	c	=	-0.596	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

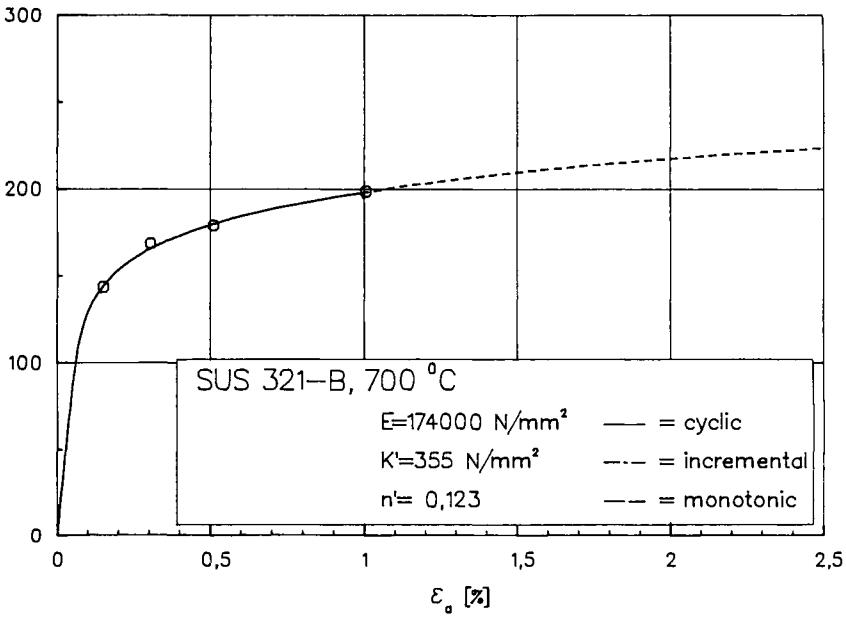
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

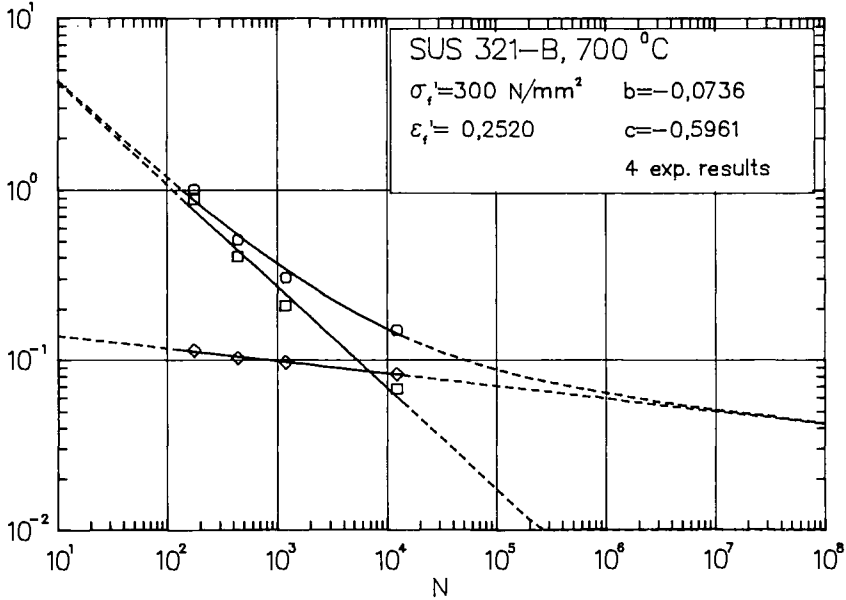
Loading condition : total strain control, R _{ϵ} = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.40 (%/min)
Waveform : triangular

Remarks :

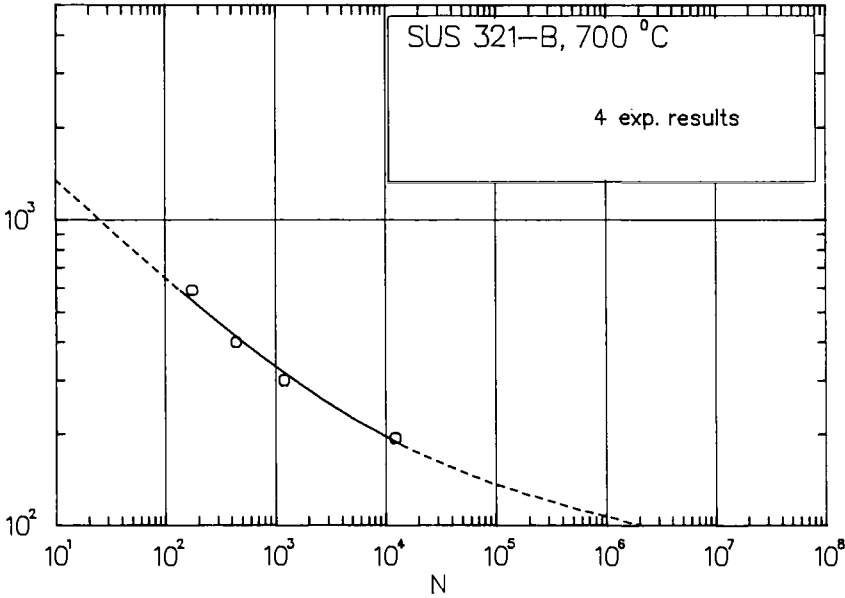
σ_a [N/mm²]



ϵ_a [%]



PSWT [N/mm²]



Material : SUS 321-B, 700⁰C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	198.6	0.0	1.0050	175.0
2.0000	179.0	0.0	0.5100	438.0
3.0000	168.7	0.0	0.3050	1191.0
4.0000	143.7	0.0	0.1500	12203.0

X 10 CrNiNb 18 9	1.4550	SUS 347-B
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Heat treatment : 1050°C/50' water, 1100°C/1h water
Test temperature : +23°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.066	0.62	1.39	0.026	0.012	9.68	17.22	0.19	0.12	0.70

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	237	N/mm ²	K	=	N/mm ²
R _m	=	615	N/mm ²	n	=	-
A ₅	=	52	%	σ _f	=	N/mm ²
Z	=	72	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	271	N/mm ²	K'	=	1967	N/mm ²
σ _g	=	160	N/mm ²	n'	=	0.319	-
ε _g	=	0.113	%	σ' _f	=	1005	N/mm ²
N _T	=	128639	cycles	e' _f	=	0.127	-
T _σ	=	1.121	-	b	=	-0.121	-
T _{εp}	=	1.178	-	c	=	-0.384	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness : HV 10 : 150

Microstructure : JIS G 0551 grain size: 9 (70%) + 5 (30%)

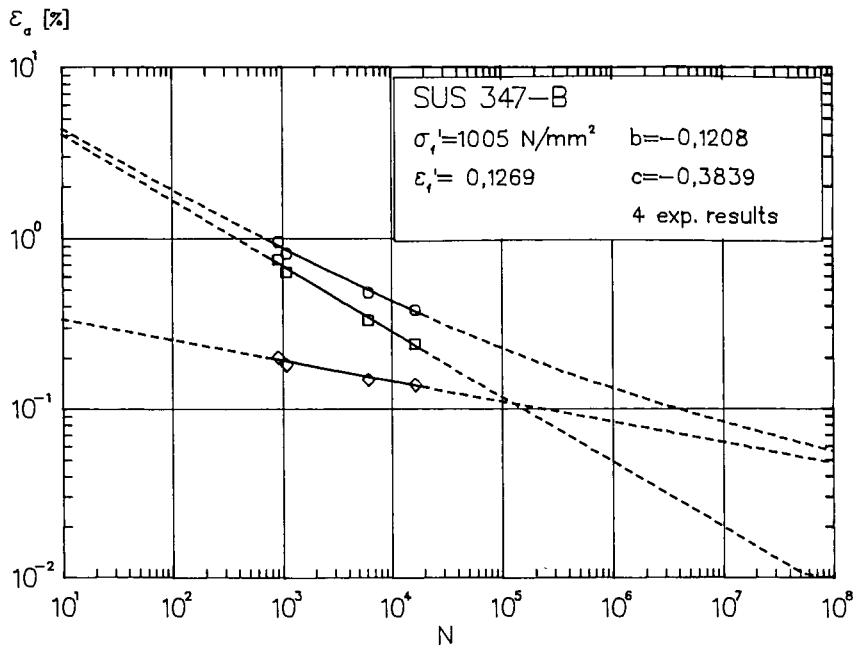
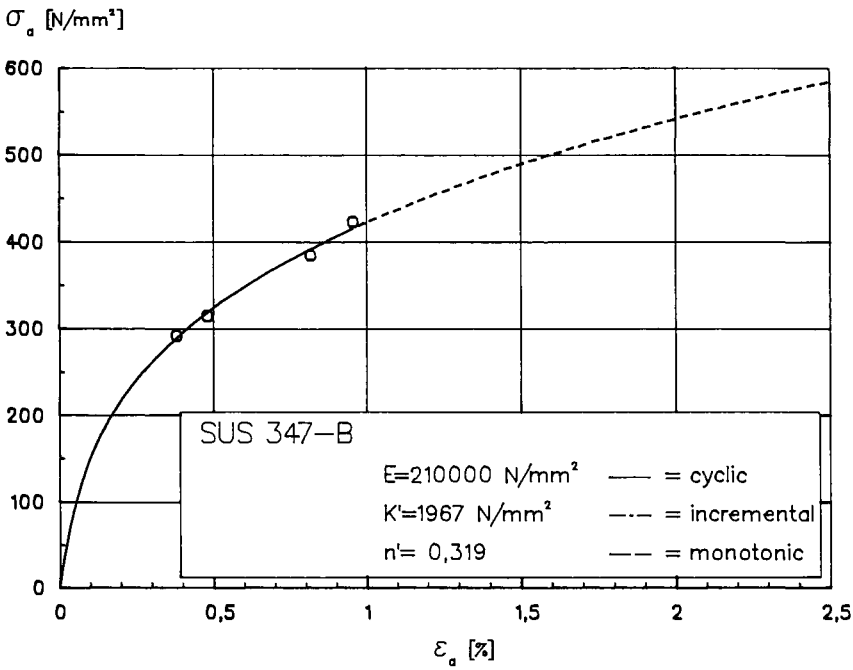
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

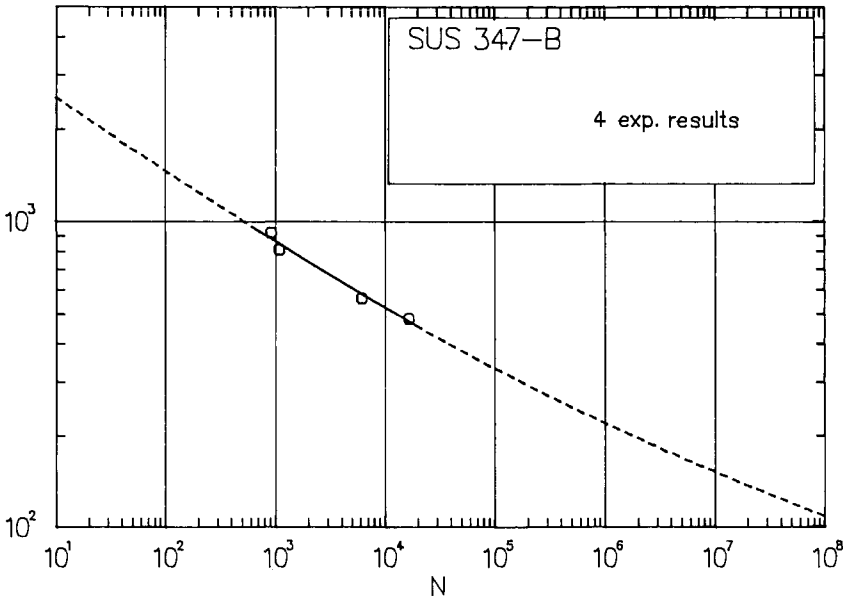
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 39 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 347-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	422.8	0.0	0.9550	911.0
2.0000	384.1	0.0	0.8150	1086.0
3.0000	314.4	0.0	0.4800	6117.0
4.0000	291.9	0.0	0.3800	16382.0

X 10 CrNiNb 18 9	1.4550	SUS 347-B
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Heat treatment : 1050°C/50' water, 1100°C/1h water
Test temperature : +23°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.066	0.62	1.39	0.026	0.012	9.68	17.22	0.19	0.12	0.70

Monotonic Properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	237	N/mm ²	K	=	N/mm ²
R _m	=	615	N/mm ²	n	=	-
A ₅	=	52	%	σ _f	=	N/mm ²
Z	=	72	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	276	N/mm ²	K'	=	1667	N/mm ²
σ _g	=	164	N/mm ²	n'	=	0.289	-
ε _g	=	0.109	%	σ' _f	=	1060	N/mm ²
N _T	=	99111	cycles	ε' _f	=	0.230	-
T _σ	=	1.164	-	b	=	-0.123	-
T _{εp}	=	1.221	-	c	=	-0.436	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ε-values valid for : half failure life

Remarks : Young's modulus estimated

Hardness : HV 10 : 150

Microstructure : JIS G 0551 grain size: 9 (70%) + 5 (30%)

Monotonic test

Loading condition :

Specimen : cylindrical, Ø 10 mm

Specimen location : in rolling direction

Gauge length : 50 mm

Testing machine :

Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

Loading condition : total strain control, R_ε = -1

Specimen : cylindrical, Ø 6 mm

Surface : mechanically polished

Specimen location : in rolling direction

Gauge length : 15 mm

Testing machine : servohydraulic, max. 50 kN

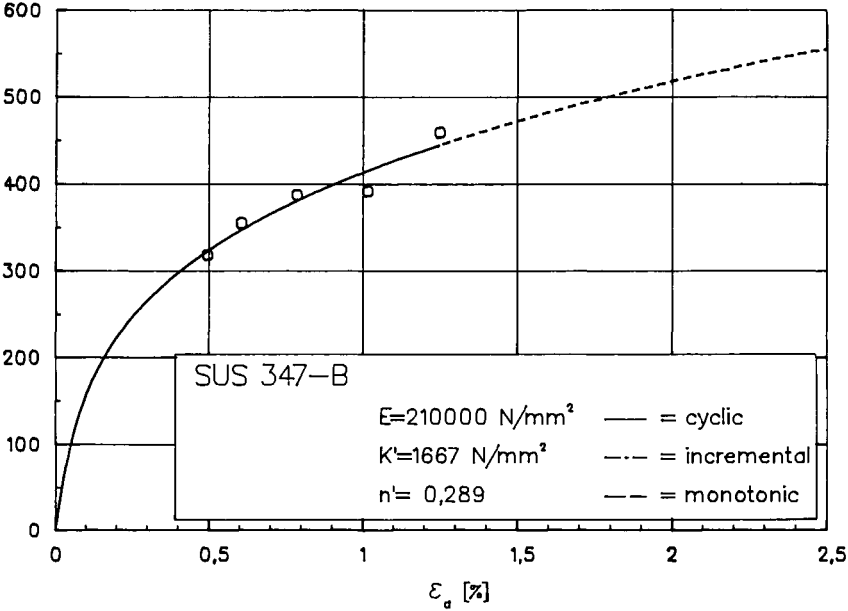
Frequency :

Strain rate : 4.1 (%/min)

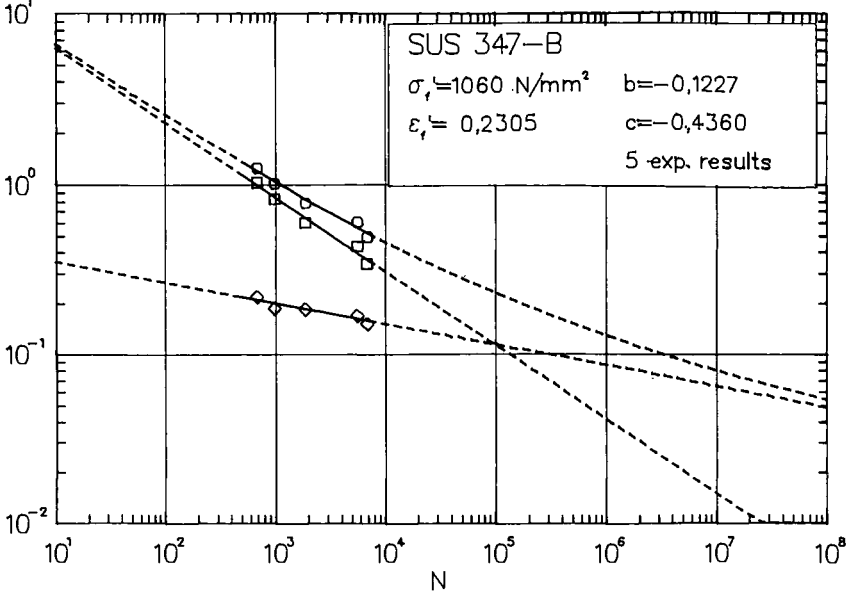
Waveform : triangular

Remarks :

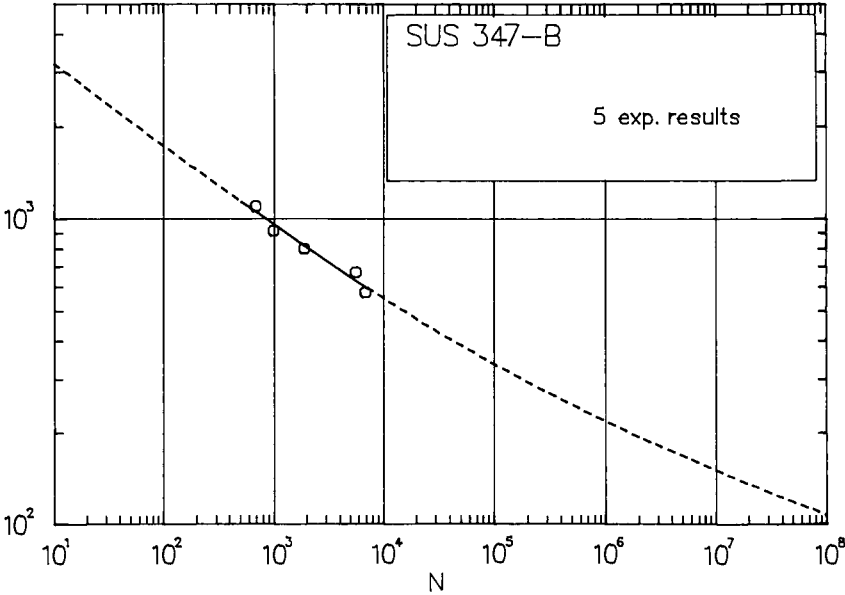
σ_a [N/mm²]



ϵ_a [%]



PSWT [N/mm²]



Material : SUS 347-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	459.1	0.0	1.2500	680.0
2.0000	391.4	0.0	1.0150	984.0
3.0000	387.5	0.0	0.7850	1868.0
4.0000	354.6	0.0	0.6050	5570.0
5.0000	318.3	0.0	0.4950	6842.0

X 10 CrNiNb 18 9	1.4550	SUS 347-B
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Heat treatment : 1050°C/50' water, 1100°C/1h water
Test temperature : +450°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.066	0.62	1.39	0.026	0.012	9.68	17.22	0.19	0.12	0.70

Monotonic properties

E	=	172000	N/mm ²	ν	=	-
R _{p0.2}	=	157	N/mm ²	K	=	N/mm ²
R _m	=	449	N/mm ²	n	=	-
A ₅	=	37	%	σ_f	=	N/mm ²
Z	=	63	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	202	N/mm ²	K'	=	3151	N/mm ²
σ_g	=	93	N/mm ²	n'	=	0.442	-
ϵ_g	=	0.089	%	σ'_f	=	1189	N/mm ²
N _T	=	255872	cycles	ϵ'_f	=	0.110	-
T _{σ}	=	1.073	-	b	=	-0.168	-
T _{ϵ_p}	=	1.204	-	c	=	-0.378	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

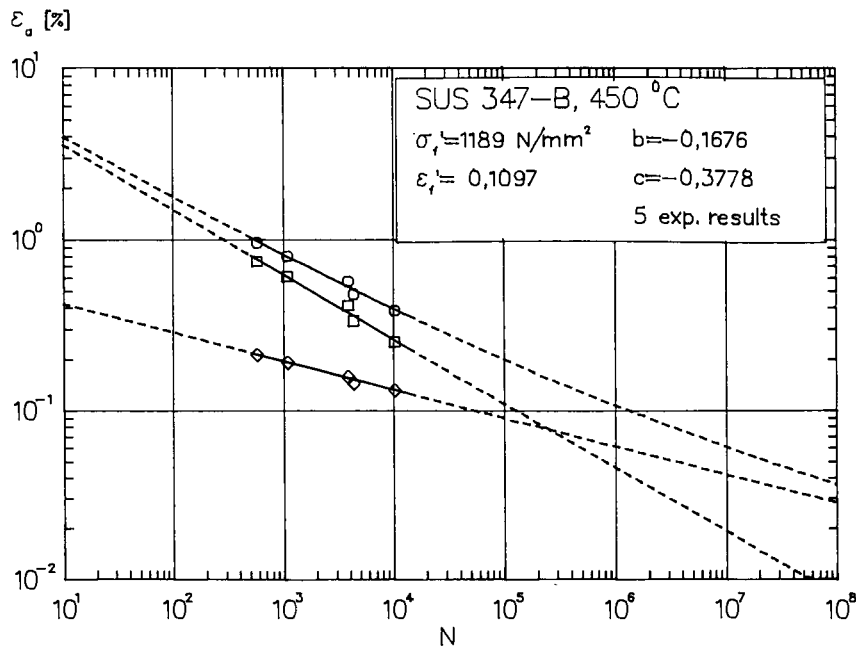
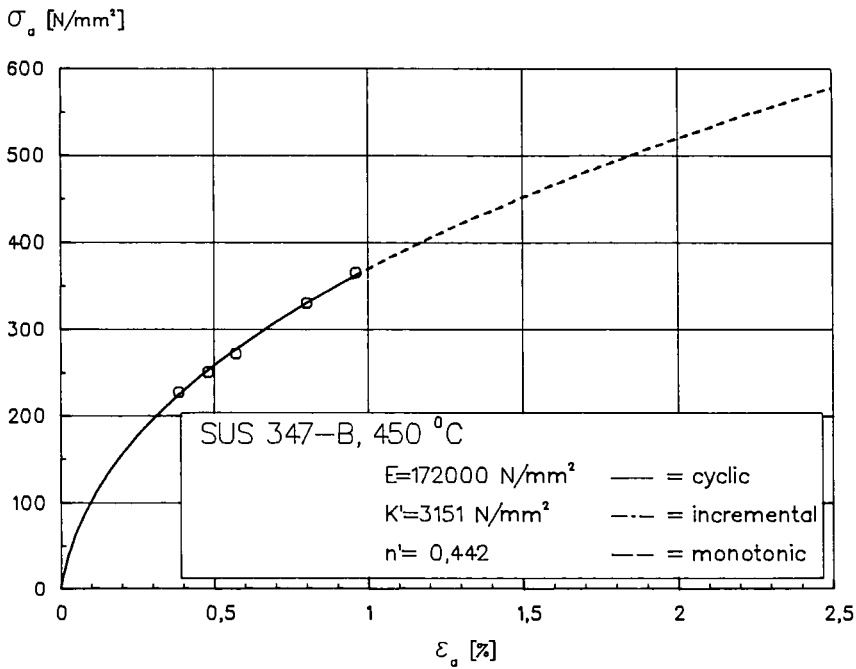
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

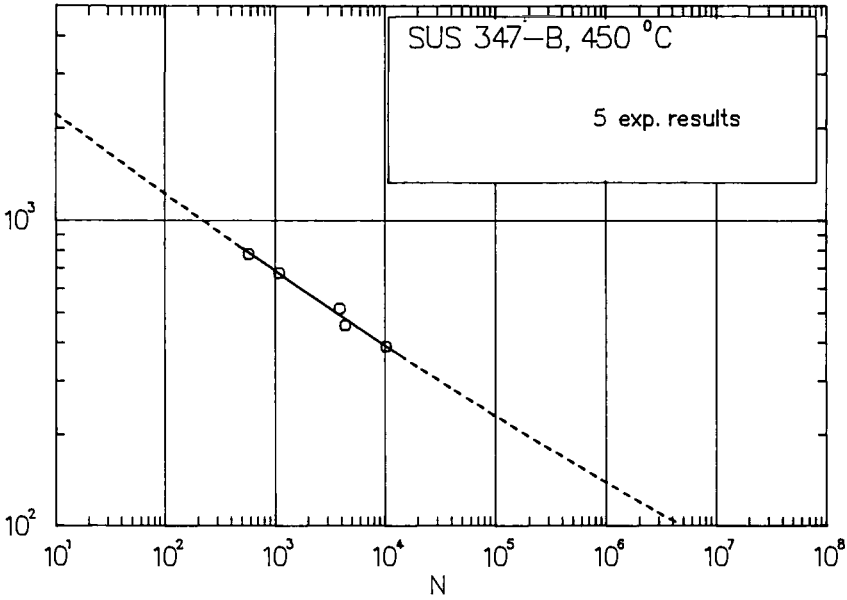
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 39 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 347-B, 450 °C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	364.9	0.0	0.9600	573.0
2.0000	330.1	0.0	0.8000	1089.0
3.0000	272.2	0.0	0.5700	3865.0
4.0000	250.6	0.0	0.4800	4343.0
5.0000	227.6	0.0	0.3850	10221.0

X 10 CrNiNb 18 9	1.4550	SUS 347-B
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Heat treatment : 1050°C/50' water, 1100°C/1h water
Test temperature : +450°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.066	0.62	1.39	0.026	0.012	9.68	17.22	0.19	0.12	0.70

Monotonic properties

E	=	172000	N/mm ²	ν	=	-
R _{p0.2}	=	157	N/mm ²	K	=	N/mm ²
R _m	=	449	N/mm ²	n	=	-
A ₅	=	37	%	σ_f	=	N/mm ²
Z	=	63	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	249	N/mm ²	K'	=	2155	N/mm ²
σ_g	=	110	N/mm ²	n'	=	0.347	-
ϵ_g	=	0.084	%	σ'_f	=	1158	N/mm ²
N _T	=	33381	cycles	ϵ'_f	=	0.159	-
T _{σ}	=	1.036	-	b	=	-0.155	-
T _{ϵ}	=	1.211	-	c	=	-0.439	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

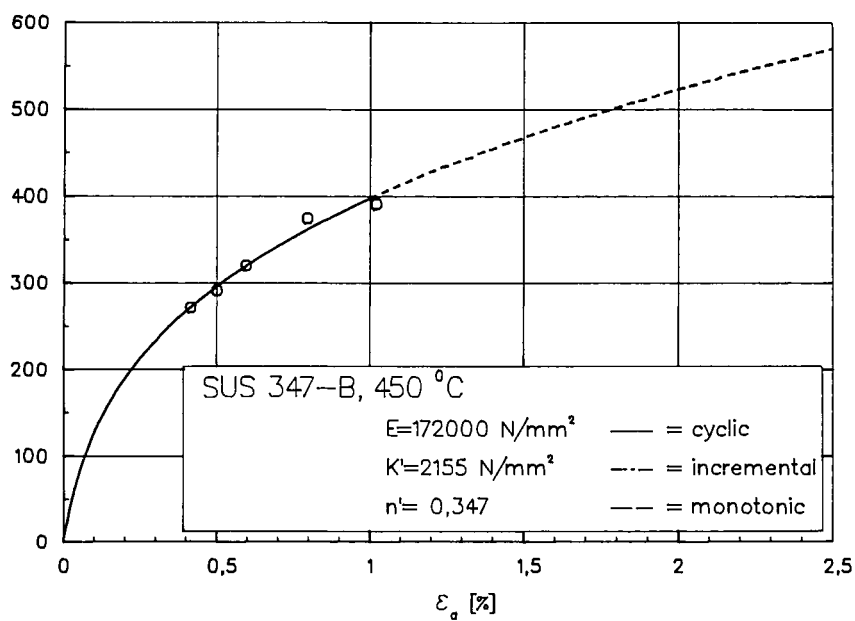
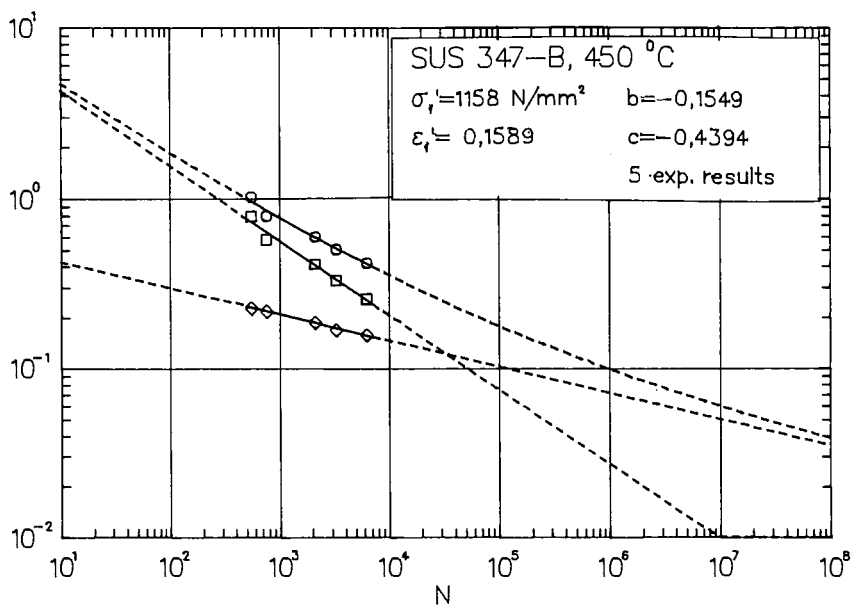
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

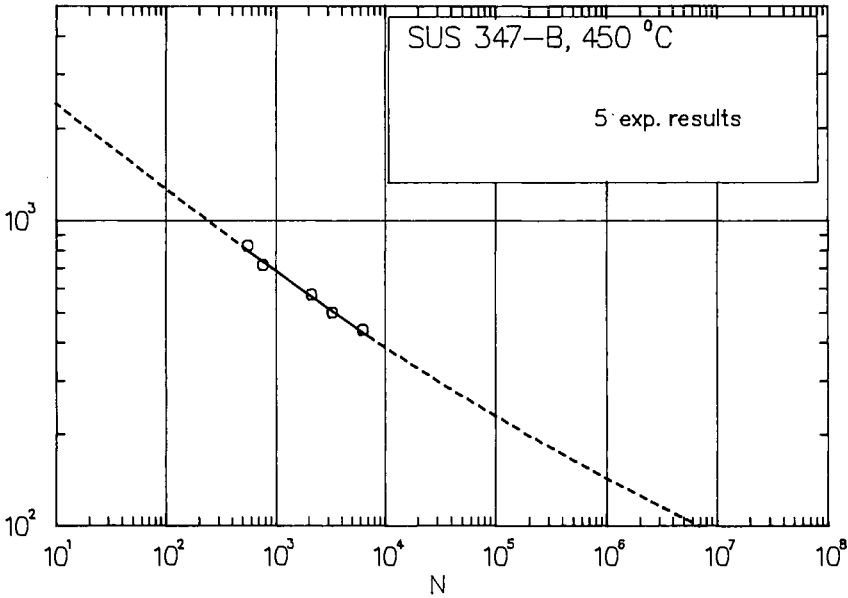
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.40 (%/min)
Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUS 347-B, 450 °C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	390.9	0.0	1.0200	552.0
2.0000	374.3	0.0	0.7950	760.0
3.0000	320.3	0.0	0.5950	2108.0
4.0000	291.4	0.0	0.5000	3276.0
5.0000	271.7	0.0	0.4150	6238.0

X 10 CrNiNb 18 9	1.4550	SUS 347-B
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Heat treatment : 1050°C/50' water, 1100°C/1h water
 Test temperature : +600°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.066	0.62	1.39	0.026	0.012	9.68	17.22	0.19	0.12	0.70

Monotonic properties

E	=	169400	N/mm ²	ν	=	-
R _{p0.2}	=	155	N/mm ²	K	=	N/mm ²
R _m	=	409	N/mm ²	n	=	-
A ₅	=	36	%	σ _f	=	N/mm ²
Z	=	63	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	235	N/mm ²	K'	=	1547	N/mm ²
σ _g	=	117	N/mm ²	n'	=	0.303	-
ε _g	=	0.088	%	σ' _f	=	863	N/mm ²
N _T	=	30450	cycles	ε' _f	=	0.155	-
T _σ	=	1.144	-	b	=	-0.131	-
T _{εp}	=	1.058	-	c	=	-0.441	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks : Young's modulus estimated

hardness :

Microstructure :

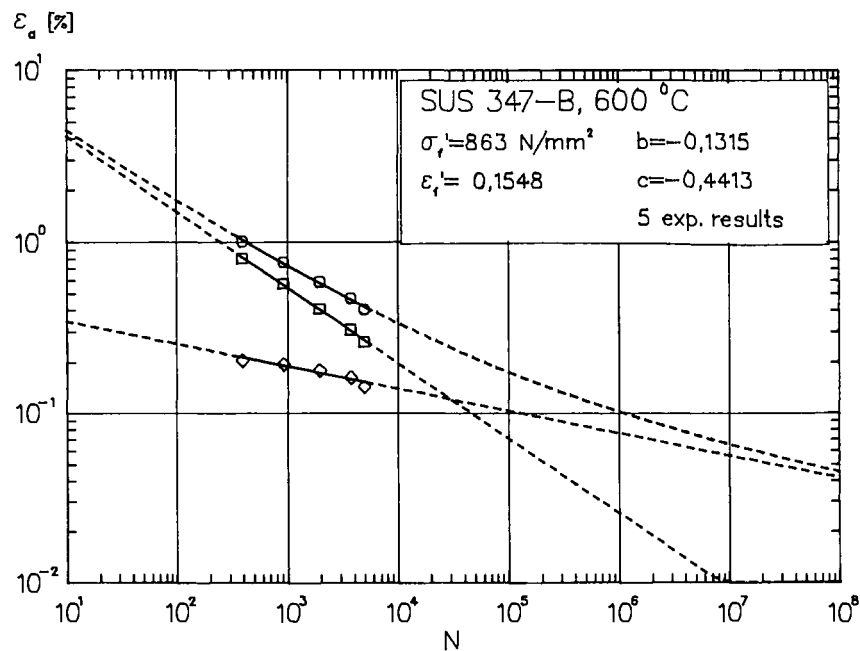
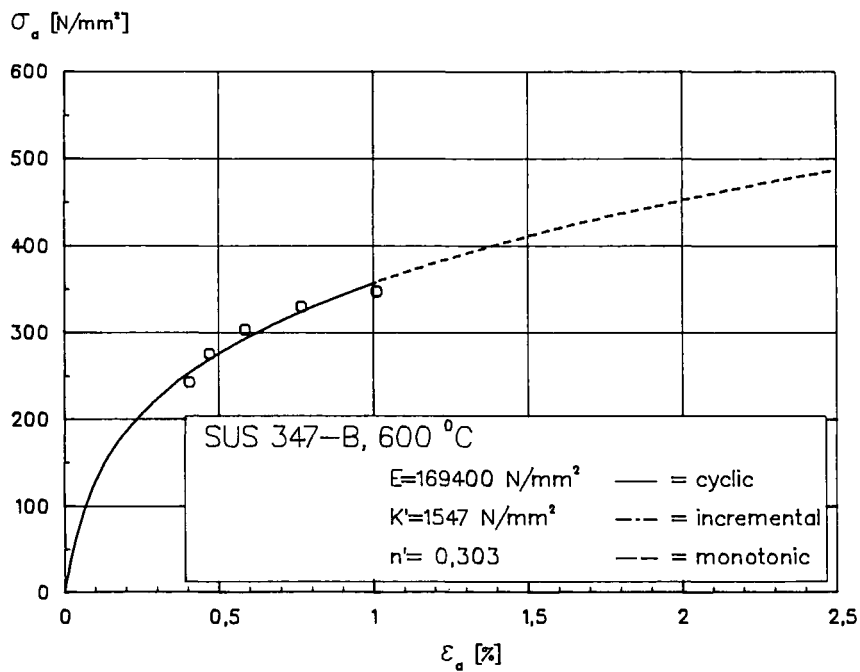
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

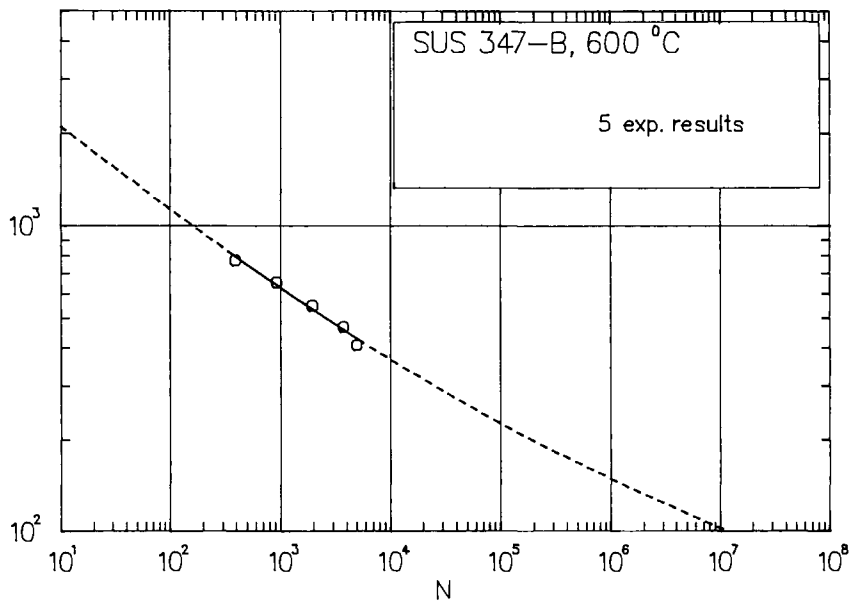
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 347-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	347.3	0.0	1.0100	391.0
2.0000	329.6	0.0	0.7650	924.0
3.0000	303.1	0.0	0.5850	1945.0
4.0000	275.7	0.0	0.4700	3717.0
5.0000	242.8	0.0	0.4050	4917.0

X 10 CrNiNb 18 9	1.4550	SUS 347-B
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Heat treatment : 1050°C/50' water, 1100°C/1h water
Test temperature : +600°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.066	0.62	1.39	0.026	0.012	9.68	17.22	0.19	0.12	0.70

Monotonic properties

E	=	196400	N/mm ²	ν	=	-
R _{p0.2}	=	155	N/mm ²	K	=	N/mm ²
R _m	=	409	N/mm ²	n	=	-
A ₅	=	36	%	σ_f	=	N/mm ²
Z	=	63	%	e_f	=	-

Cyclic properties

R' _{p0.2}	=	256	N/mm ²	K'	=	1028	N/mm ²
σ_g	=	176	N/mm ²	n'	=	0.224	-
ϵ_g	=	0.125	%	σ'_f	=	559	N/mm ²
N _T	=	65849	cycles	ϵ'_f	=	0.069	-
T _{σ}	=	1.170	-	b	=	-0.076	-
T _{ep}	=	1.790	-	c	=	-0.347	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

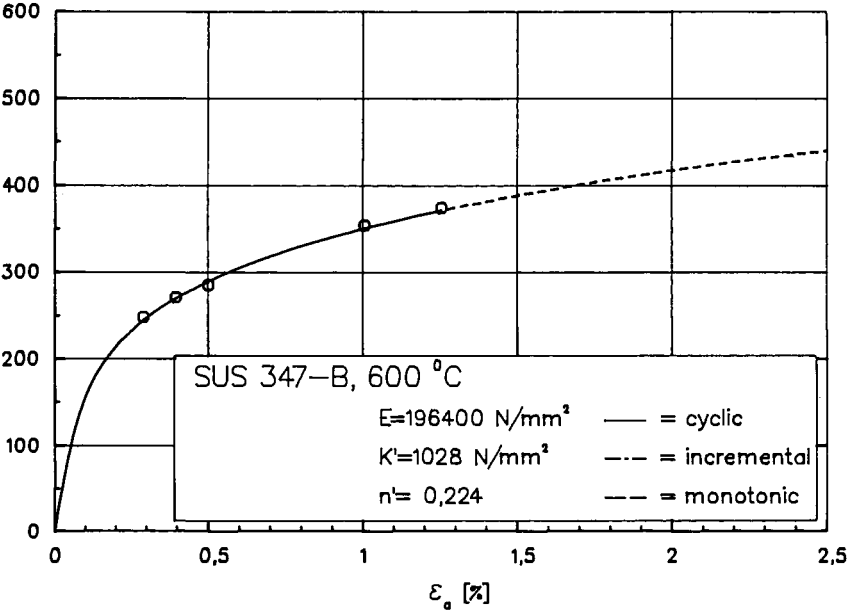
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

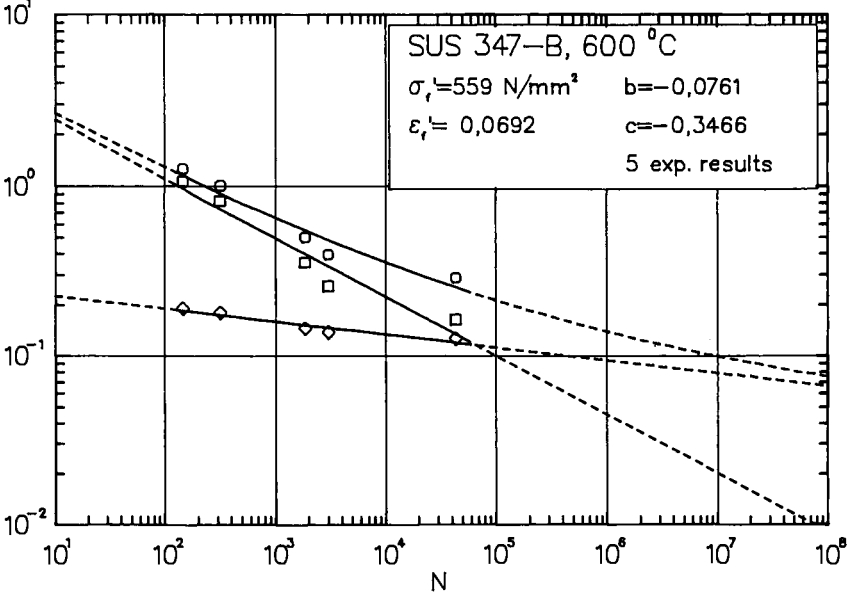
Loading condition : total strain control, R _{ϵ} = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 4.0 (%/min)
Waveform : triangular

Remarks :

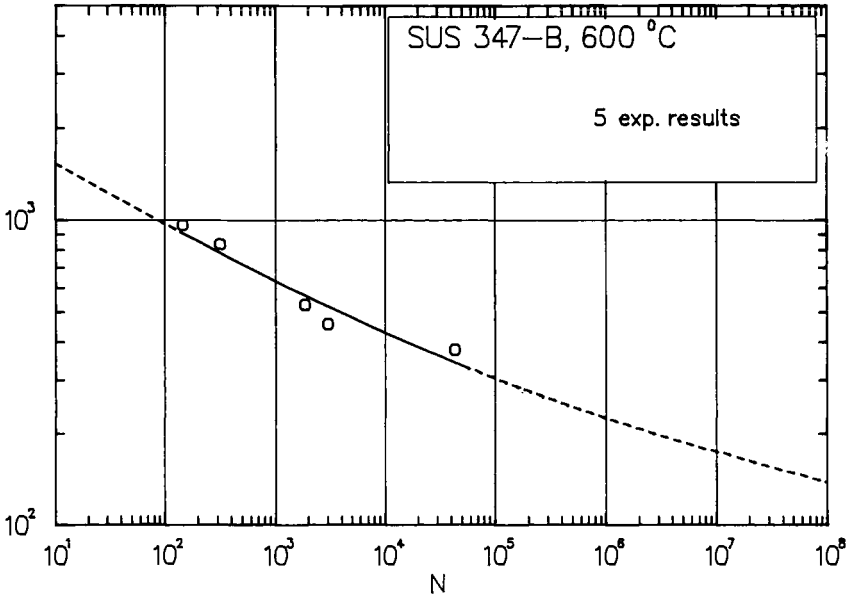
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 347-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	374.3	0.0	1.2550	145.0
2.0000	353.6	0.0	1.0050	317.0
3.0000	285.5	0.0	0.5000	1849.0
4.0000	270.8	0.0	0.3950	3002.0
5.0000	248.2	0.0	0.2900	43068.0

X 10 CrNiNb 18 9	1.4550	SUS 347-B
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Heat treatment : 1050°C/50' water, 1100°C/1h water
 Test temperature : +600°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.3]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.066	0.62	1.39	0.026	0.012	9.68	17.22	0.19	0.12	0.70

Monotonic properties

E	=	196400	N/mm ²	ν	=	-
R _{p0.2}	=	155	N/mm ²	K	=	N/mm ²
R _m	=	409	N/mm ²	n	=	-
A ₅	=	36	%	σ_f	=	N/mm ²
Z	=	63	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	262	N/mm ²	K'	=	820	N/mm ²
σ_g	=	167	N/mm ²	n'	=	0.184	-
ϵ_g	=	0.103	%	σ'_f	=	508	N/mm ²
N _T	=	16165	cycles	ϵ'_f	=	0.071	-
T _{σ}	=	1.051	-	b	=	-0.073	-
T _{ϵ_p}	=	1.172	-	c	=	-0.392	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

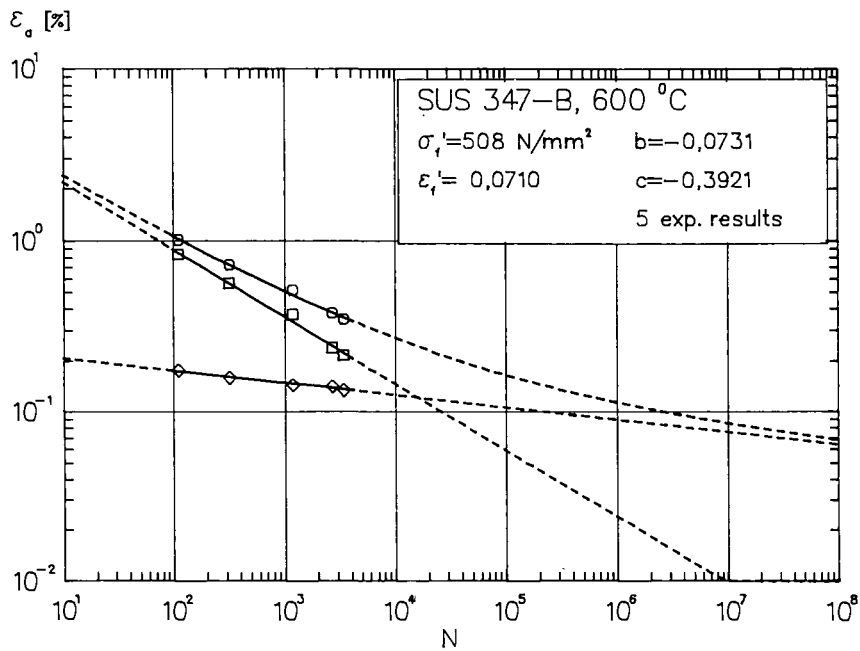
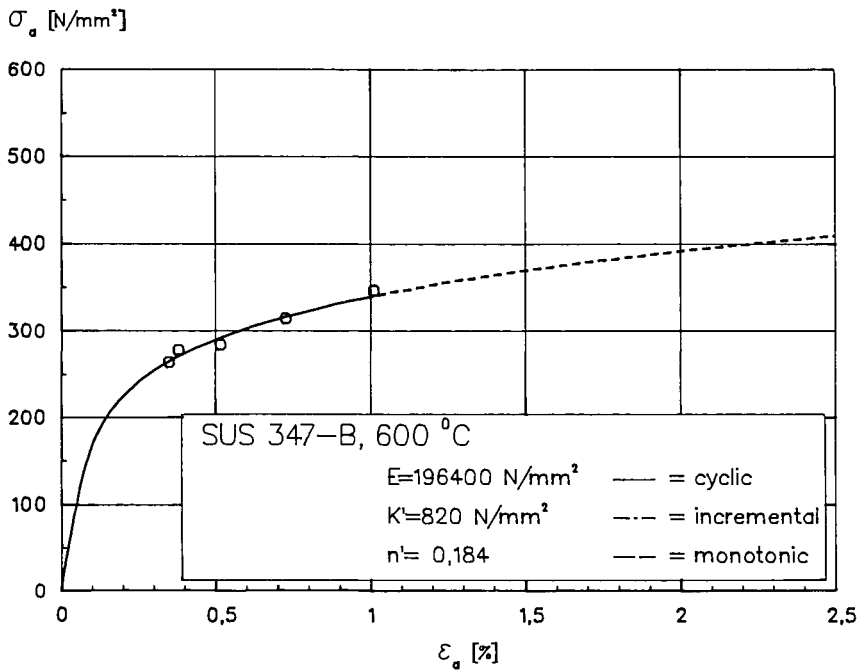
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

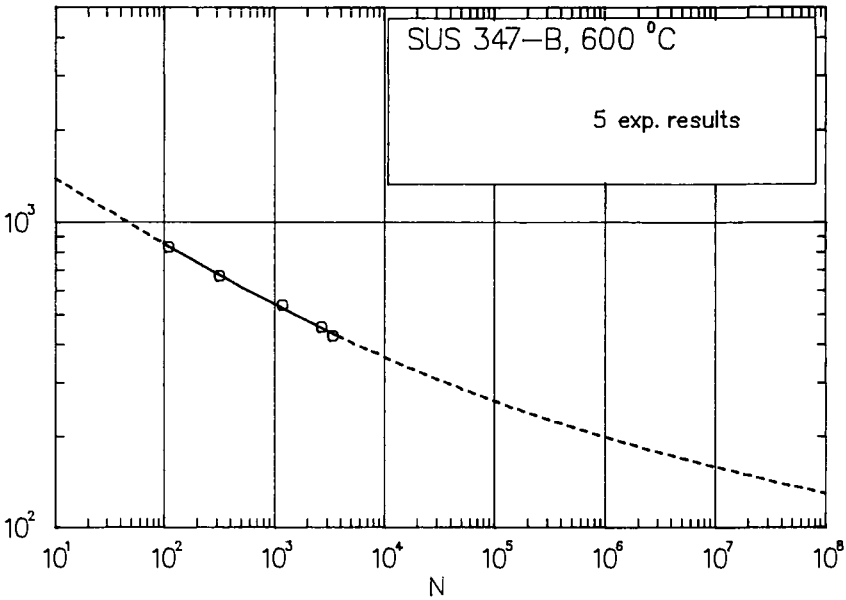
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.40 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 347-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	345.8	0.0	1.0100	110.0
2.0000	313.9	0.0	0.7250	318.0
3.0000	284.0	0.0	0.5150	1179.0
4.0000	278.1	0.0	0.3800	2672.0
5.0000	263.9	0.0	0.3500	3390.0

X 10 CrNiNb 18 9	1.4550	SUS 347-B
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Heat treatment : 1050°C/50' water, 1100°C/1h water
 Test temperature : +700°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.31]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.066	0.62	1.39	0.026	0.012	9.68	17.22	0.19	0.12	0.70

Monotonic properties

E	=	168750	N/mm ²	ν	=	-
R _{p0.2}	=	160	N/mm ²	K	=	N/mm ²
R _m	=	319	N/mm ²	n	=	-
A ₅	=	48	%	σ_f	=	N/mm ²
Z	=	61	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	233	N/mm ²	K'	=	593	N/mm ²
σ_g	=	157	N/mm ²	n'	=	0.151	-
ϵ_g	=	0.108	%	σ'_f	=	440	N/mm ²
N _T	=	16514	cycles	ϵ'_f	=	0.135	-
T _{σ}	=	1.111	-	b	=	-0.068	-
T _{ϵ_p}	=	1.249	-	c	=	-0.447	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

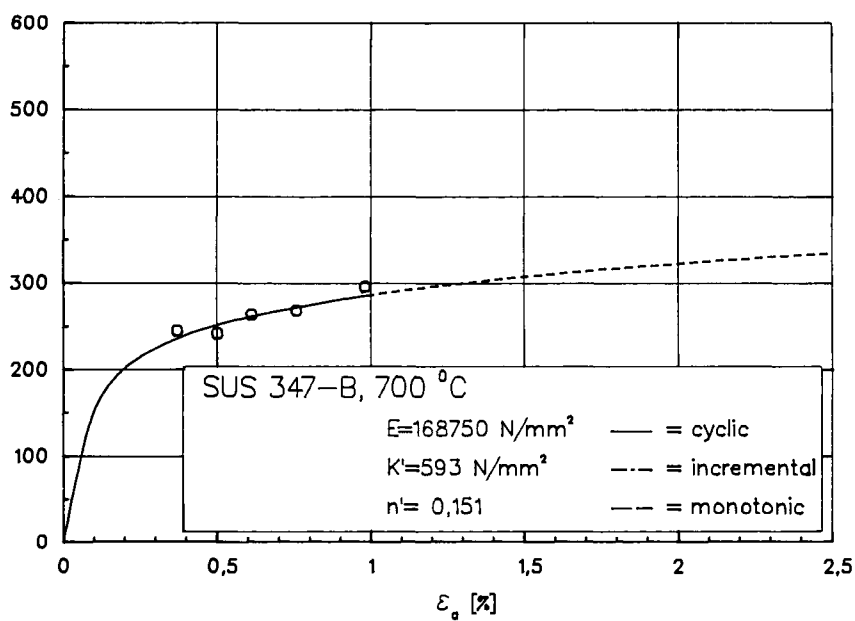
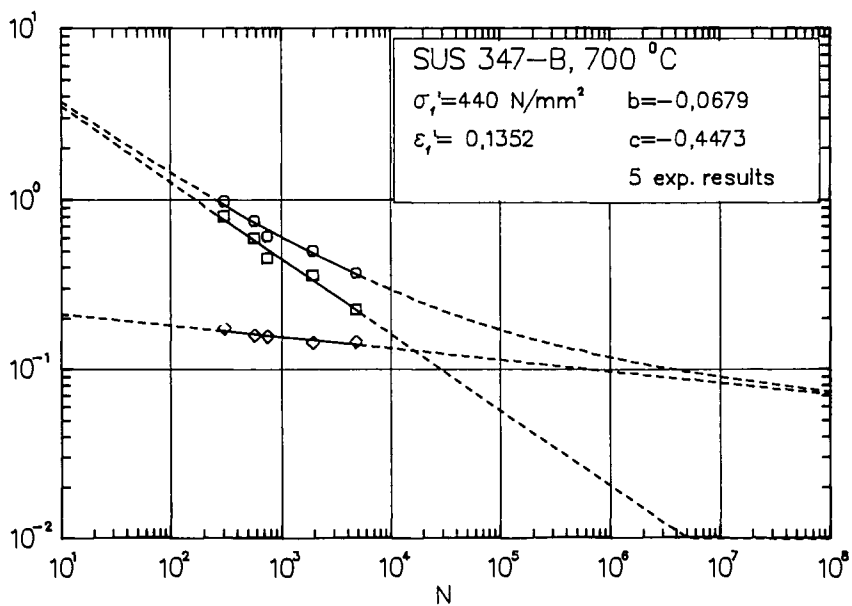
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

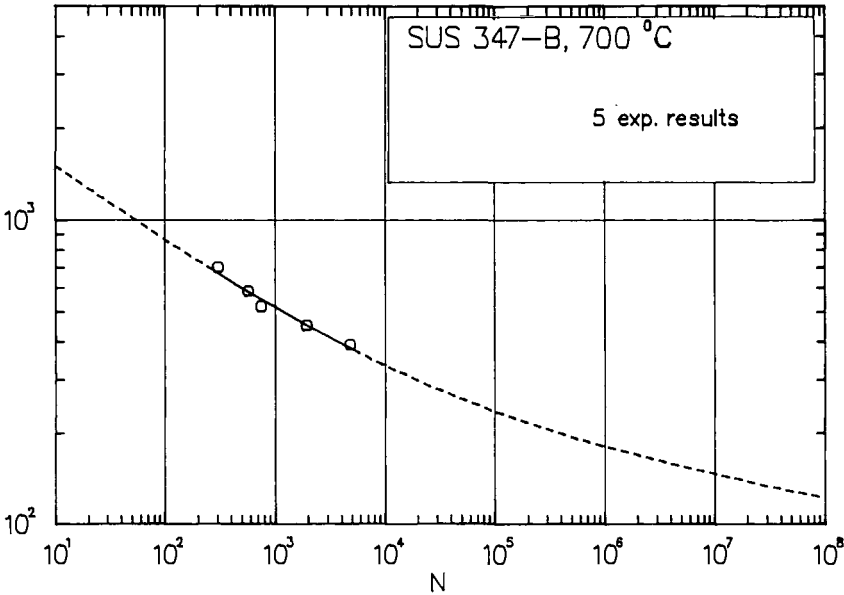
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks :

σ_e [N/mm²] ε_e [%]

PSWT [N/mm²]



Material : SUS 347-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	296.3	0.0	0.9800	303.0
2.0000	268.3	0.0	0.7550	570.0
3.0000	263.9	0.0	0.6100	745.0
4.0000	241.8	0.0	0.5000	1925.0
5.0000	245.3	0.0	0.3700	4762.0

X 10 CrNiNb 18 9	1.4550	SUS 347-B
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Heat treatment : 1050°C/50' water, 1100°C/1h water
Test temperature : +700°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.066	0.62	1.39	0.026	0.012	9.68	17.22	0.19	0.12	0.70

Monotonic Properties

E	=	168750	N/mm ²	ν	=	-
R _{p0.2}	=	160	N/mm ²	K	=	N/mm ²
R _m	=	319	N/mm ²	n	=	-
A ₅	=	48	%	σ _f	=	N/mm ²
Z	=	61	%	ε _f	=	-

Cyclic Properties

R' _{p0.2}	=	218	N/mm ²	K'	=	704	N/mm ²
σ _g	=	141	N/mm ²	n'	=	0.189	-
ε _g	=	0.104	%	σ' _f	=	428	N/mm ²
N _T	=	21881	cycles	ε' _f	=	0.070	-
T _σ	=	1.077	-	b	=	-0.073	-
T _{εp}	=	1.656	-	c	=	-0.384	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

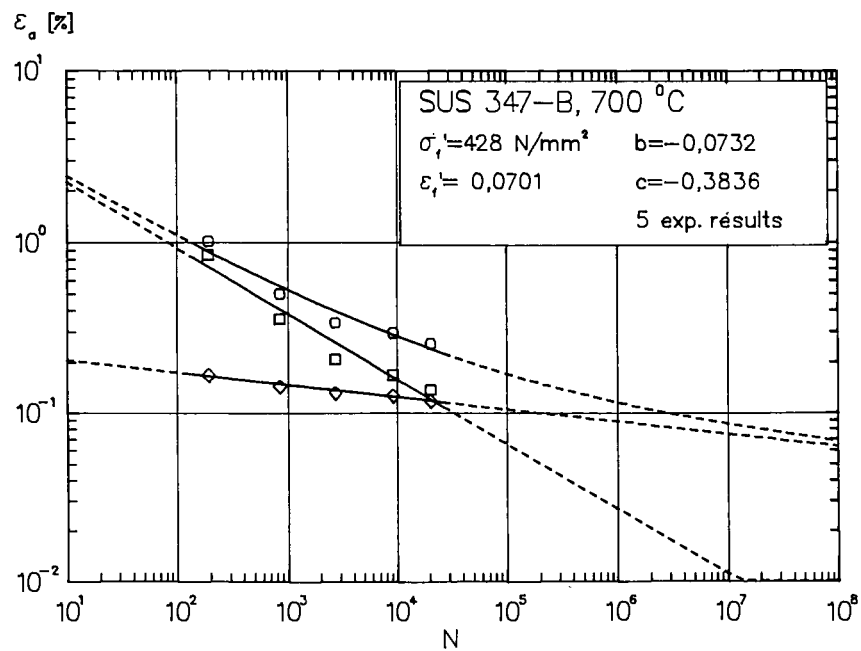
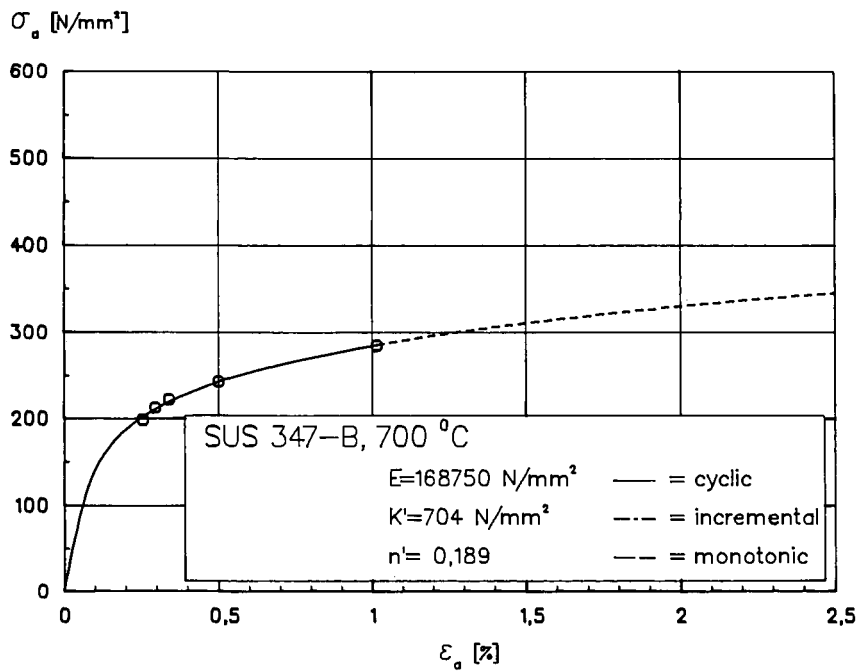
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

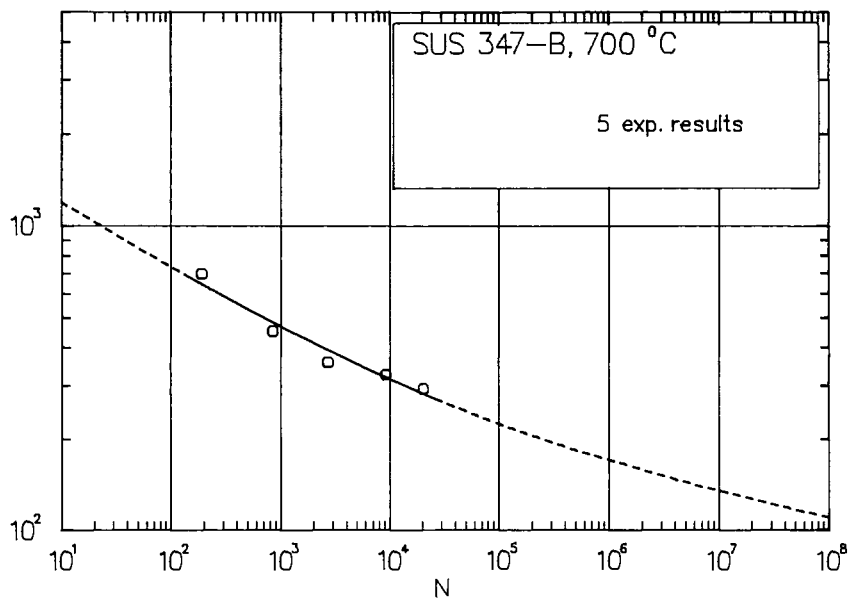
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 4.0 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 347-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	284.5	0.0	1.0150	191.0
2.0000	242.8	0.0	0.5000	843.0
3.0000	222.2	0.0	0.3400	2707.0
4.0000	212.9	0.0	0.2950	9160.0
5.0000	198.6	0.0	0.2550	20375.0

X 10 CrNiNb 18 9	1.4550	SUS 347-B
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Heat treatment : 1050°C/50' water, 1100°C/1h water
Test temperature : +700°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.066	0.62	1.39	0.026	0.012	9.68	17.22	0.19	0.12	0.70

Monotonic properties

E	=	168750	N/mm ²	v	=	-
R _{p0.2}	=	160	N/mm ²	K	=	N/mm ²
R _m	=	319	N/mm ²	n	=	-
A ₅	=	48	%	σ _f	=	N/mm ²
Z	=	61	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	200	N/mm ²	K'	=	676	N/mm ²
σ _g	=	116	N/mm ²	n'	=	0.196	-
ε _g	=	0.082	%	σ' _f	=	412	N/mm ²
N _T	=	14921	cycles	ε' _f	=	0.073	-
T _σ	=	1.088	-	b	=	-0.083	-
T _{εp}	=	1.684	-	c	=	-0.414	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

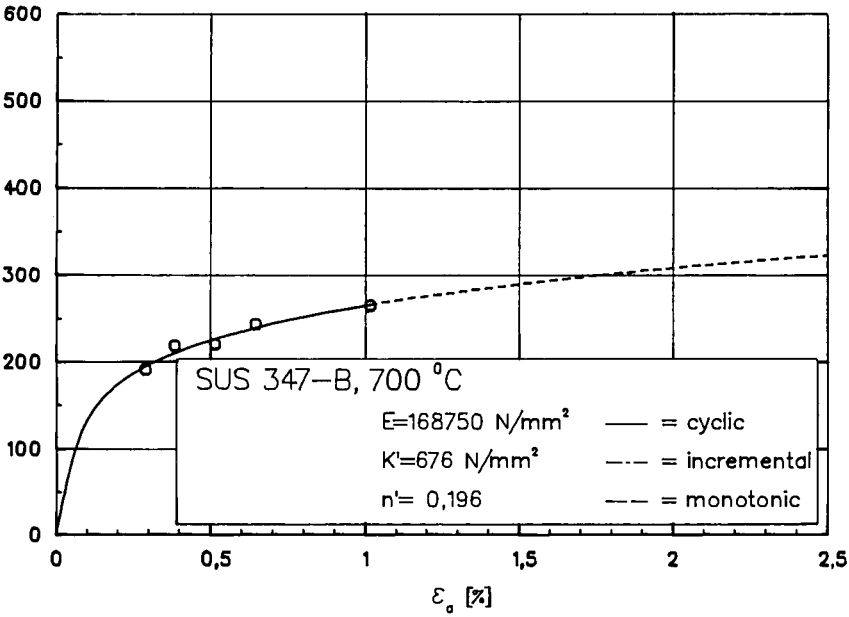
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

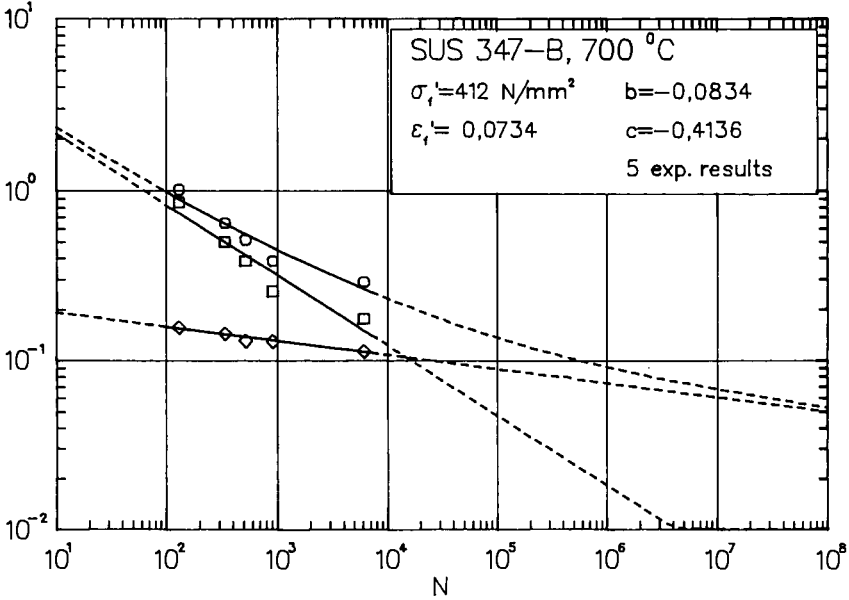
Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.40 (%/min)
Waveform : triangular

Remarks :

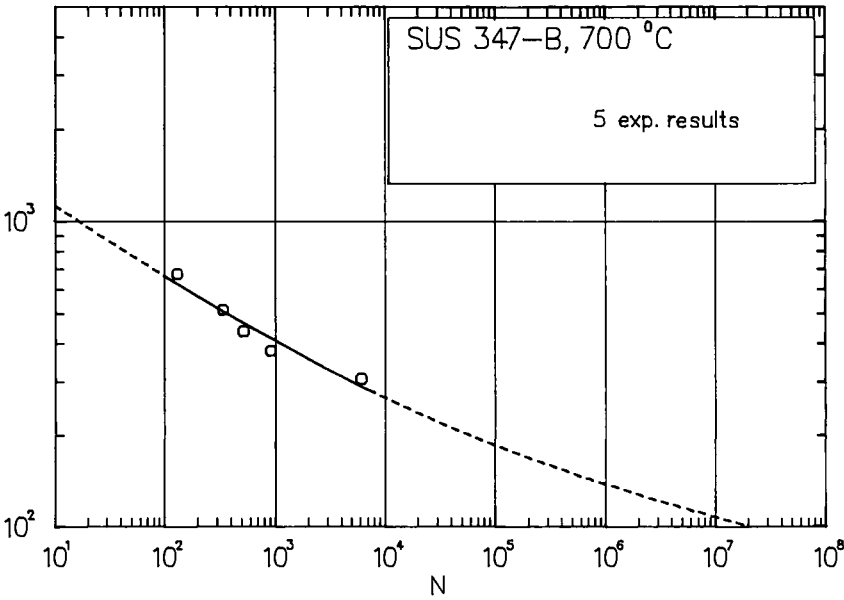
σ_e [N/mm²]



ϵ_e [%]



PSWT [N/mm²]



Material : SUS 347-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	264.9	0.0	1.0150	130.0
2.0000	243.3	0.0	0.6450	340.0
3.0000	220.7	0.0	0.5150	519.0
4.0000	218.8	0.0	0.3850	911.0
5.0000	191.3	0.0	0.2900	6084.0

X 10 CrNiNb 18 9	1.4550	SUS 347-B
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Heat treatment : 1050°C/50' water, 1100°C/1h water
Test temperature : +800°C
Semifinished material : bar, Ø 22 mm
Reference : [4,3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.066	0.62	1.39	0.026	0.012	9.68	17.22	0.19	0.12	0.70

Monotonic properties

E	=	169350	N/mm ²	ν	=	-
R _{p0.2}	=	127	N/mm ²	K	=	N/mm ²
R _m	=	216	N/mm ²	n	=	-
A ₅	=	49	%	σ_f	=	N/mm ²
Z	=	53	%	ϵ_f	=	-

Cyclic properties

R _{p0.2}	=	168	N/mm ²	K'	=	423	N/mm ²
σ_g	=	95	N/mm ²	n'	=	0.149	-
ϵ_g	=	0.060	%	σ'_f	=	354	N/mm ²
N _T	=	9569	cycles	ϵ'_f	=	0.352	-
T _{σ}	=	1.095	-	b	=	-0.086	-
T _{ϵ_p}	=	1.210	-	c	=	-0.606	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

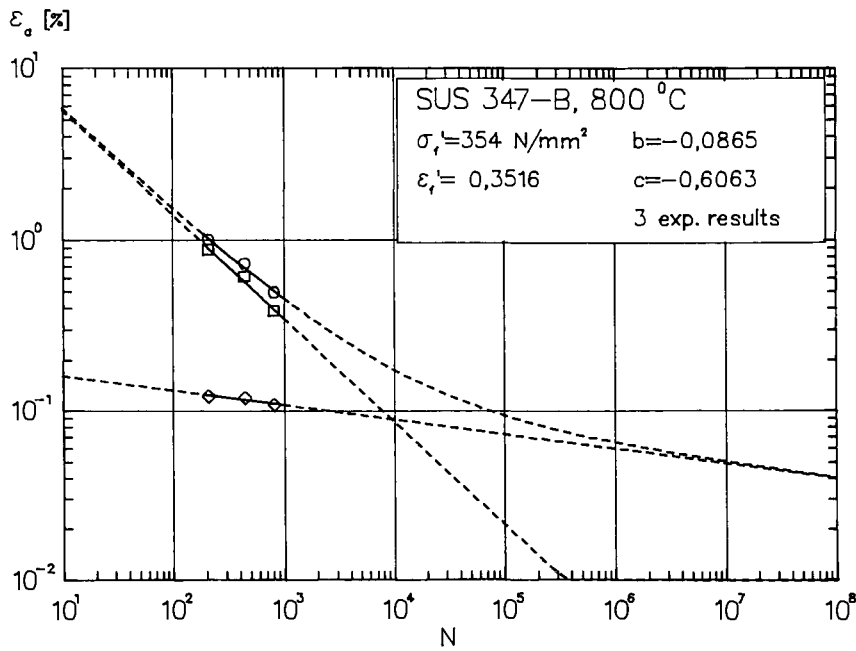
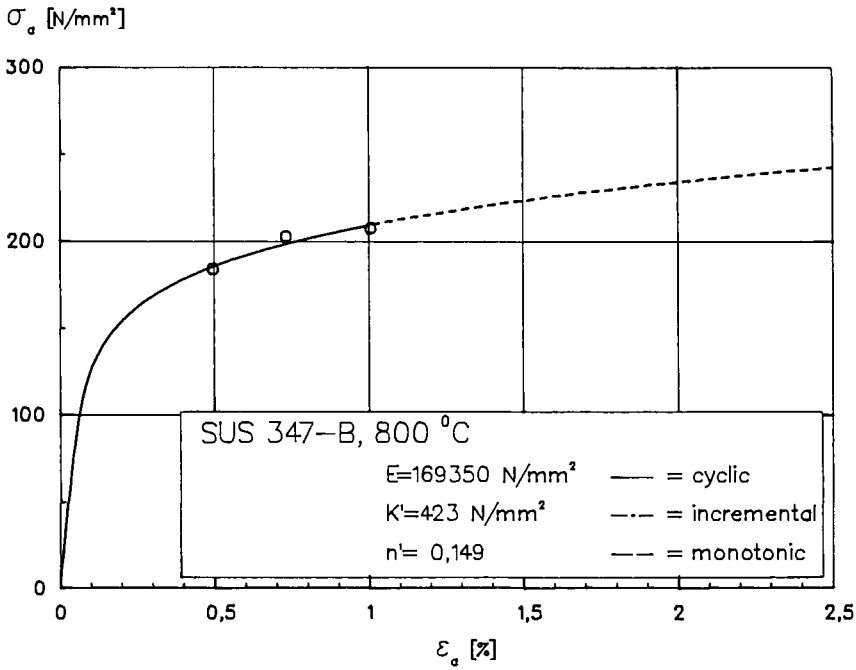
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

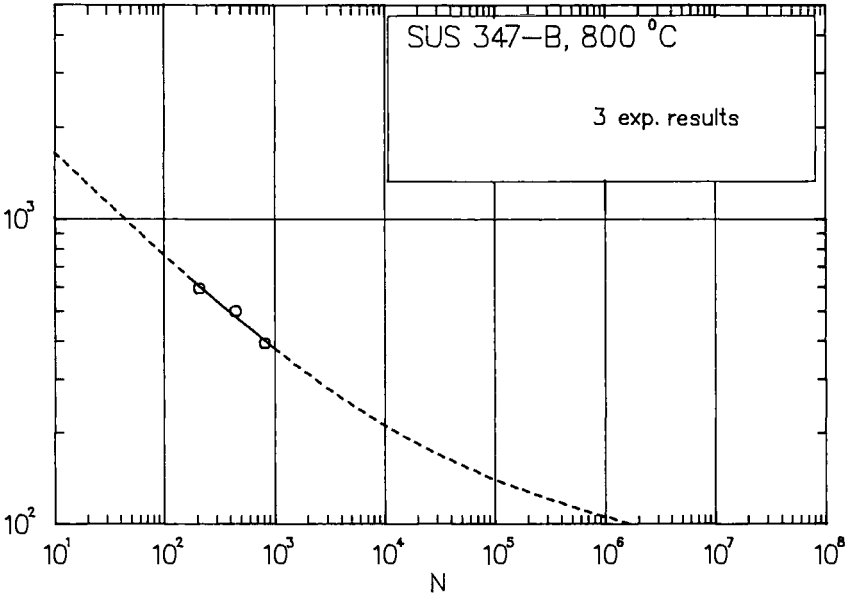
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 347-B, 800°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	207.5	0.0	1.0050	208.0
2.0000	202.6	0.0	0.7300	442.0
3.0000	183.9	0.0	0.4950	808.0

X 10 CrNiNb 18 9	1.4550	SUS 347-B
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Heat treatment : 1050°C/50' water, 1100°C/1h water
Test temperature : +800°C
Semifinished material : bar, Ø 22 mm
Reference : [4.3]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.066	0.62	1.39	0.026	0.012	9.68	17.22	0.19	0.12	0.70

Monotonic Properties

E	=	169350	N/mm ²	ν	=	-
R _{p0.2}	=	127	N/mm ²	K	=	N/mm ²
R _m	=	216	N/mm ²	n	=	-
A ₅	=	48	%	σ_f	=	N/mm ²
Z	=	61	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	108	N/mm ²	K'	=	290	N/mm ²
σ_g	=	55	N/mm ²	n'	=	0.159	-
ϵ_g	=	0.035	%	σ'_f	=	237	N/mm ²
N _T	=	16152	cycles	ϵ'_f	=	0.272	-
T _σ	=	1.004	-	b	=	-0.096	-
T _{εp}	=	1.108	-	c	=	-0.604	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

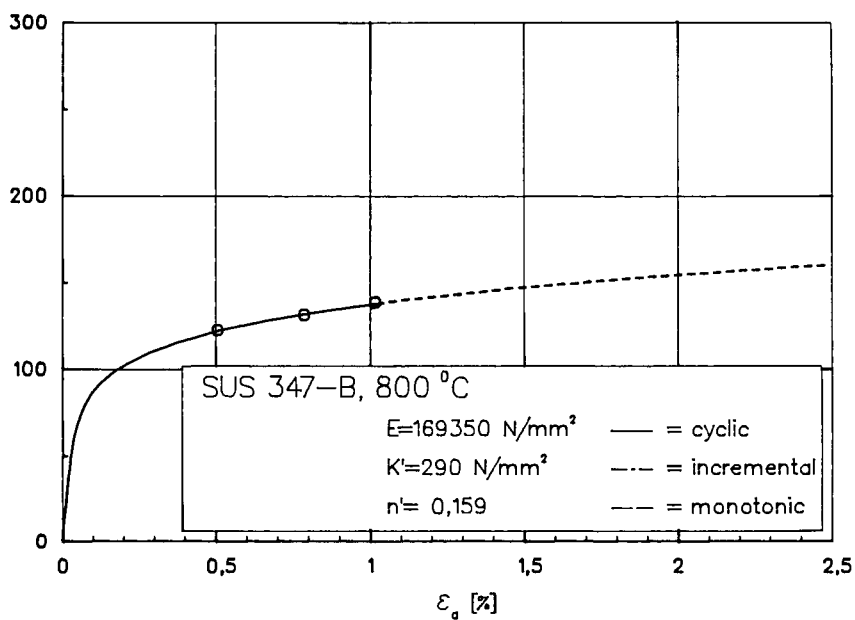
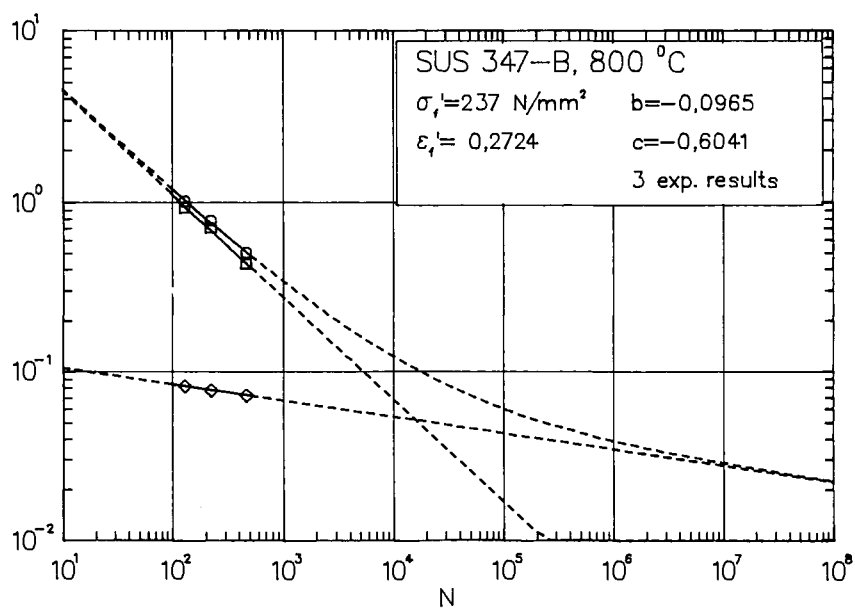
Monotonic test

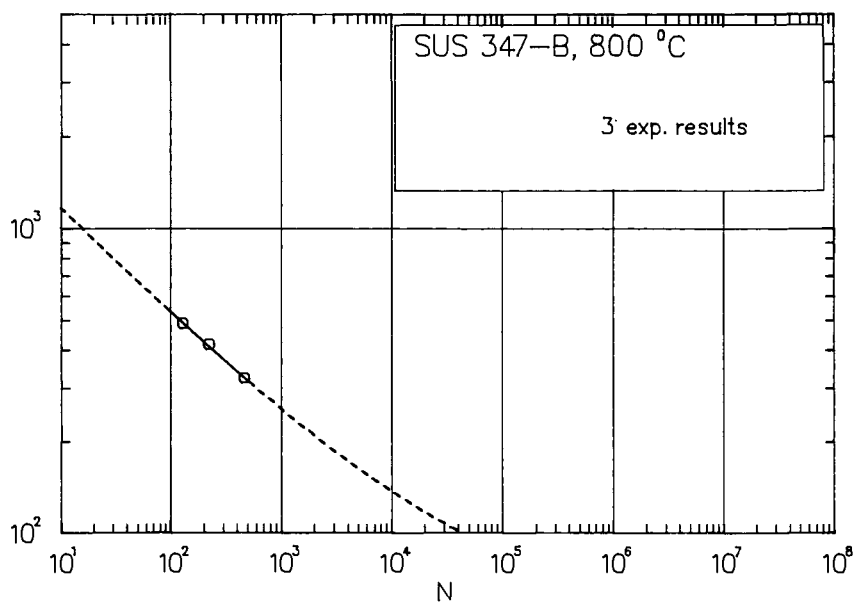
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.41 (%/min)
Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]

Material : SUS 347-B, 800°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	138.8	0.0	1.0150	129.0
2.0000	131.4	0.0	0.7850	222.0
3.0000	122.6	0.0	0.5050	465.0

X 15 Cr 13	SUS 403-B
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Heat treatment : 950°C, quenched, 730°C, water
 Test temperature : +23°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.4]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.11	0.27	0.41	0.018	0.019	0.21	12.77	<0.05	<0.05	0.010

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	598	N/mm ²	K	=	N/mm ²
R _m	=	736	N/mm ²	n	=	-
A _g	=	21	%	σ_f	=	N/mm ²
Z	=	70	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	497	N/mm ²	K'	=	987	N/mm ²
σ_g	=	308	N/mm ²	n'	=	0.110	-
ϵ_g	=	0.149	%	σ'_f	=	962	N/mm ²
N _T	=	2536	cycles	ϵ'_f	=	0.798	-
T _{σ}	=	1.047	-	b	=	-0.075	-
T _{ϵ_p}	=	1.413	-	c	=	-0.680	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness : HV 10 : 238

Microstructure : JIS G 0551 grain size: 9.1

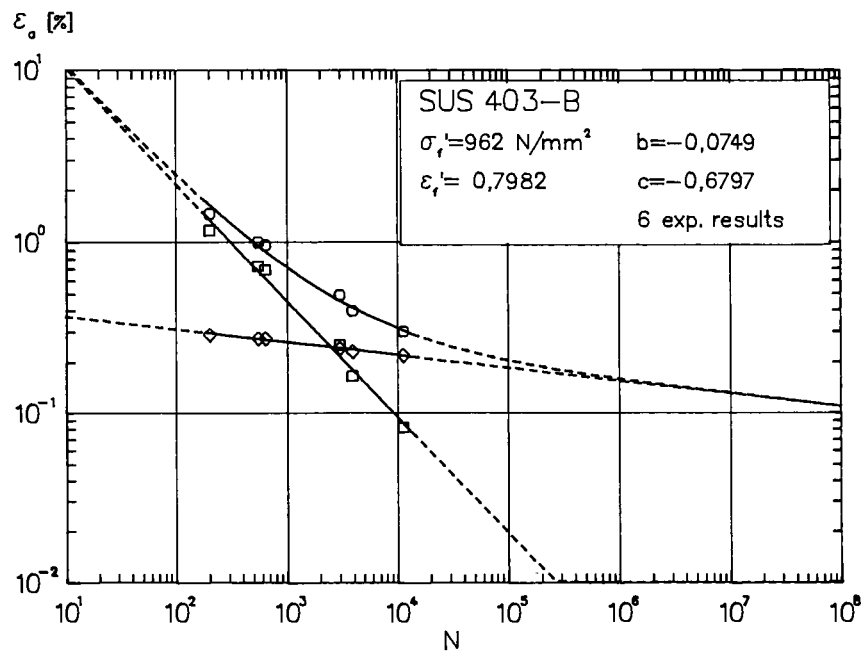
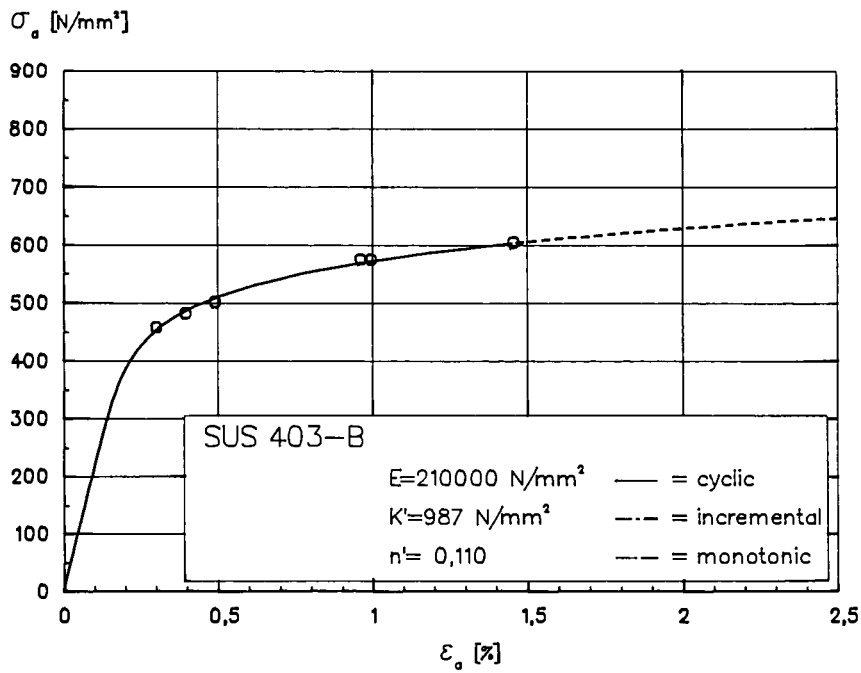
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

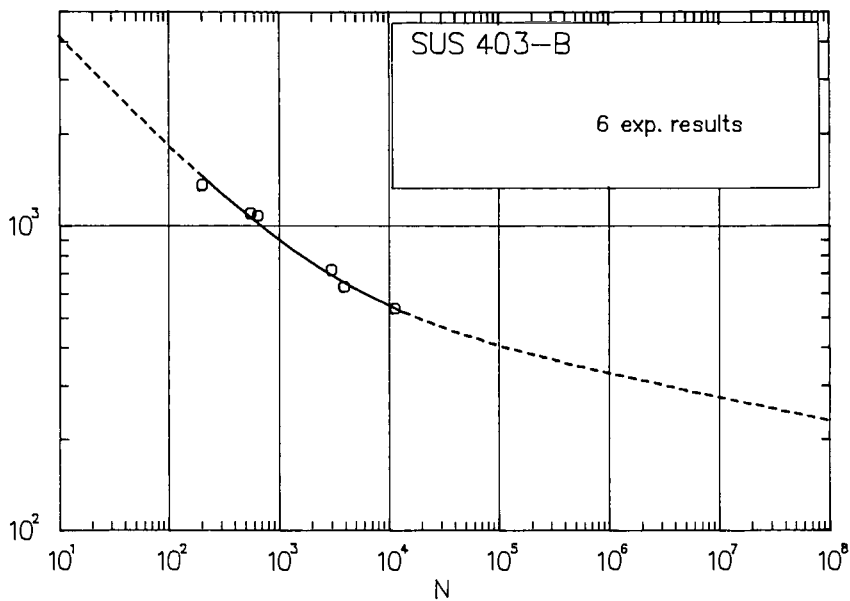
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 403-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	604.3	0.0	1.4550	201.0
2.0000	574.9	0.0	0.9950	551.0
3.0000	574.9	0.0	0.9600	640.0
4.0000	501.3	0.0	0.4900	2969.0
5.0000	482.2	0.0	0.3950	3875.0
6.0000	457.6	0.0	0.3000	11287.0

X 15 Cr 13	SUS 403-B
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Heat treatment : 950°C, quenched, 730°C, water
 Test temperature : +23°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.4]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.11	0.27	0.41	0.018	0.019	0.21	12.77	<0.05	<0.05	0.010

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	598	N/mm ²	K	=	N/mm ²
R _m	=	736	N/mm ²	n	=	-
A _g	=	21	%	σ_f	=	N/mm ²
Z	=	70	%	ε_f	=	-

Cyclic properties

R'p0.2	=	475	N/mm ²	K'	=	1056	N/mm ²
σ_g	=	301	N/mm ²	n'	=	0.128	-
ε_g	=	0.149	%	σ'_f	=	932	N/mm ²
N _T	=	3368	cycles	ε'_f	=	0.380	-
T _{σ}	=	1.033	-	b	=	-0.074	-
T _{ε_p}	=	1.248	-	c	=	-0.579	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ε -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness : HV 10 : 238

Microstructure : JIS G 0551 grain size: 9.1

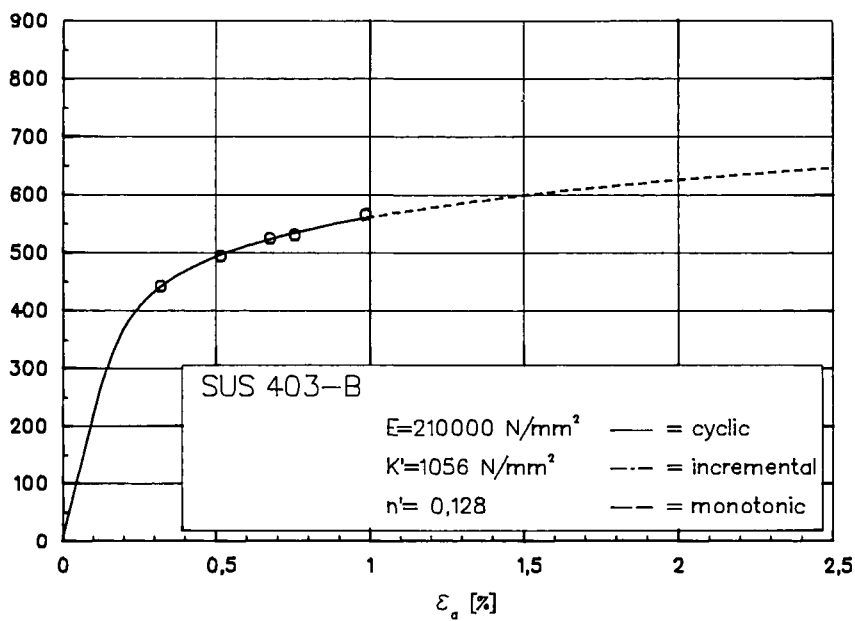
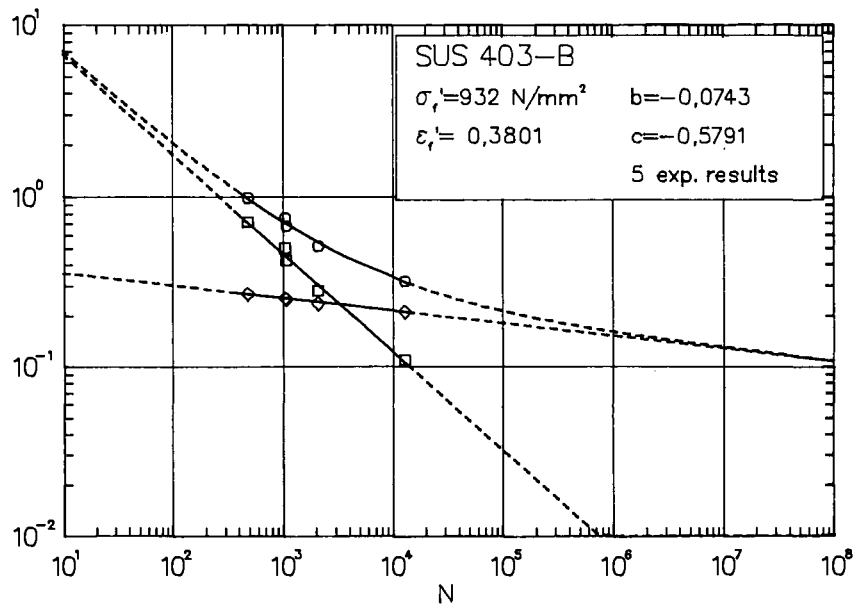
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

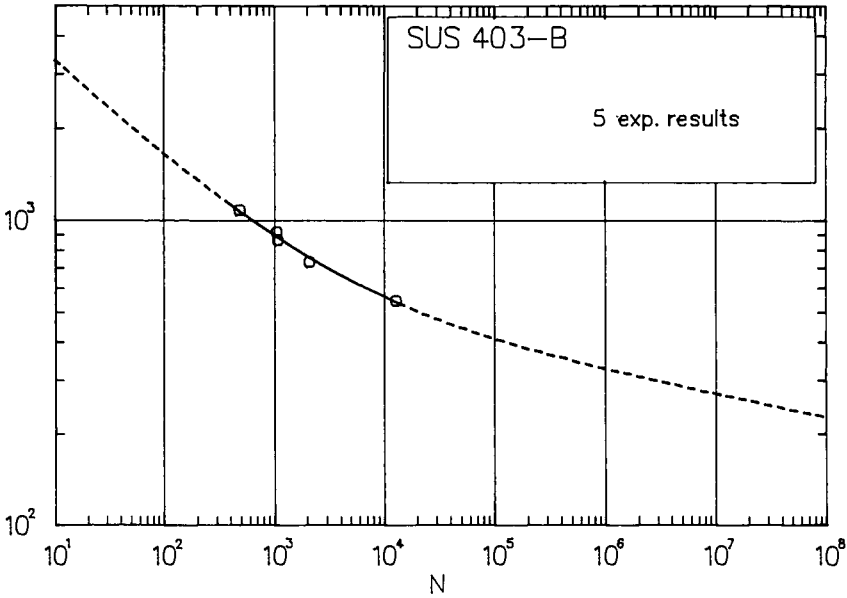
Cyclic test

Loading condition : total strain control, R_g = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 4.0 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUS 403-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	565.5	0.0	0.9850	481.0
2.0000	530.2	0.0	0.7550	1050.0
3.0000	524.3	0.0	0.6750	1069.0
4.0000	493.9	0.0	0.5150	2079.0
5.0000	441.9	0.0	0.3200	12813.0

X 15 Cr 13		SUS 403-B
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Heat treatment : 950°C, quenched, 730°C, water
 Test temperature : 400°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.4]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.11	0.27	0.41	0.018	0.019	0.21	12.77	<0.05	<0.05	0.010

Monotonic properties

E	=	185200	N/mm ²	ν	=	-
R _{p0.2}	=	488	N/mm ²	K	=	N/mm ²
R _m	=	585	N/mm ²	n	=	-
A ₅	=	15	%	σ_f	=	N/mm ²
Z	=	69	%	ϵ_f	=	-

Cyclic properties

R _{p0.2}	=	379	N/mm ²	K'	=	691	N/mm ²
σ_g	=	244	N/mm ²	n'	=	0.097	-
ϵ_g	=	0.134	%	σ'_f	=	668	N/mm ²
N _T	=	2535	cycles	ϵ'_f	=	0.701	-
T _{σ}	=	1.062	-	b	=	-0.066	-
T _{ϵ_p}	=	1.070	-	c	=	-0.684	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

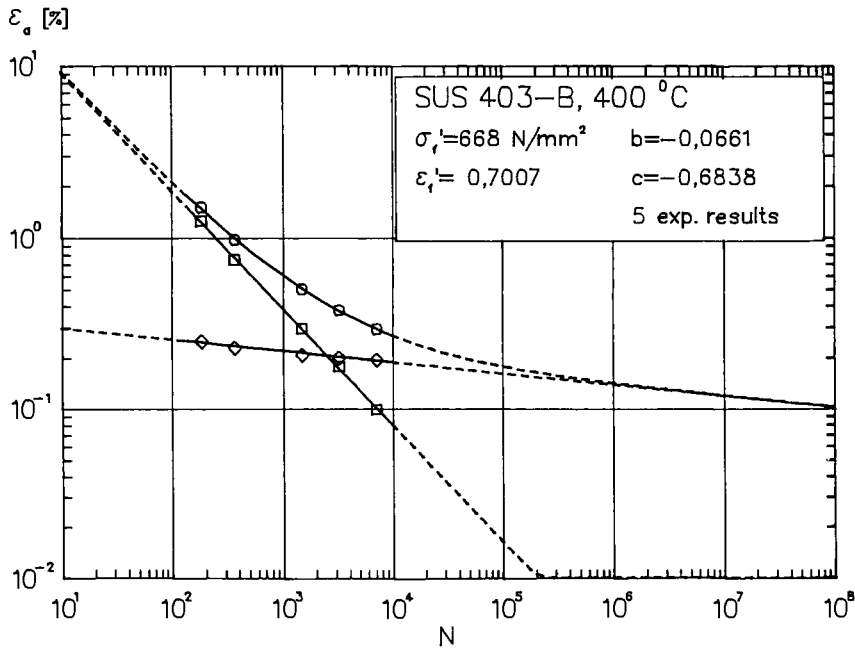
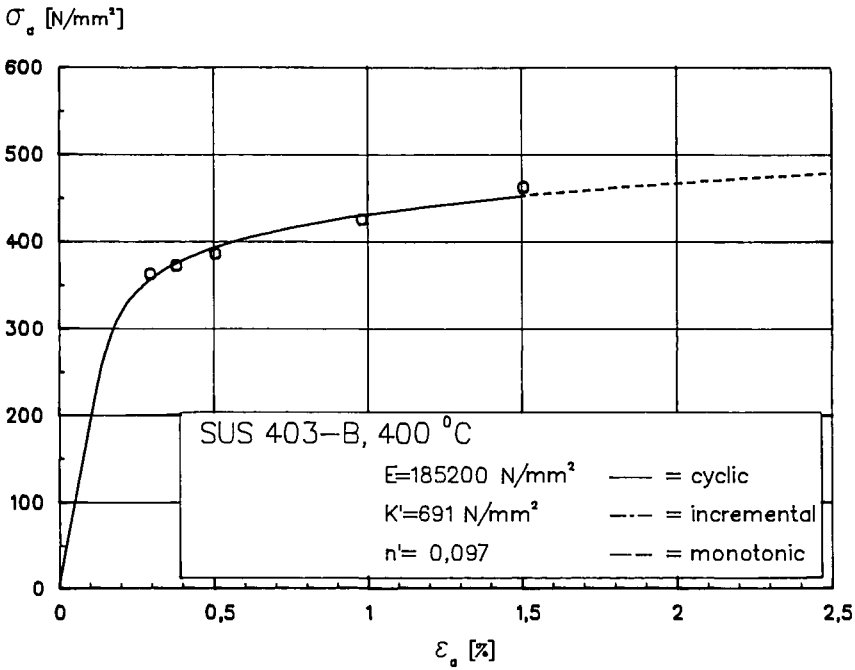
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

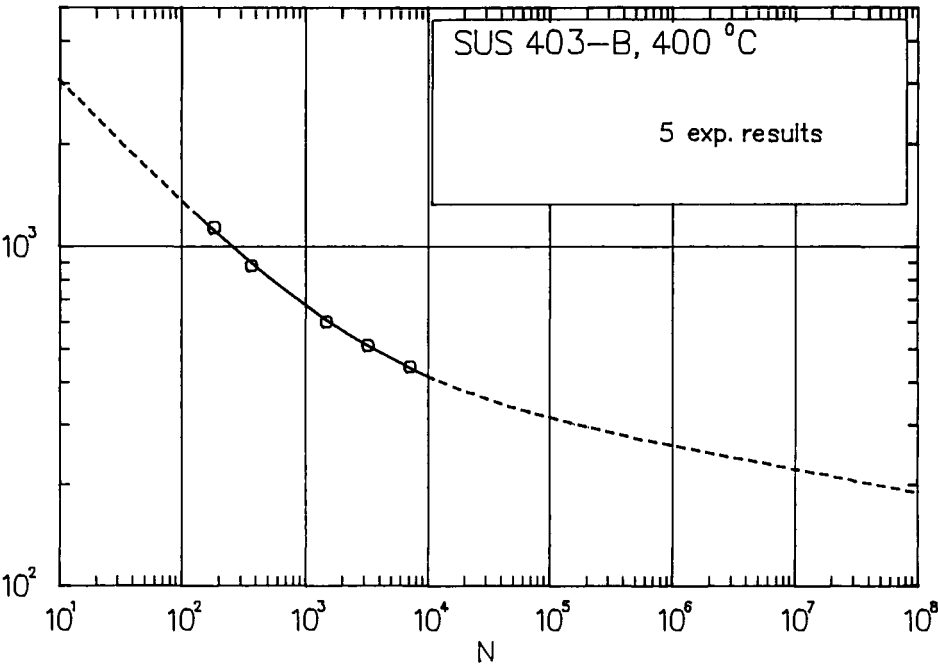
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 403-B, 400 °C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	462.5	0.0	1.5050	183.0
2.0000	425.3	0.0	0.9800	366.0
3.0000	385.5	0.0	0.5050	1484.0
4.0000	371.8	0.0	0.3800	3218.0
5.0000	362.0	0.0	0.2950	7107.0

X 15 Cr 13		SUS 403-B
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Heat treatment : 950°C, quenched, 730°C, water
 Test temperature : 400°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.4]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.11	0.27	0.41	0.018	0.019	0.21	12.77	<0.05	<0.05	0.010

Monotonic properties

E	=	185200	N/mm ²	ν	=	-
R _{p0.2}	=	488	N/mm ²	K	=	N/mm ²
R _m	=	585	N/mm ²	n	=	-
A ₅	=	15	%	σ_f	=	N/mm ²
Z	=	69	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	393	N/mm ²	K'	=	641	N/mm ²
σ_g	=	290	N/mm ²	n'	=	0.079	-
ϵ_g	=	0.161	%	σ'_f	=	585	N/mm ²
N _T	=	2526	cycles	ϵ'_f	=	0.339	-
T _{σ}	=	1.112	-	b	=	-0.046	-
T _{ϵ_p}	=	1.482	-	c	=	-0.594	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

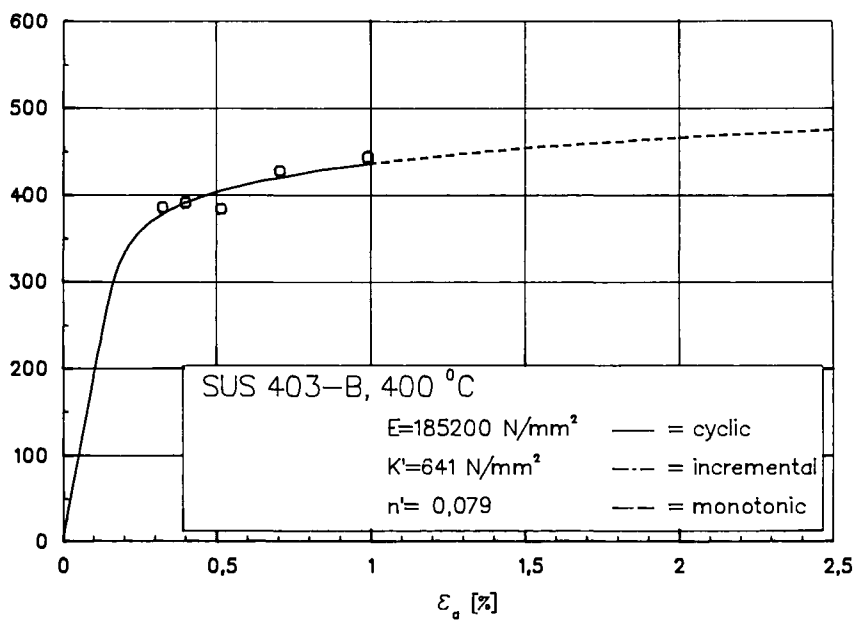
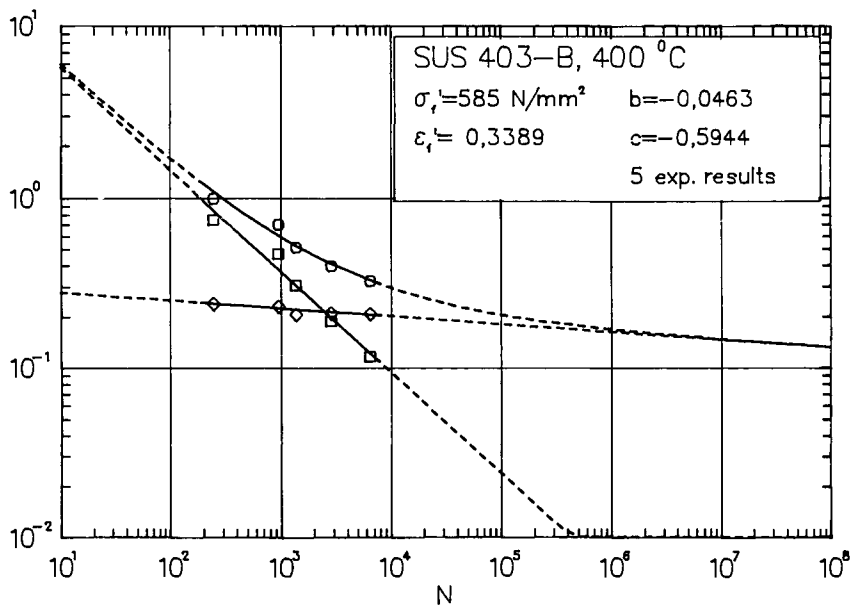
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

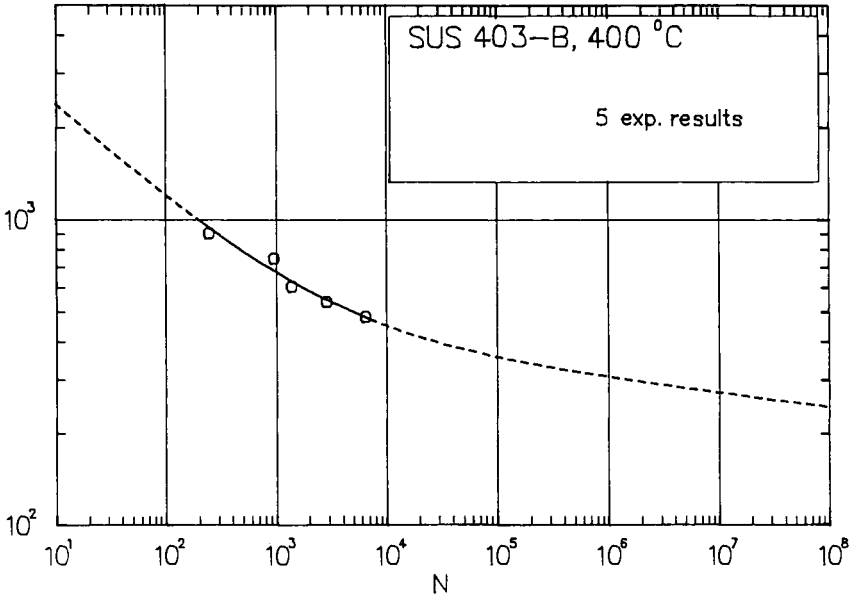
Cyclic test

Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.40 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²] ϵ_a [%]

PSWT [N/mm²]



Material : SUS 403-B, 400°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	443.4	0.0	0.9900	246.0
2.0000	427.7	0.0	0.7050	953.0
3.0000	383.6	0.0	0.5150	1368.0
4.0000	390.9	0.0	0.4000	2840.0
5.0000	385.5	0.0	0.3250	6452.0

X 15 Cr 13	SUS 403-B
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Heat treatment : 950°C, quenched, 730°C, water
Test temperature : 500°C
Semifinished material : bar, Ø 22 mm
Reference : [4.4]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.11	0.27	0.41	0.018	0.019	0.21	12.77	<0.05	<0.05	0.010

Monotonic properties

E	=	197250	N/mm ²	ν	=	-
R _{p0.2}	=	404	N/mm ²	K	=	N/mm ²
R _m	=	492	N/mm ²	n	=	-
A ₅	=	17	%	σ _f	=	N/mm ²
Z	=	76	%	ε _f	=	-

Cyclic properties

R _{p0.2}	=	318	N/mm ²	K'	=	715	N/mm ²
σ _g	=	195	N/mm ²	n'	=	0.131	-
ε _g	=	0.103	%	σ' _f	=	624	N/mm ²
N _T	=	4972	cycles	ε' _f	=	0.412	-
T _σ	=	1.126	-	b	=	-0.077	-
T _{εp}	=	1.435	-	c	=	-0.605	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

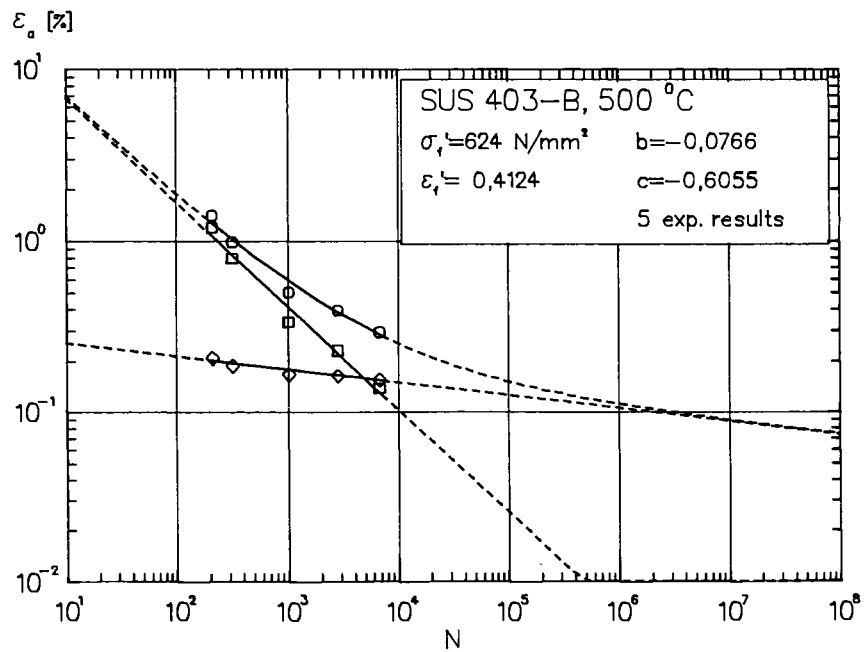
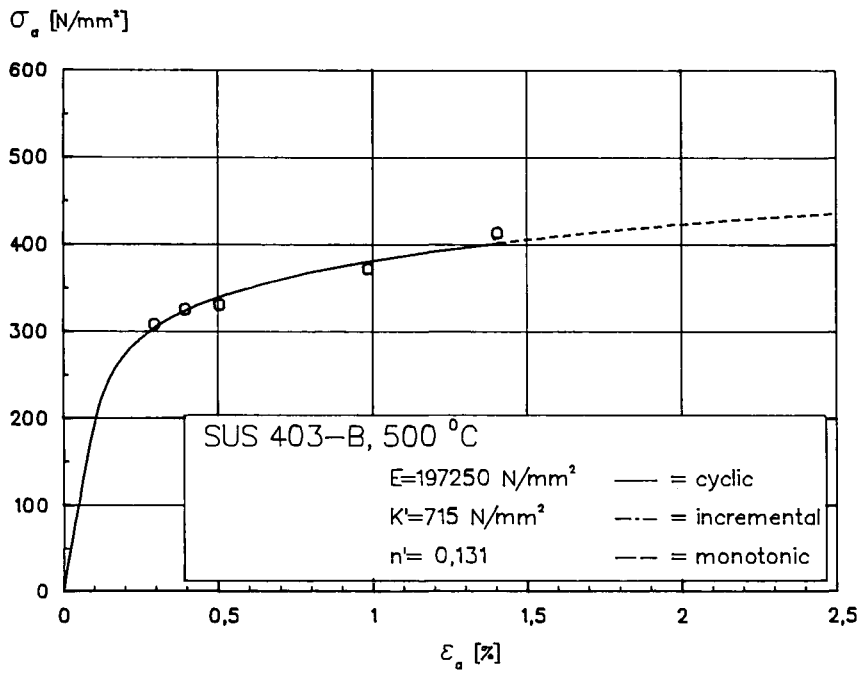
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

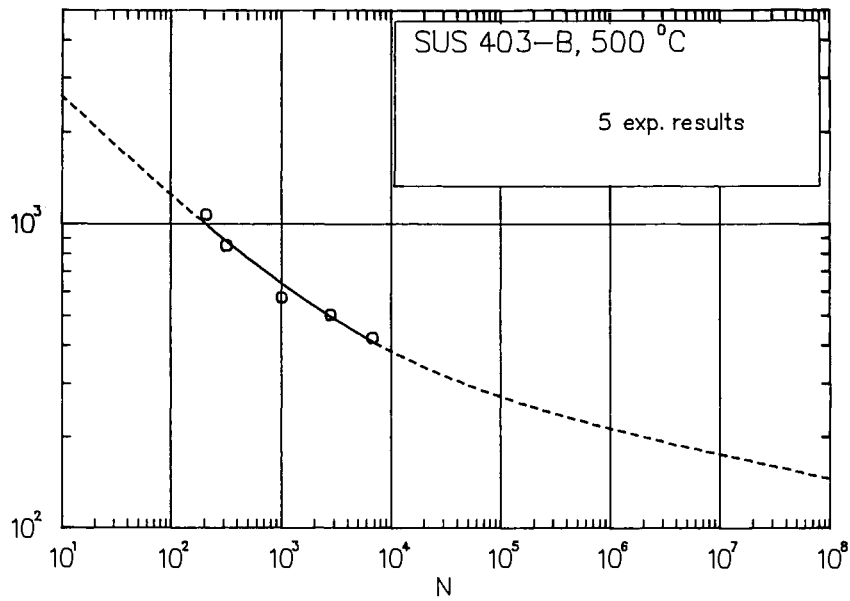
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 403-B, 500°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	413.0	0.0	1.4050	210.0
2.0000	371.8	0.0	0.9850	320.0
3.0000	330.6	0.0	0.5050	1019.0
4.0000	325.2	0.0	0.3950	2825.0
5.0000	308.0	0.0	0.2950	6772.0

X 15 Cr 13		SUS 403-B
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Heat treatment : 950°C, quenched, 730°C, water
 Test temperature : +500°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.4]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.11	0.27	0.41	0.018	0.019	0.21	12.77	<0.05	<0.05	0.010

Monotonic properties

E	=	197250	N/mm ²	v	=	-
R _{p0.2}	=	404	N/mm ²	K	=	N/mm ²
R _m	=	492	N/mm ²	n	=	-
A ₅	=	17	%	σ _f	=	N/mm ²
Z	=	76	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	278	N/mm ²	K'	=	507	N/mm ²
σ _g	=	197	N/mm ²	n'	=	0.097	-
ε _g	=	0.106	%	σ' _f	=	466	N/mm ²
N _T	=	9002	cycles	ε' _f	=	0.418	-
T _σ	=	1.030	-	b	=	-0.056	-
T _{εp}	=	1.457	-	c	=	-0.585	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

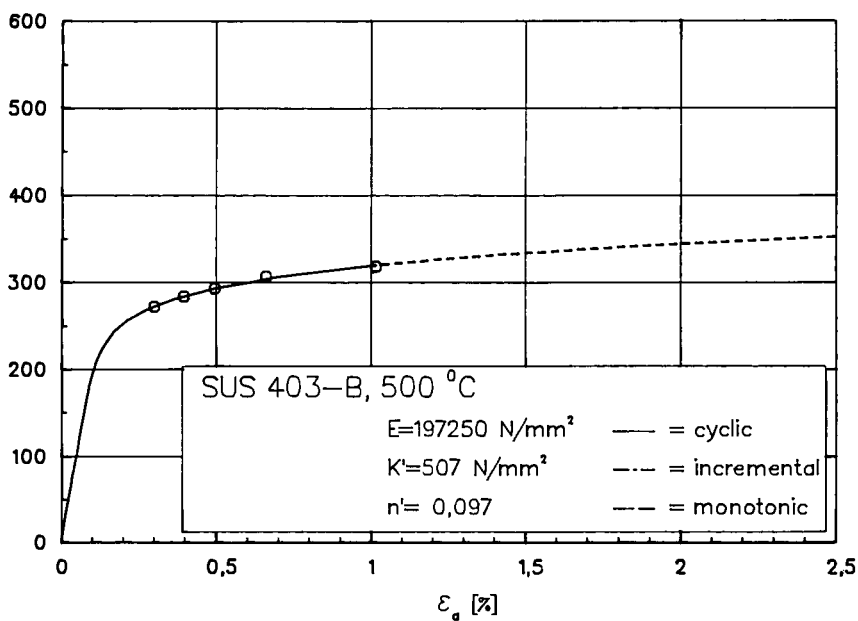
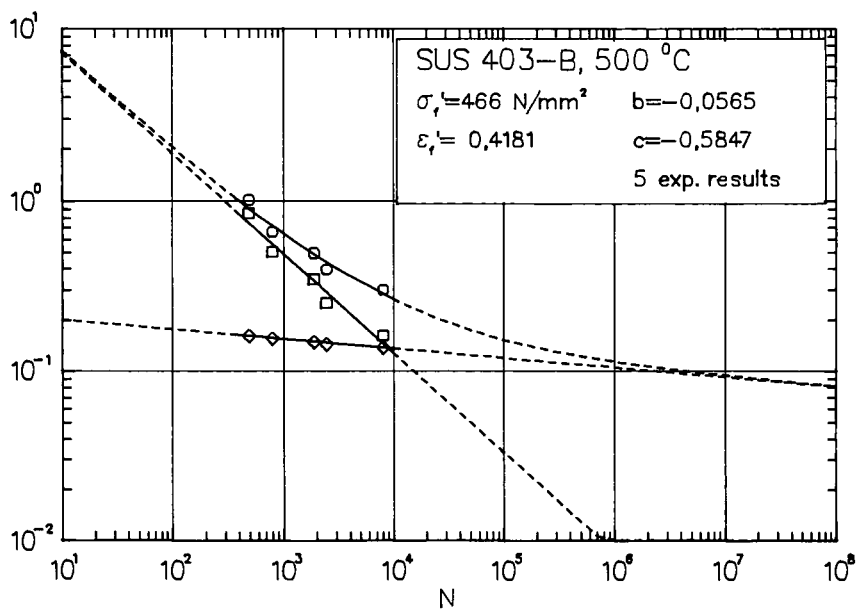
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

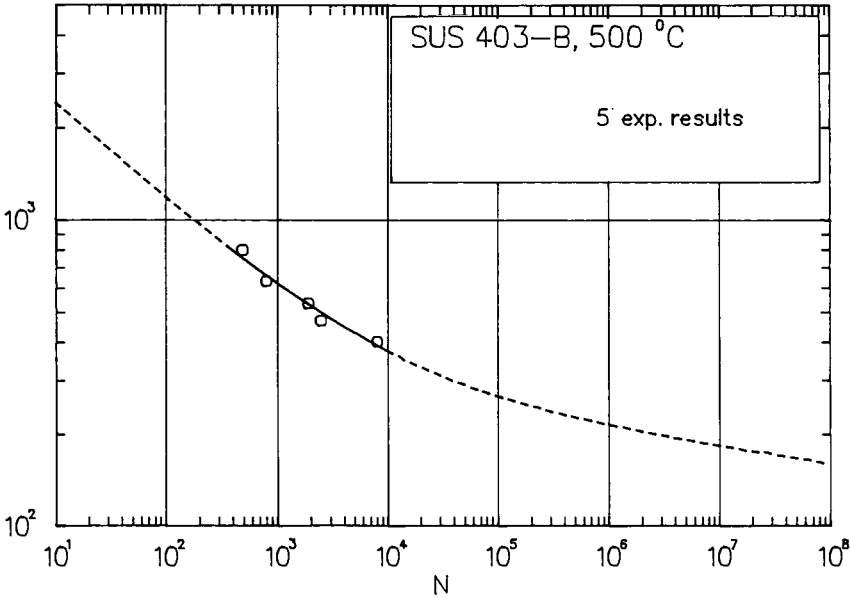
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.40 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUS 403-B, 500°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	318.3	0.0	1.0150	487.0
2.0000	307.0	0.0	0.6600	794.0
3.0000	293.3	0.0	0.4950	1884.0
4.0000	284.0	0.0	0.3950	2441.0
5.0000	272.2	0.0	0.3000	7975.0

X 15 Cr 13		SUS 403-B
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Heat treatment : 950°C, quenched, 730°C, water
 Test temperature : +600°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.4]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.11	0.27	0.41	0.018	0.019	0.21	12.77	<0.05	<0.05	0.010

Monotonic properties

E	=	173500	N/mm ²	ν	=	-
R _{p0.2}	=	232	N/mm ²	K	=	N/mm ²
R _m	=	342	N/mm ²	n	=	-
A ₅	=	25	%	σ _f	=	N/mm ²
Z	=	89	%	ε _f	=	-

Cyclic properties

R _{p0.2}	=	221	N/mm ²	K'	=	453	N/mm ²
σ _g	=	136	N/mm ²	n'	=	0.116	-
ε _g	=	0.082	%	σ' _f	=	451	N/mm ²
N _T	=	9270	cycles	ε' _f	=	0.923	-
T _σ	=	1.036	-	b	=	-0.079	-
T _{εp}	=	1.419	-	c	=	-0.676	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture

σ/ε-values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

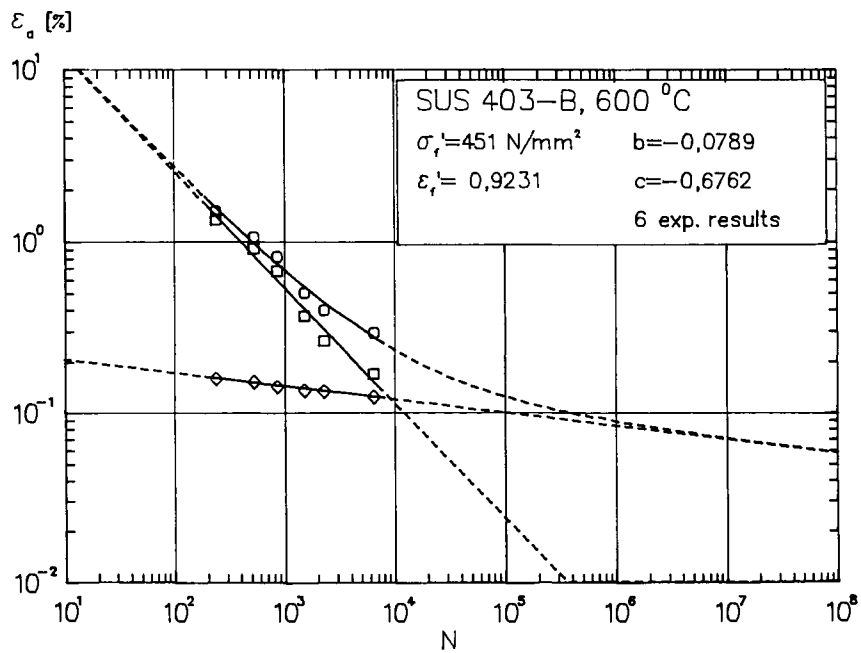
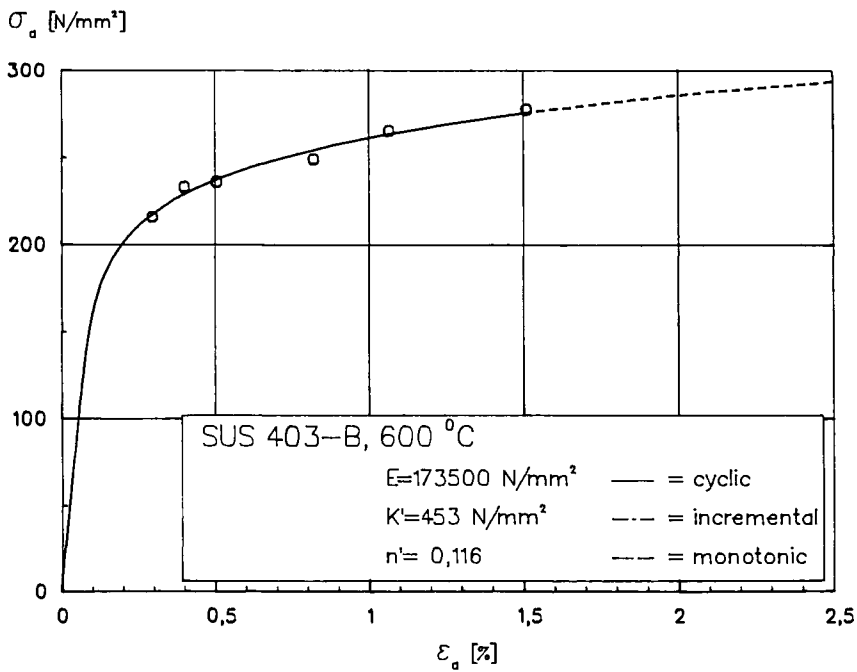
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

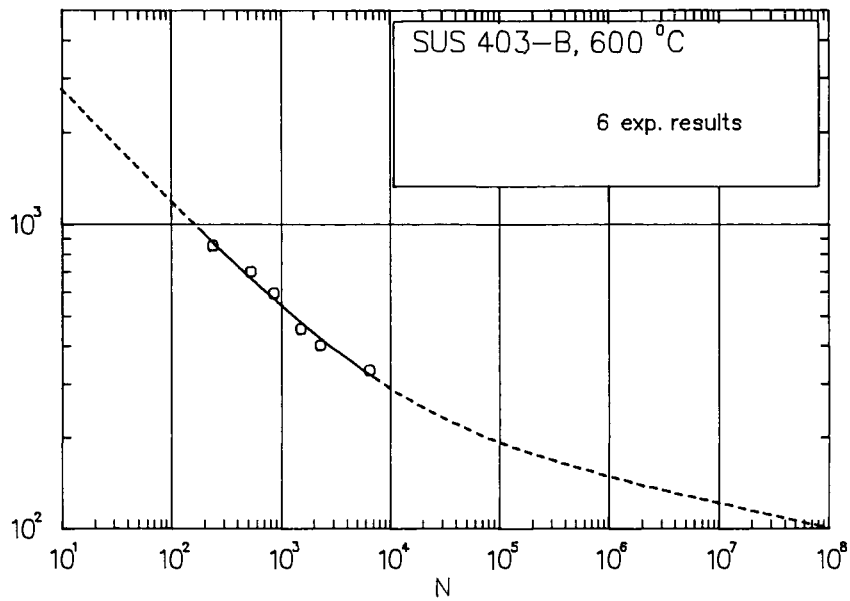
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 40 (%/min)
 Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUS 403-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	277.6	0.0	1.5100	238.0
2.0000	265.4	0.0	1.0650	527.0
3.0000	249.2	0.0	0.8200	857.0
4.0000	235.9	0.0	0.5050	1510.0
5.0000	233.0	0.0	0.4000	2266.0
6.0000	215.8	0.0	0.2950	6456.0

X 15 Cr 13		SUS 403-B
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Heat treatment : 950°C, quenched, 730°C, water
 Test temperature : +600°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.4]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	Nb+Ta
0.11	0.27	0.41	0.018	0.019	0.21	12.77	<0.05	<0.05	0.010

Monotonic Properties

E	=	173500	N/mm ²	v	=	-
R _{p0.2}	=	232	N/mm ²	K	=	N/mm ²
R _m	=	342	N/mm ²	n	=	-
A ₅	=	25	%	σ _f	=	N/mm ²
Z	=	89	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	178	N/mm ²	K'	=	275	N/mm ²
σ _g	=	139	N/mm ²	n'	=	0.070	-
ε _g	=	0.086	%	σ' _f	=	255	N/mm ²
N _T	=	14710	cycles	ε' _f	=	0.356	-
T _σ	=	1.073	-	b	=	-0.040	-
T _{εp}	=	1.272	-	c	=	-0.573	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ε-values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

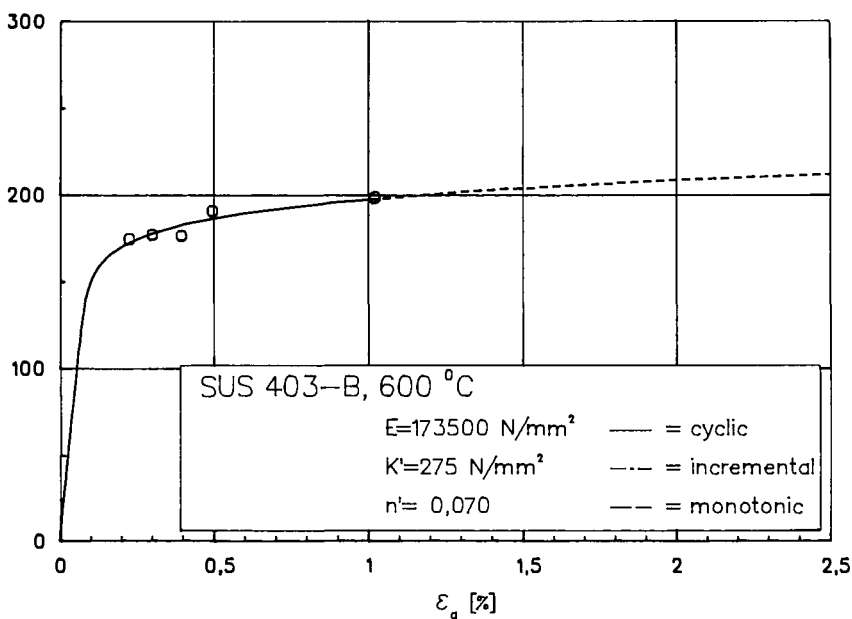
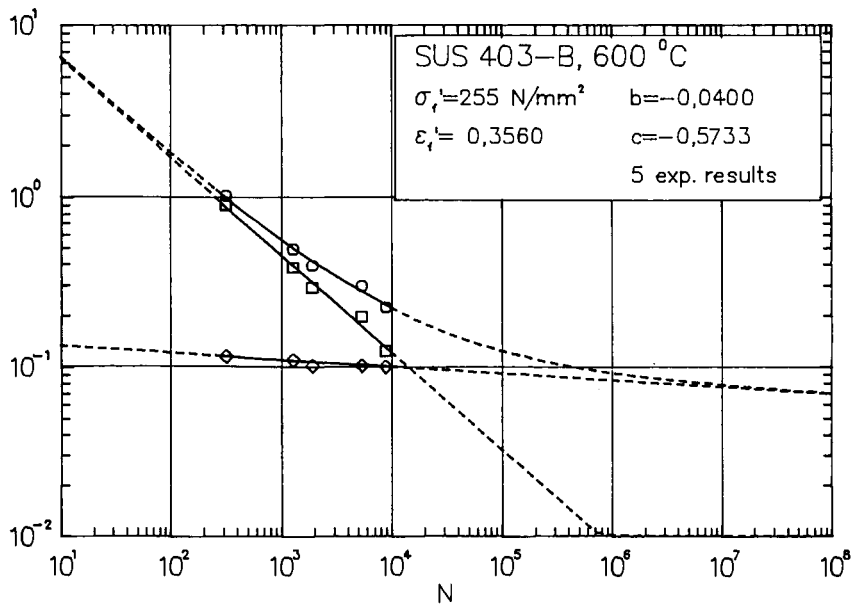
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

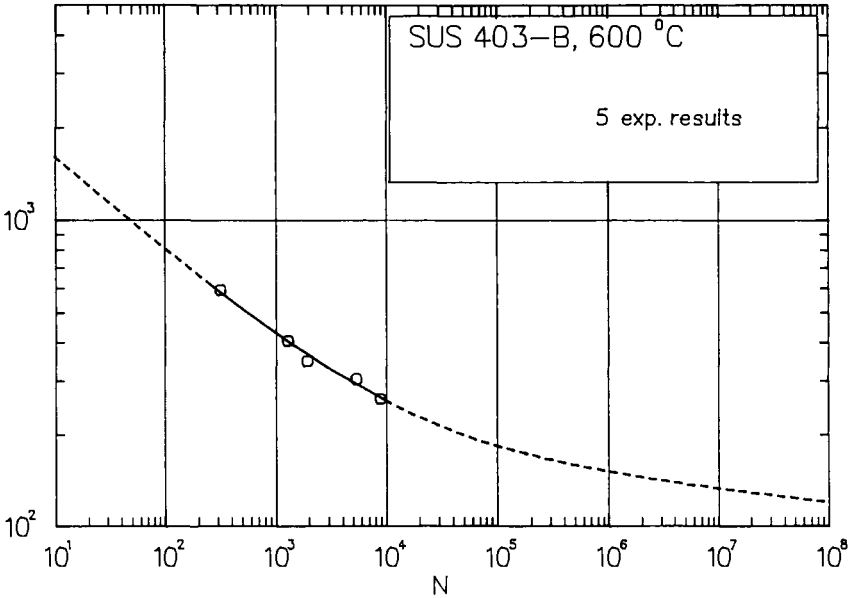
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.40 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUS 403-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	198.6	0.0	1.0200	317.0
2.0000	190.8	0.0	0.4950	1279.0
3.0000	176.6	0.0	0.3950	1905.0
4.0000	177.1	0.0	0.3000	5350.0
5.0000	174.6	0.0	0.2250	8783.0

X 15 CrNiSi 25 20	1.4841	SUH 310-B
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Heat treatment : 1050°C/50', water
Test temperature : +23°C
Semifinished material : bar, Ø 22 mm
Reference : [4.8]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N
0.13	1.00	1.85	0.025	0.009	20.01	24.70	0.26	0.11	0.0516

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	271	N/mm ²	K	=	N/mm ²
R _m	=	630	N/mm ²	n	=	-
A ₅	=	45	%	σ _f	=	N/mm ²
Z	=	69	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	289	N/mm ²	K'	=	2302	N/mm ²
σ _g	=	147	N/mm ²	n'	=	0.334	-
ε _g	=	0.096	%	σ' _f	=	1512	N/mm ²
N _T	=	78145	cycles	ε' _f	=	0.301	-
T _σ	=	1.171	-	b	=	-0.153	-
T _{εp}	=	1.438	-	c	=	-0.465	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
σ/s-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness : HV 10 : 155

Microstructure : JIS G 0551 grain size: 10 (40%), 6 (60%)

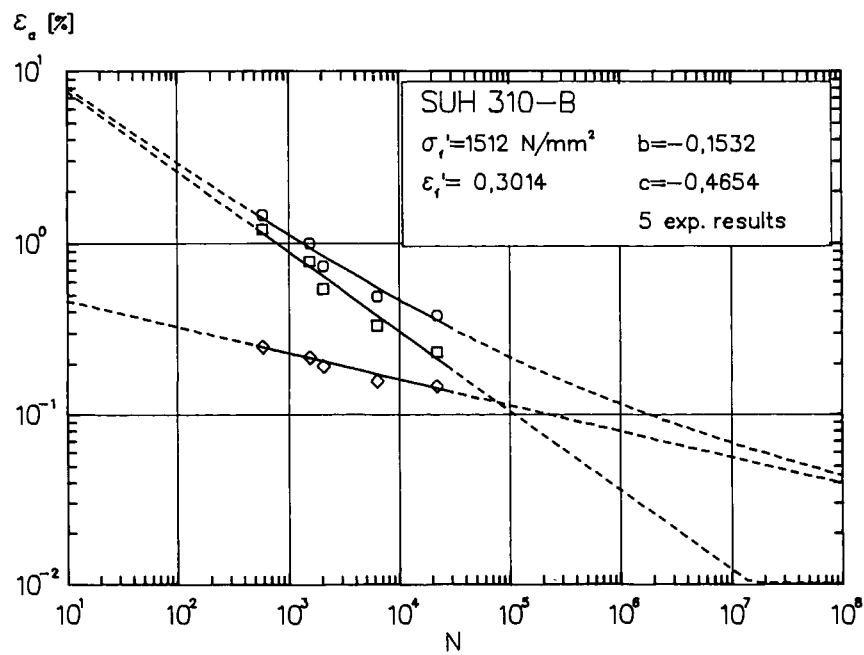
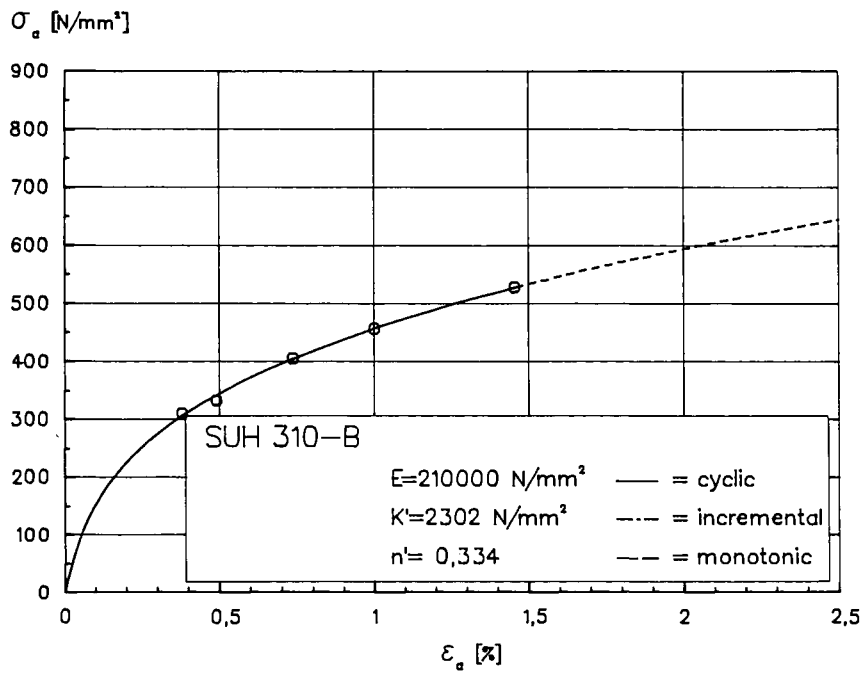
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

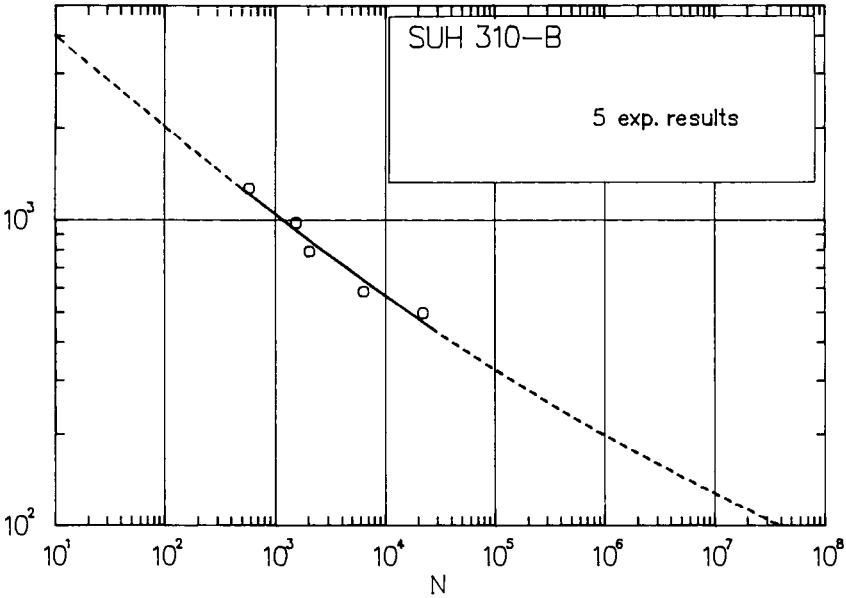
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 39 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUH 310-B

Spec. no	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	527.8	0.0	1.4550	582.0
2.0000	456.2	0.0	1.0000	1541.0
3.0000	405.1	0.0	0.7350	2048.0
4.0000	332.6	0.0	0.4900	6320.0
5.0000	310.0	0.0	0.3800	21915.0

X 15 CrNiSi 25 20	1.4841	SUH 310-B
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Heat treatment : 1050°C/50', water
Test temperature : +23°C
Semifinished material : bar, Ø 22 mm
Reference : [4.8]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N
0.13	1.00	1.85	0.025	0.009	20.01	24.70	0.26	0.11	0.0516

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	271	N/mm ²	K	=	N/mm ²
R _m	=	630	N/mm ²	n	=	-
A ₅	=	45	%	σ_f	=	N/mm ²
Z	=	69	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	284	N/mm ²	K'	=	2242	N/mm ²
σ_g	=	149	N/mm ²	n'	=	0.332	-
ϵ_g	=	0.100	%	σ'_f	=	1492	N/mm ²
N _T	=	103820	cycles	ϵ'_f	=	0.289	-
T _{σ}	=	1.074	-	b	=	-0.152	-
T _{ϵ}	=	1.339	-	c	=	-0.454	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness : HV 10 : 155

Microstructure : JIS G 0551 grain size: 10 (40%), 6 (60%)

Monotonic test

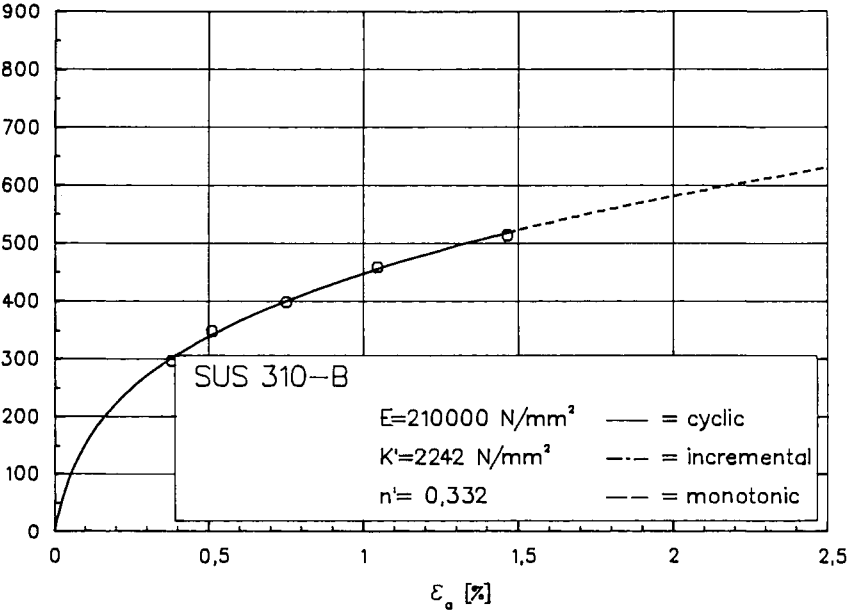
Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

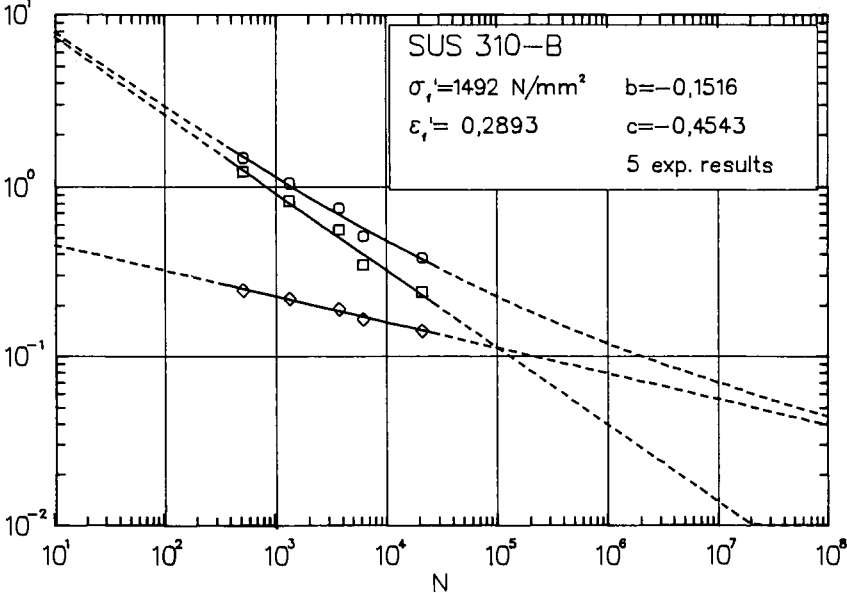
Loading condition : total strain control, R _{ϵ} = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 4.0 (%/min)
Waveform : triangular

Remarks :

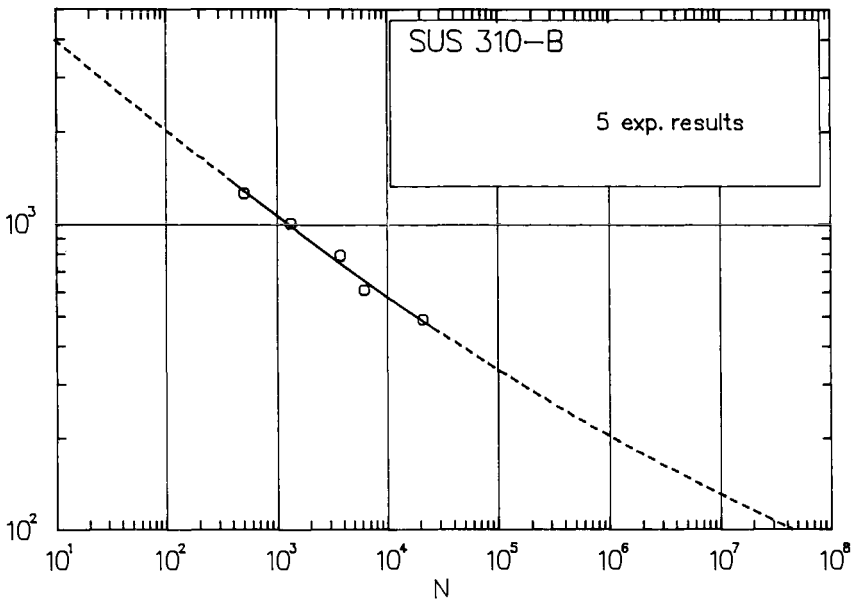
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUS 310-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	514.0	0.0	1.4650	504.0
2.0000	458.6	0.0	1.0450	1327.0
3.0000	398.3	0.0	0.7500	3736.0
4.0000	348.3	0.0	0.5100	6161.0
5.0000	296.3	0.0	0.3800	21025.0

X 15 CrNiSi 25 20	1.4841	SUH 310-B
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Heat treatment : 1050⁰C/50', water
Test temperature : +450⁰C
Semifinished material : bar, Ø 22 mm
Reference : [4.8]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N
0.13	1.00	1.85	0.025	0.009	20.01	24.70	0.26	0.11	0.0516

Monotonic properties

E	=	165650	N/mm ²	ν	=	-
R _{p0.2}	=	178	N/mm ²	K	=	N/mm ²
R _m	=	521	N/mm ²	n	=	-
A ₅	=	42	%	σ _f	=	N/mm ²
Z	=	60	%	ε _f	=	-

Cyclic properties

R _{p0.2}	=	274	N/mm ²	K'	=	1754	N/mm ²
σ _g	=	137	N/mm ²	n'	=	0.299	-
ε _g	=	0.105	%	σ' _f	=	1235	N/mm ²
N _T	=	33317	cycles	ε' _f	=	0.272	-
T _σ	=	1.051	-	b	=	-0.144	-
T _{εp}	=	1.426	-	c	=	-0.468	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

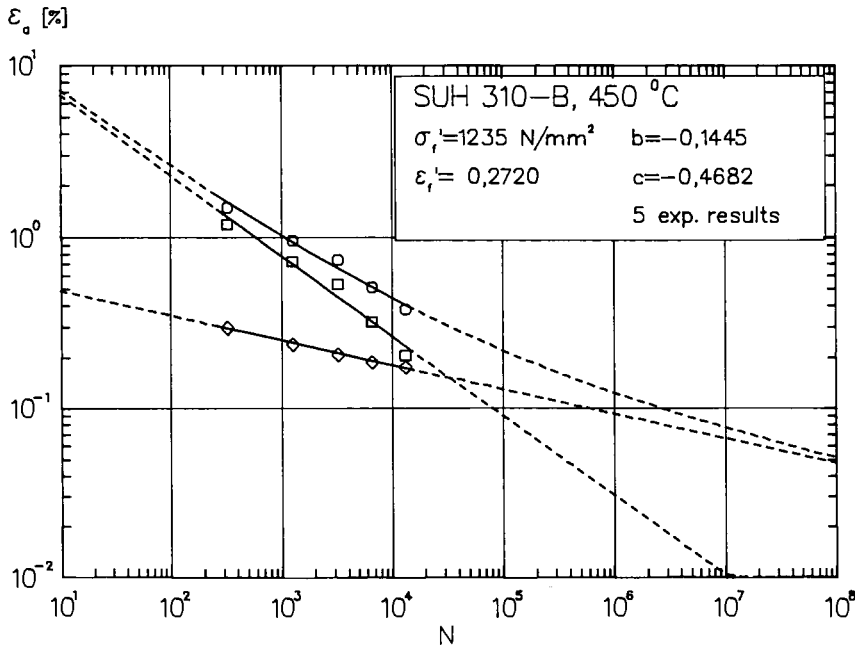
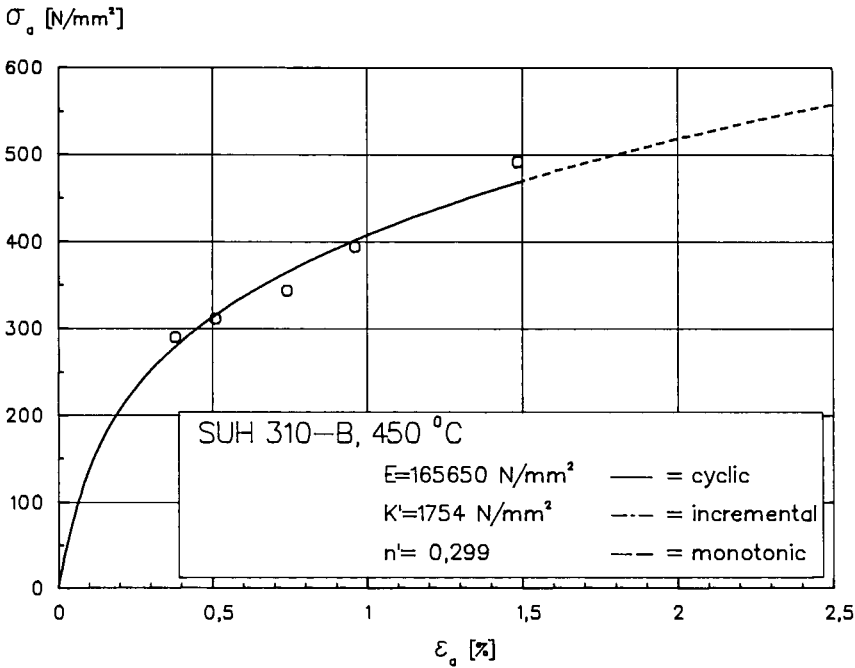
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

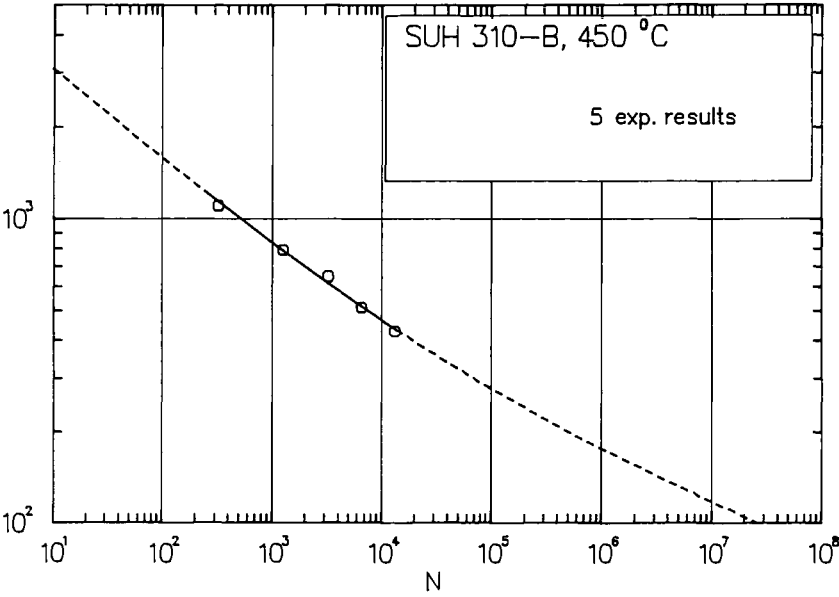
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 39 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUH 310-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	492.0	0.0	1.4850	326.0
2.0000	393.9	0.0	0.9600	1255.0
3.0000	343.4	0.0	0.7400	3226.0
4.0000	311.0	0.0	0.5100	6598.0
5.0000	289.9	0.0	0.3800	13191.0

X 15 CrNiSi 25 20	1.4841	SUH 310-B
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Heat treatment : 1050°C/50', water
Test temperature : 450°C
Semifinished material : bar, Ø 22 mm
Reference : [4,8]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N
0.13	1.00	1.85	0.025	0.009	20.01	24.70	0.26	0.11	0.0516

Monotonic Properties

E	=	165650	N/mm ²	ν	=	-
R _{p0.2}	=	178	N/mm ²	K	=	N/mm ²
R _m	=	521	N/mm ²	n	=	-
A ₅	=	42	%	σ_f	=	N/mm ²
Z	=	60	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	353	N/mm ²	K'	=	1627	N/mm ²
σ_g	=	177	N/mm ²	n'	=	0.246	-
ϵ_g	=	0.118	%	σ'_f	=	1130	N/mm ²
N _T	=	5597	cycles	ϵ'_f	=	0.251	-
T _{σ}	=	1.135	-	b	=	-0.122	-
T _{ep}	=	1.544	-	c	=	-0.509	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

Loading condition :

Specimen : cylindrical, Ø 10 mm

Specimen location : in rolling direction

Gauge length : 50 mm

Testing machine :

Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

Loading condition : total strain control, R _{ϵ} = -1

Specimen : cylindrical, Ø 6 mm

Surface : mechanically polished

Specimen location : in rolling direction

Gauge length : 15 mm

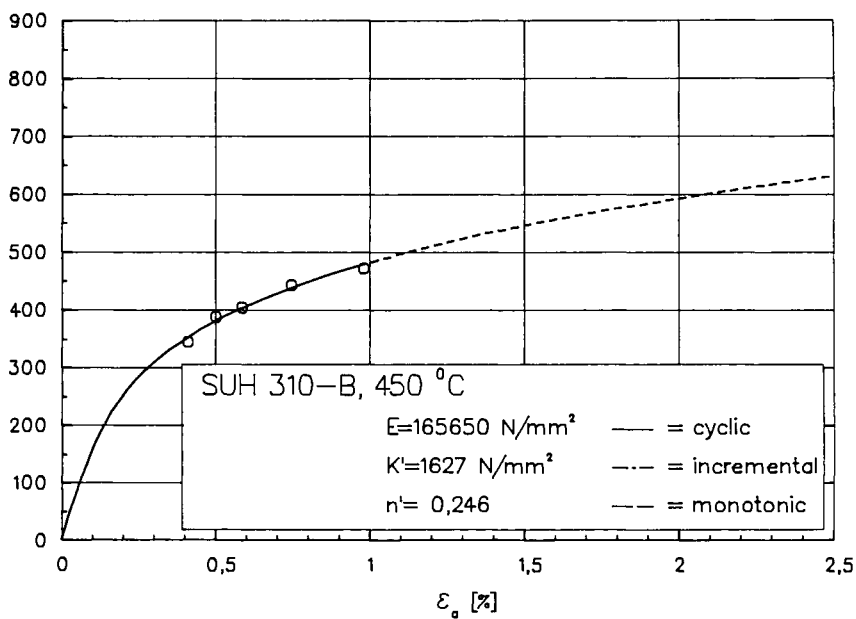
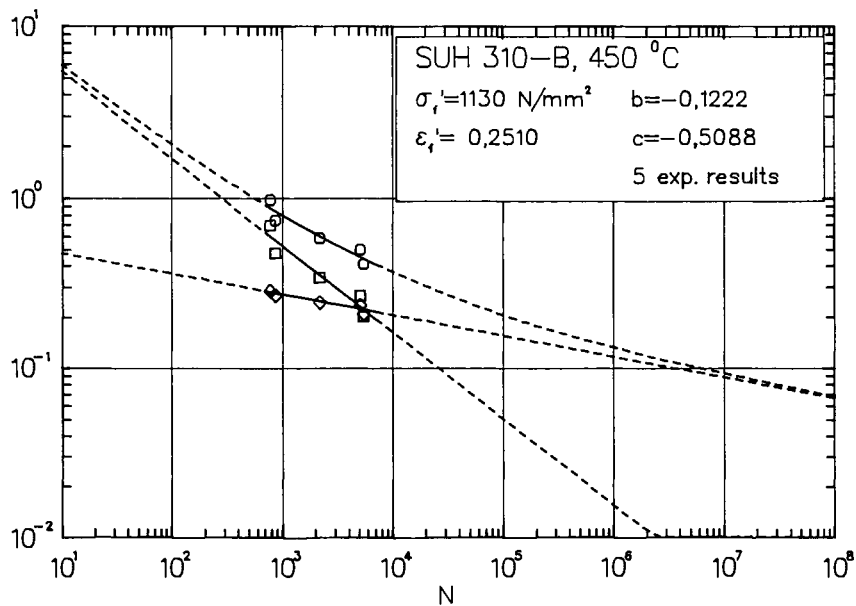
Testing machine : servohydraulic, max. 50 kN

Frequency :

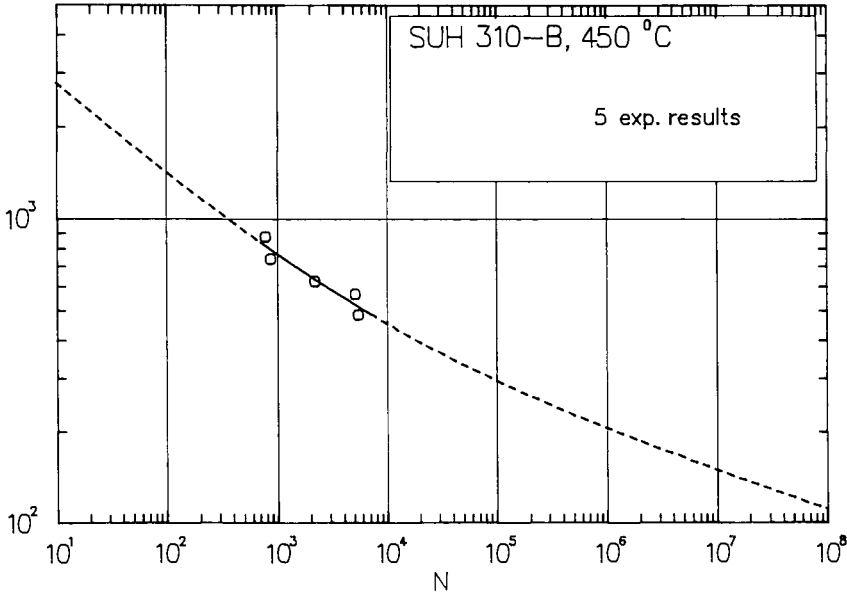
Strain rate : 0.40 (%/min)

Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUH 310-B, 450°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	471.9	0.0	0.9800	778.0
2.0000	443.4	0.0	0.7450	867.0
3.0000	404.2	0.0	0.5850	2173.0
4.0000	388.0	0.0	0.5000	5086.0
5.0000	345.3	0.0	0.4100	5436.0

X 15 CrNiSi 25 20	1.4841	SUH 310-B
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Heat treatment : 1050°C/50', water
Test temperature : 600°C
Semifinished material : bar, Ø 22 mm
Reference : [4.8]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N
0.13	1.00	1.85	0.025	0.009	20.01	24.70	0.26	0.11	0.0516

Monotonic properties

E	=	163550	N/mm ²	ν	=	-
R _{p0.2}	=	161	N/mm ²	K	=	N/mm ²
R _m	=	456	N/mm ²	n	=	-
A ₅	=	40	%	σ _f	=	N/mm ²
Z	=	54	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	305	N/mm ²	K'	=	1404	N/mm ²
σ _g	=	160	N/mm ²	n'	=	0.246	-
ε _g	=	0.111	%	σ' _f	=	945	N/mm ²
N _T	=	9106	cycles	e' _f	=	0.223	-
T _σ	=	1.236	-	b	=	-0.117	-
T _{εp}	=	1.311	-	c	=	-0.489	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

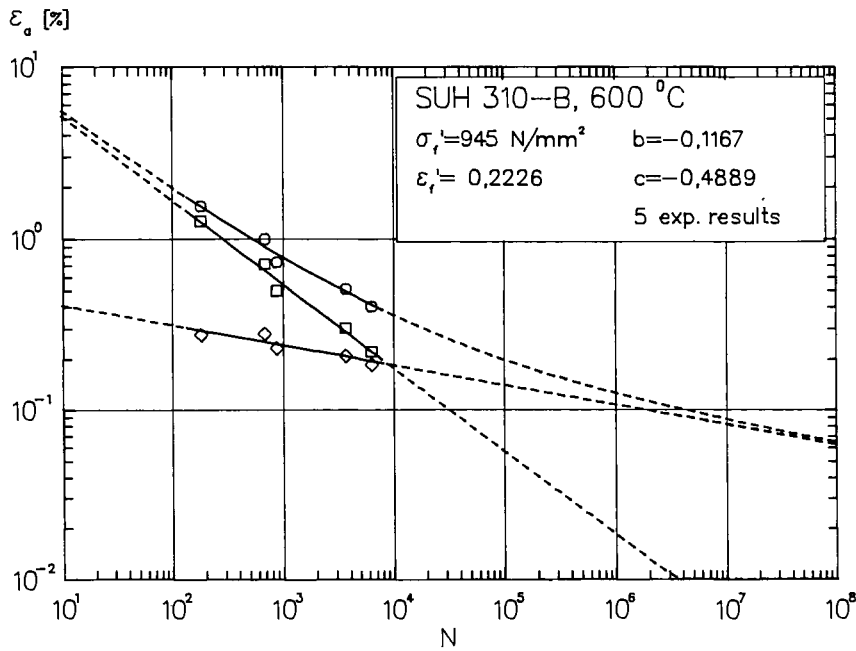
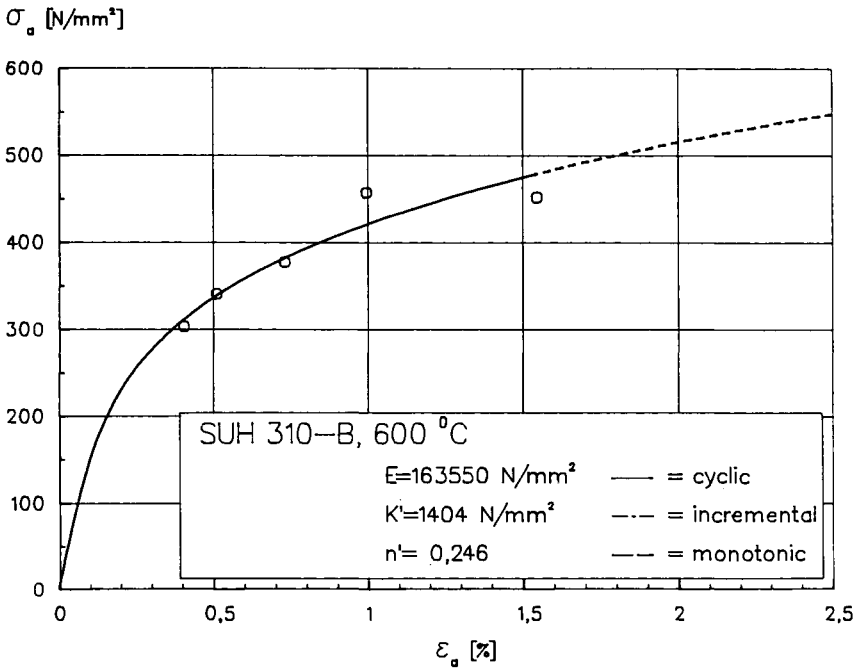
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

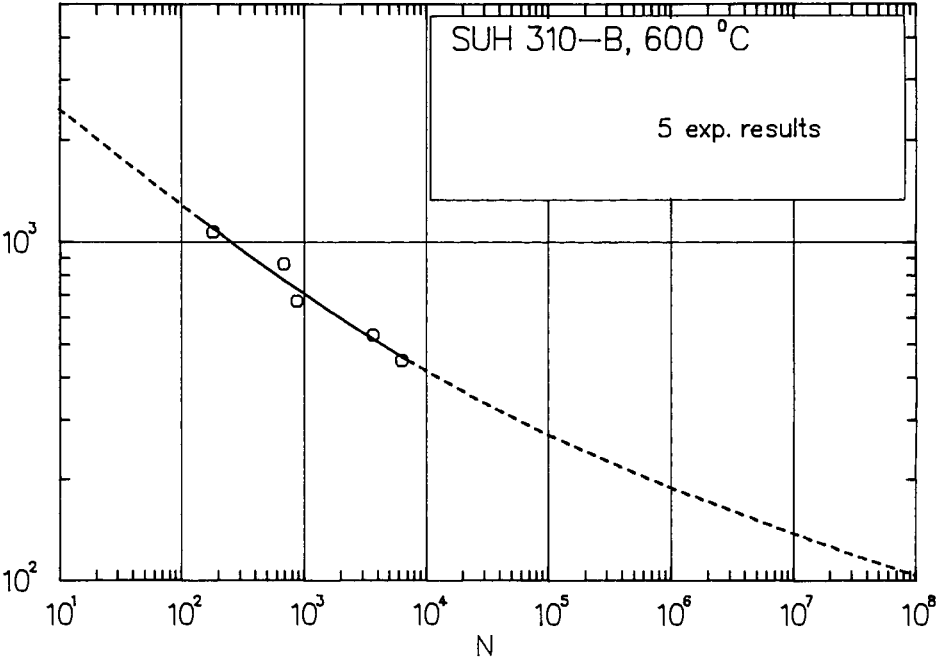
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUH 310-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	452.2	0.0	1.5450	181.0
2.0000	457.6	0.0	0.9950	680.0
3.0000	377.2	0.0	0.7300	872.0
4.0000	340.4	0.0	0.5100	3643.0
5.0000	303.1	0.0	0.4050	6279.0

X 15 CrNiSi 25 20	1.4841	SUH 310-B
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Heat treatment : 1050°C/50', water
Test temperature : +600°C
Semifinished material : bar, Ø 22 mm
Reference : [4.8]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N
0.13	1.00	1.85	0.025	0.009	20.01	24.70	0.26	0.11	0.0516

Monotonic properties

E	=	163550	N/mm ²	ν	=	-
R _{p0.2}	=	161	N/mm ²	K	=	N/mm ²
R _m	=	456	N/mm ²	n	=	-
A ₅	=	40	%	σ_f	=	N/mm ²
Z	=	54	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	342	N/mm ²	K'	=	1026	N/mm ²
σ_g	=	170	N/mm ²	n'	=	0.177	-
ϵ_g	=	0.108	%	σ'_f	=	792	N/mm ²
N _T	=	1844	cycles	ϵ'_f	=	0.236	-
T _{σ}	=	1.052	-	b	=	-0.101	-
T _{ep}	=	1.079	-	c	=	-0.575	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

Loading condition :

Specimen : cylindrical, Ø 10 mm

Specimen location : in rolling direction

Gauge length : 50 mm

Testing machine :

Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

Loading condition : total strain control, R_ε = -1

Specimen : cylindrical, Ø 6 mm

Surface : mechanically polished

Specimen location : in rolling direction

Gauge length : 15 mm

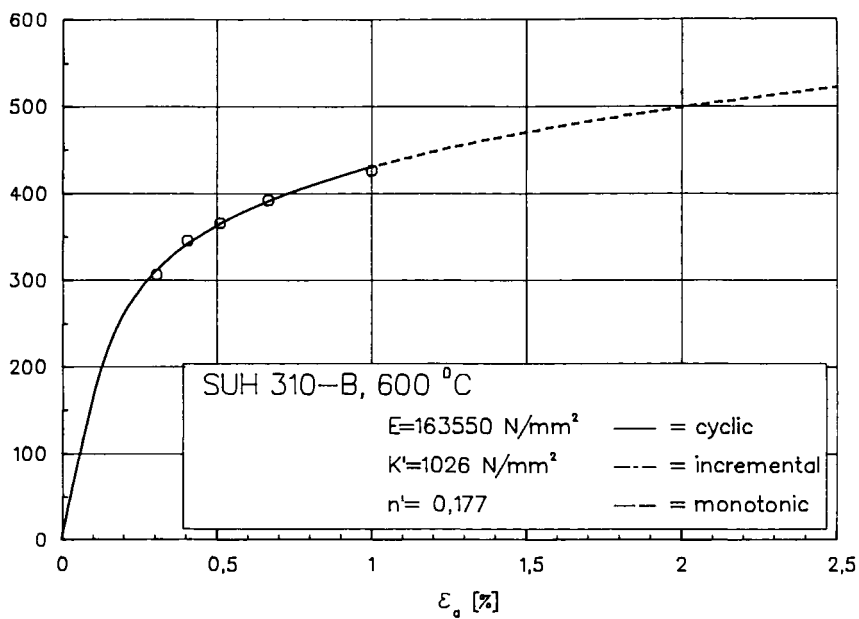
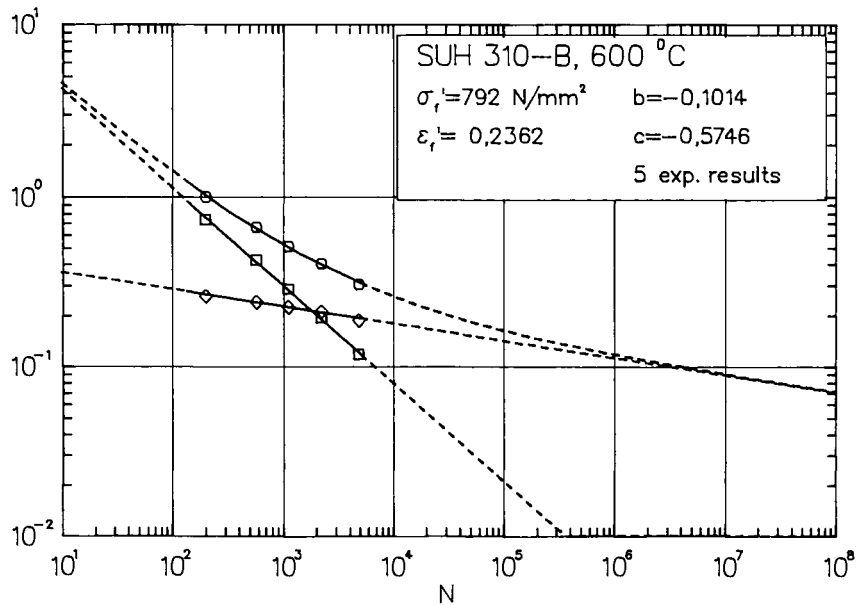
Testing machine : servohydraulic, max. 50 kN

Frequency :

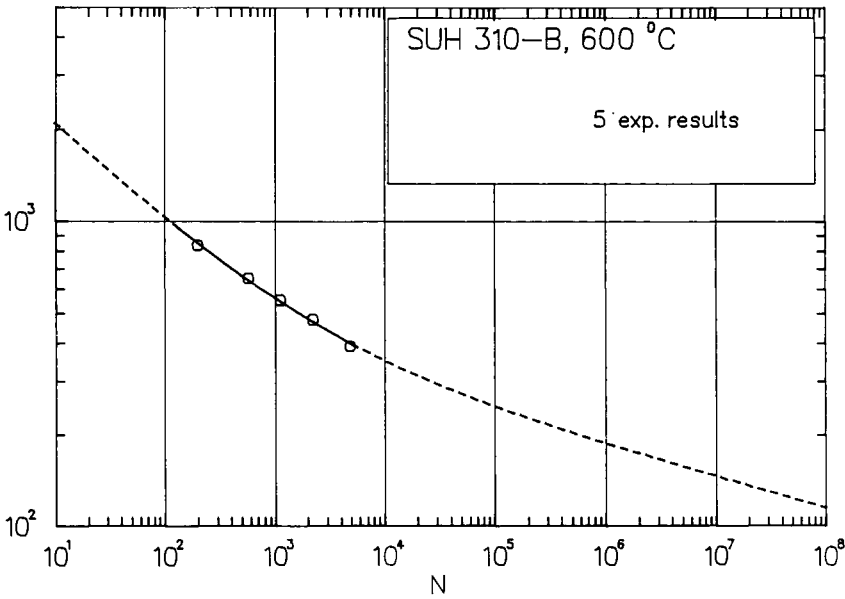
Strain rate : 0.40 (%/min)

Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUH 310-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	426.2	0.0	1.0000	198.0
2.0000	391.9	0.0	0.6650	568.0
3.0000	365.9	0.0	0.5100	1107.0
4.0000	345.3	0.0	0.4050	2195.0
5.0000	306.1	0.0	0.3050	4838.0

X 15 CrNiSi 25 20	1.4841	SUH 310-B
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Heat treatment : 1050°C/50', water
Test temperature : +700°C
Semifinished material : bar, Ø 22 mm
Reference : [4,8]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N
0.13	1.00	1.85	0.025	0.009	20.01	24.70	0.26	0.11	0.0516

Monotonic properties

E	=	164000	N/mm ²	ν	=	-
R _{p0.2}	=	156	N/mm ²	K	=	N/mm ²
R _m	=	357	N/mm ²	n	=	-
A ₅	=	44	%	σ_f	=	N/mm ²
Z	=	58	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	243	N/mm ²	K'	=	700	N/mm ²
σ'_g	=	154	N/mm ²	n'	=	0.171	-
ϵ'_g	=	0.107	%	σ'_f	=	527	N/mm ²
N _T	=	15381	cycles	ϵ'_f	=	0.194	-
T _{σ}	=	1.069	-	b	=	-0.081	-
T _{ϵ_p}	=	1.134	-	c	=	-0.478	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

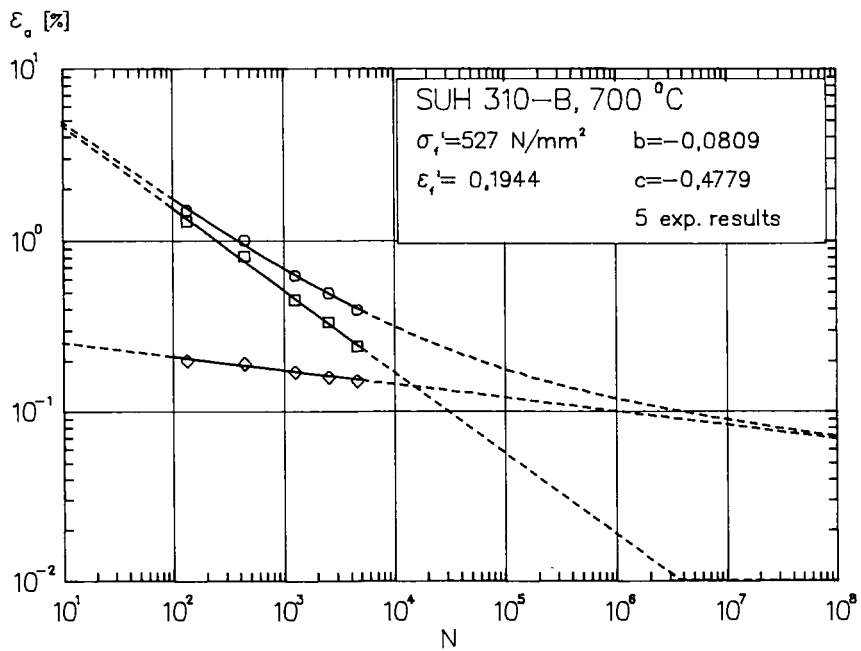
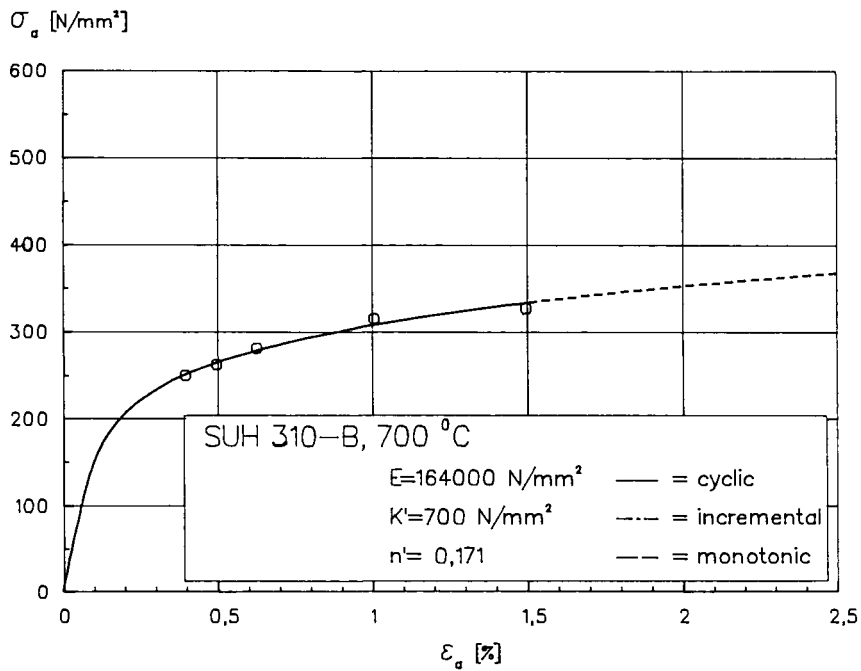
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 10 mm
Specimen location : in rolling direction
Gauge length : 50 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

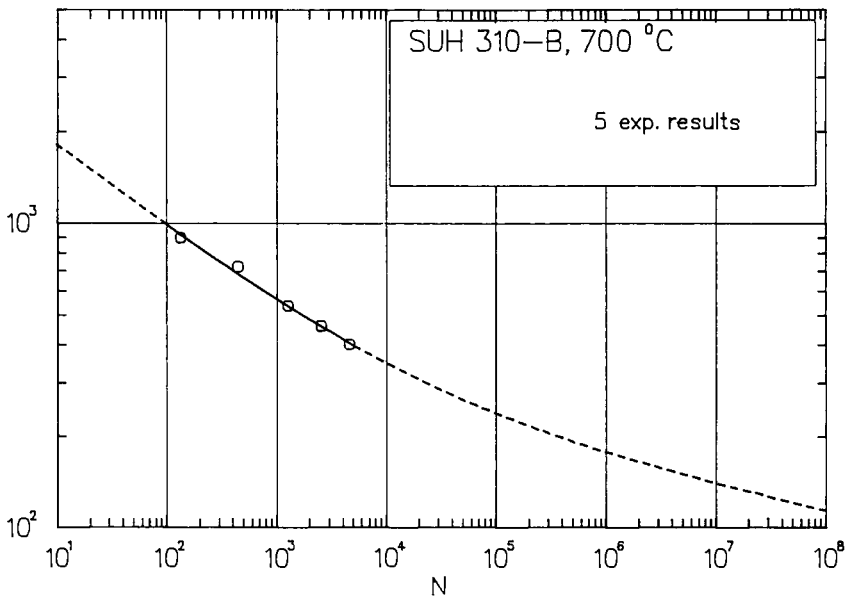
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUH 310-B, 700°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	327.6	0.0	1.4950	133.0
2.0000	315.4	0.0	1.0050	441.0
3.0000	281.5	0.0	0.6250	1256.0
4.0000	262.4	0.0	0.4950	2528.0
5.0000	249.7	0.0	0.3950	4591.0

X 15 CrNiSi 25 20	1.4841	SUH 310-B
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Heat treatment : 1050°C/50', water
 Test temperature : +700°C
 Semifinished material : bar, Ø 22 mm
 Reference : [4.8]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N
0.13	1.00	1.85	0.025	0.009	20.01	24.70	0.26	0.11	0.0516

Monotonic properties

E	=	164000	N/mm ²	ν	=	-
R _{p0.2}	=	156	N/mm ²	K	=	N/mm ²
R _m	=	357	N/mm ²	n	=	-
A ₅	=	44	%	σ _f	=	N/mm ²
Z	=	58	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	180	N/mm ²	K'	=	617	N/mm ²
σ _g	=	113	N/mm ²	n'	=	0.199	-
ε _g	=	0.088	%	σ' _f	=	386	N/mm ²
N _T	=	41248	cycles	ε' _f	=	0.095	-
T _σ	=	1.064	-	b	=	-0.081	-
T _{εp}	=	1.213	-	c	=	-0.408	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks : Young's modulus estimated

Hardness :

Microstructure :

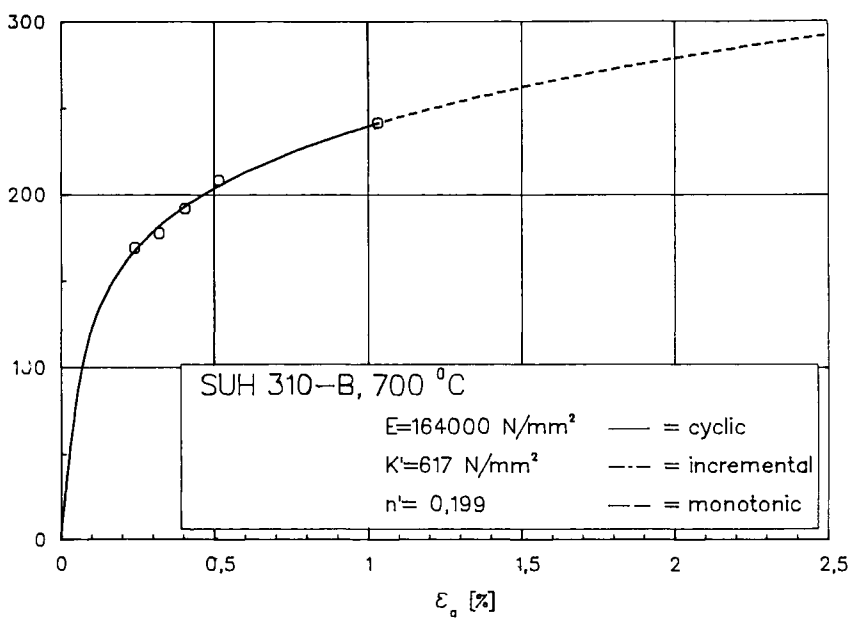
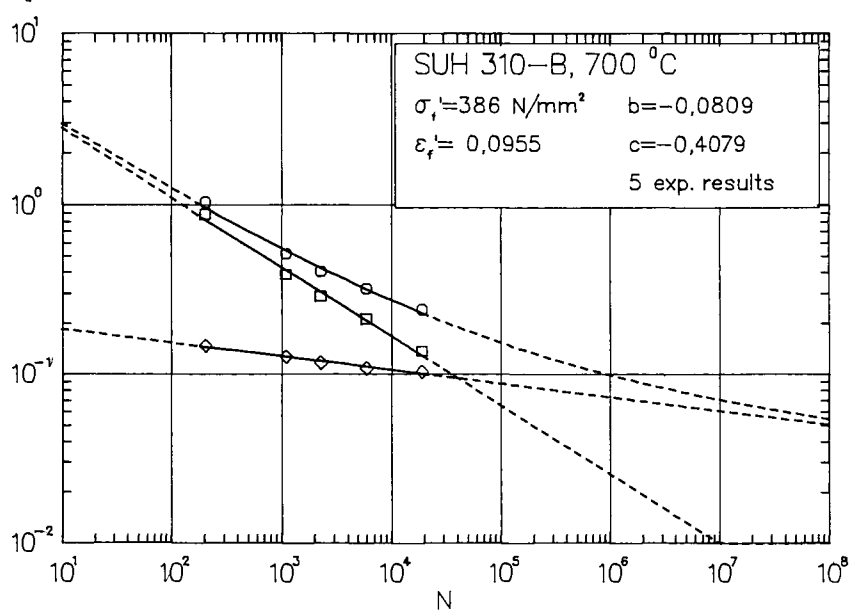
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 10 mm
 Specimen location : in rolling direction
 Gauge length : 50 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

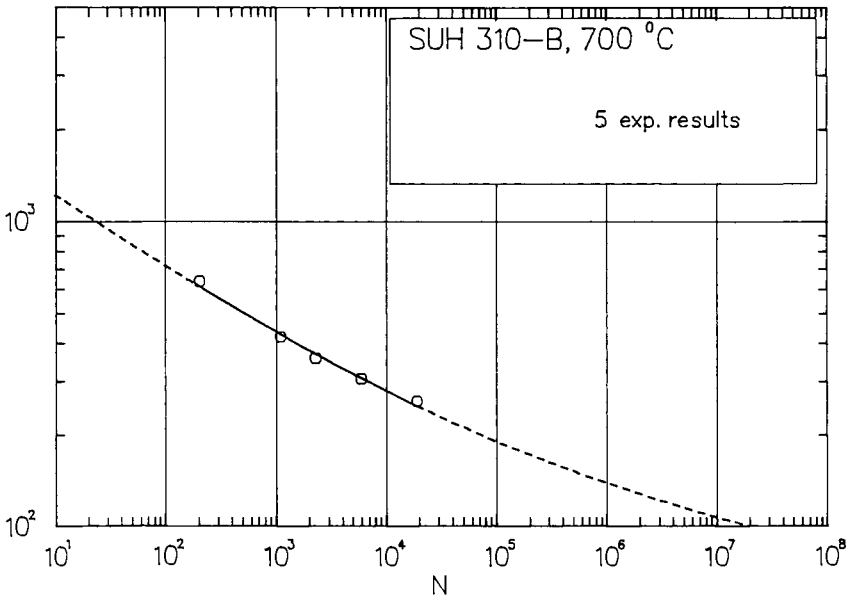
Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.41 (%/min)
 Waveform : triangular

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUH 310-B, 700° c

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	241.3	0.0	1.0300	203.0
2.0000	208.0	0.0	0.5150	1098.0
3.0000	191.8	0.0	0.4050	2260.0
4.0000	177.6	0.0	0.3200	5887.0
5.0000	169.2	0.0	0.2400	18855.0

X 20 CrMo 12 1	1.4935	SUH 616-B
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Heat treatment : 1052°C/80', quenched, 640°C/100', air
Test temperature : +23°C
Semifinished material : bar, Ø 50 mm
Reference : [4.4]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	W	V
0.25	0.40	0.80	0.016	0.005	0.68	11.40	0.90	0.99	0.28

Monotonic properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	795	N/mm ²	K	=	N/mm ²
R _m	=	1013	N/mm ²	n	=	-
A ₅	=	15	%	σ_f	=	N/mm ²
Z	=	47	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	730	N/mm ²	K'	=	1301	N/mm ²
σ_g	=	476	N/mm ²	n'	=	0.093	-
ϵ_g	=	0.229	%	σ'_f	=	1216	N/mm ²
N _T	=	793	cycles	ϵ'_f	=	0.490	-
T _σ	=	1.034	-	b	=	-0.062	-
T _{εp}	=	1.341	-	c	=	-0.664	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/κ -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness : HV 10 : 317

Microstructure : JIS G 0551 grain size: 5.9

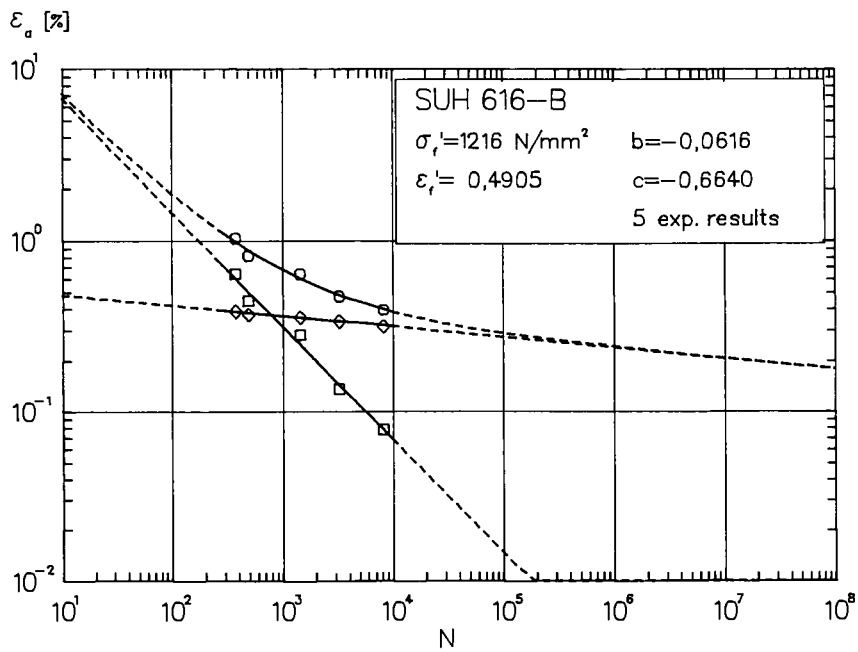
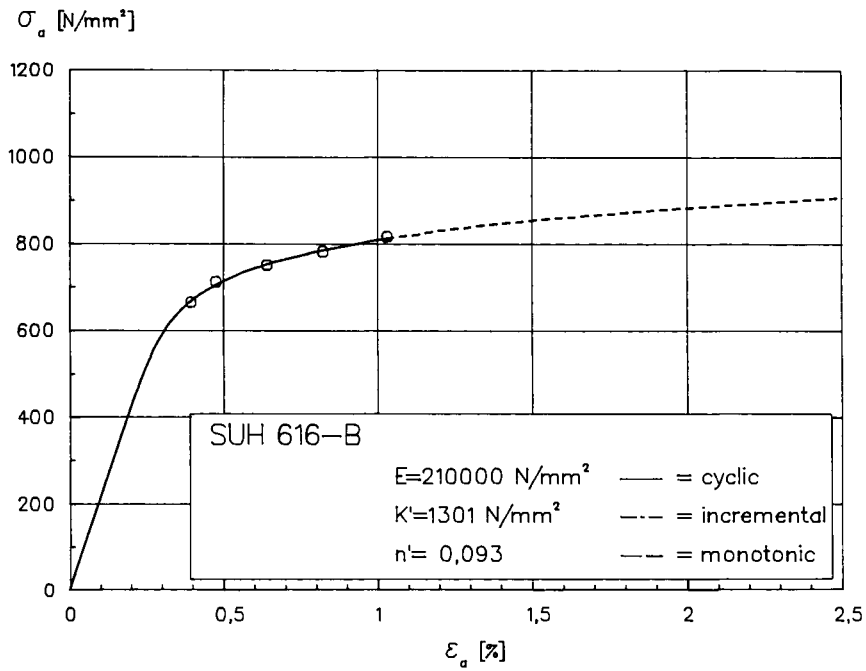
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 6 mm
Specimen location : in rolling direction
Gauge length : 30 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

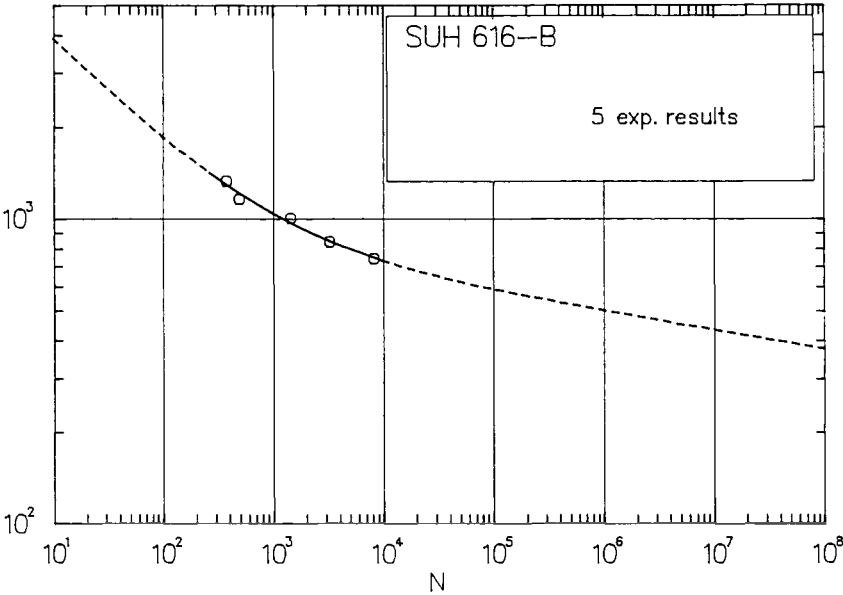
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUH 616-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	816.7	0.0	1.0300	373.0
2.0000	782.3	0.0	0.8200	489.0
3.0000	750.5	0.0	0.6400	1429.0
4.0000	711.7	0.0	0.4750	3250.0
5.0000	665.1	0.0	0.3950	8188.0

X 20 CrMo 12 1	1.4935	SUH 616-B
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Heat treatment : 1052°C/80', quenched, 640°C/100', air
 Test temperature : +23°C
 Semifinished material : bar, Ø 50 mm
 Reference : [4.4]
 Year : 1978

Hardness : HV 10 : 317

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	W	V
0.25	0.40	0.80	0.016	0.005	0.68	11.40	0.90	0.99	0.28

Microstructure : JIS G 0551 grain size: 5.9

Monotonic Properties

E	=	210000	N/mm ²	ν	=	-
R _{p0.2}	=	795	N/mm ²	K	=	N/mm ²
R _m	=	1013	N/mm ²	n	=	-
A ₅	=	15	%	σ_f	=	N/mm ²
Z	=	47	%	ϵ_f	=	-

Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 6 mm
 Specimen location : in rolling direction
 Gauge length : 30 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

Cyclic properties

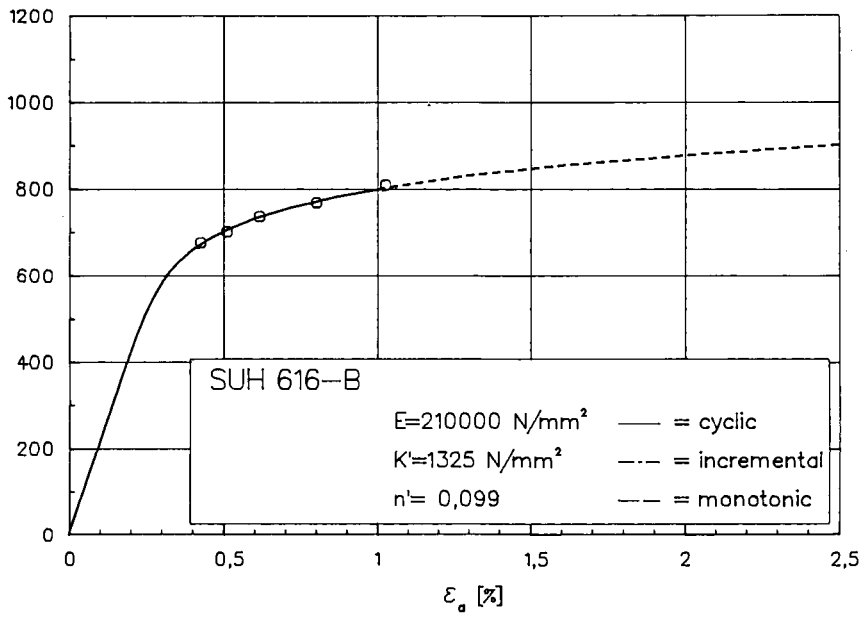
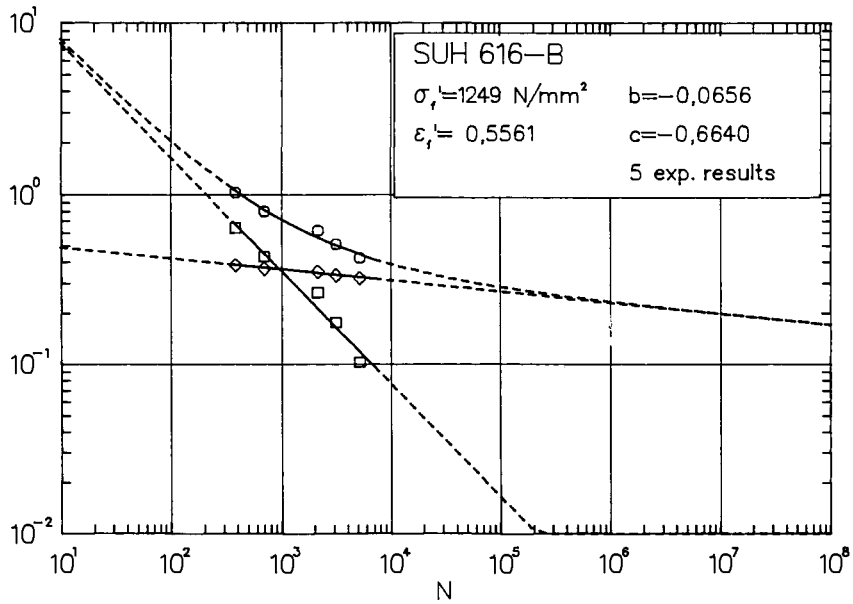
R' _{p0.2}	=	716	N/mm ²	K'	=	1325	N/mm ²
σ_g	=	461	N/mm ²	n'	=	0.099	-
ϵ_g	=	0.222	%	σ'_f	=	1249	N/mm ²
N _T	=	982	cycles	ϵ'_f	=	0.556	-
T _{σ}	=	1.037	-	b	=	-0.066	-
T _{ϵ_p}	=	1.499	-	c	=	-0.664	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Cyclic test

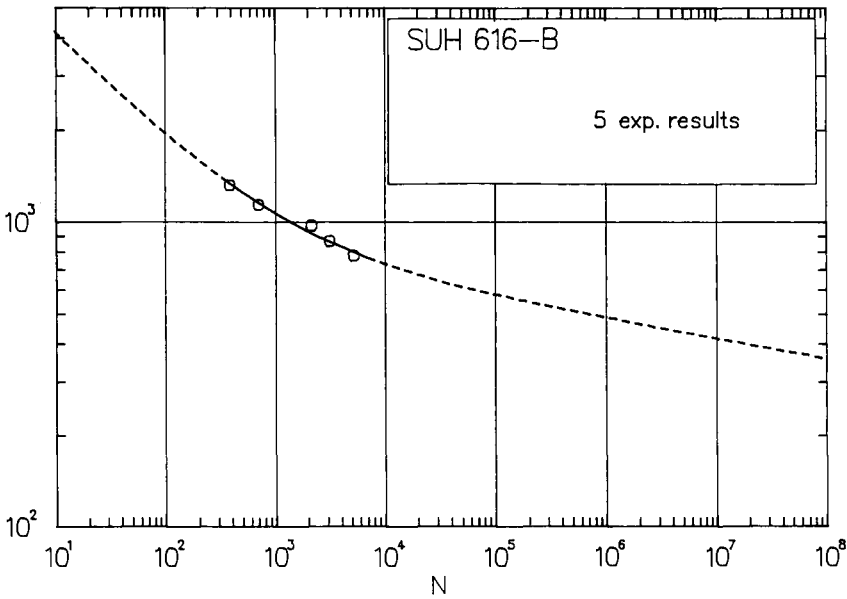
Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 4.1 (%/min)
 Waveform : triangular

Failure criterion : complete rupture
 σ/ϵ -values valid for : half failure life
 Remarks : Young's modulus estimated

Remarks :

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : SUH 616-B

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	809.8	0.0	1.0250	382.0
2.0000	768.6	0.0	0.8000	699.0
3.0000	736.2	0.0	0.6150	2141.0
4.0000	701.4	0.0	0.5100	3141.0
5.0000	675.9	0.0	0.4250	5164.0

X 20 CrMo 12 1	1.4935	SUH 616-B
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Heat treatment : 1052°C/80', quenched, 640°C/100', air
Test temperature : +400°C
Semifinished material : bar, Ø 50 mm
Reference : [4.4]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	W	V
0.25	0.40	0.80	0.016	0.005	0.68	11.40	0.90	0.99	0.28

Monotonic properties

E	=	191800	N/mm ²	ν	=	-
R _{p0.2}	=	647	N/mm ²	K	=	N/mm ²
R _m	=	816	N/mm ²	n	=	-
A ₅	=	12	%	σ_f	=	N/mm ²
Z	=	49	%	ε_f	=	-

Cyclic properties

R _{p0.2}	=	589	N/mm ²	K'	=	1096	N/mm ²
σ_g	=	319	N/mm ²	n'	=	0.100	-
ε_g	=	0.167	%	σ'_f	=	1193	N/mm ²
N _T	=	985	cycles	ε'_f	=	1.891	-
T _{σ}	=	1.031	-	b	=	-0.087	-
T _{ε_p}	=	1.417	-	c	=	-0.840	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
 σ/ε -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

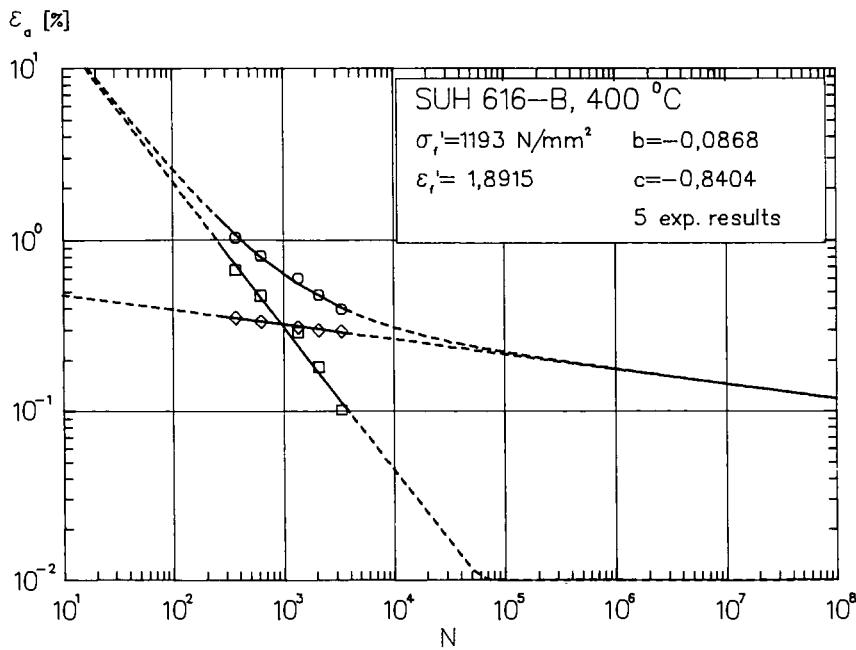
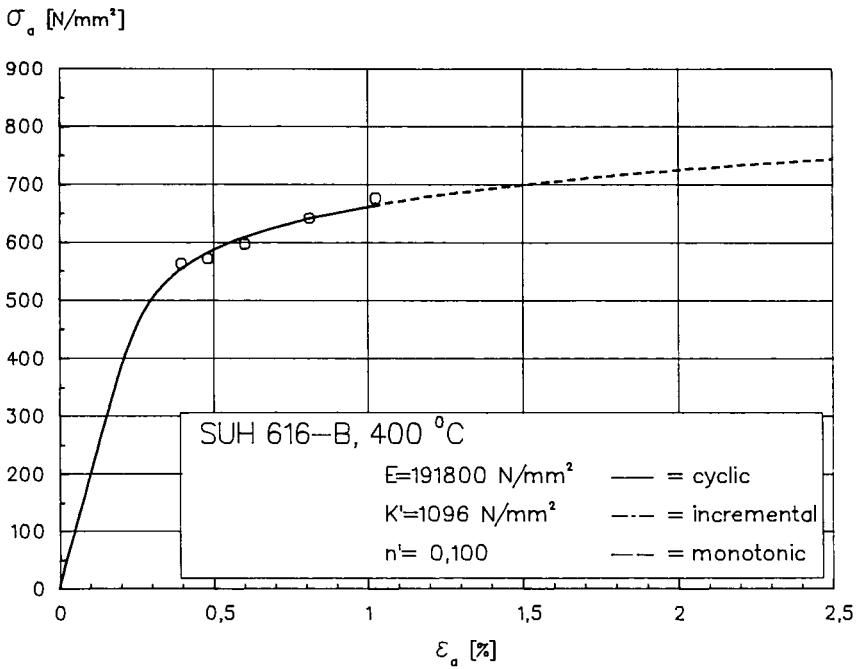
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 6 mm
Specimen location : in rolling direction
Gauge length : 30 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

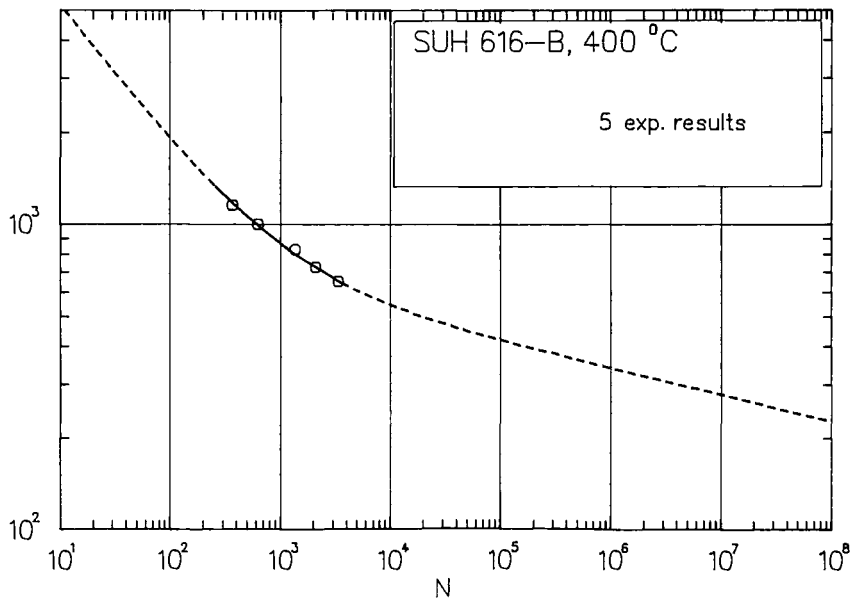
Cyclic test

Loading condition : total strain control, R_e = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUH 616-B, 400°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	676.9	0.0	1.0250	368.0
2.0000	642.1	0.0	0.8100	623.0
3.0000	596.9	0.0	0.6000	1359.0
4.0000	571.9	0.0	0.4800	2081.0
5.0000	563.1	0.0	0.3950	3348.0

X 20 CrMo 12 1	1.4935	SUH 616-B
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Heat treatment : 1052°C/80', quenched, 640°C/100', air
Test temperature : +400°C
Semifinished material : bar, Ø 50 mm
Reference : [4.4]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	W	V
0.25	0.40	0.80	0.016	0.005	0.68	11.40	0.90	0.99	0.28

Monotonic properties

E	=	191800	N/mm ²	ν	=	-
R _{p0.2}	=	647	N/mm ²	K	=	N/mm ²
R _m	=	816	N/mm ²	n	=	-
A ₅	=	12	%	σ_f	=	N/mm ²
Z	=	49	%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	694	N/mm ²	K'	=	1034	N/mm ²
σ_g	=	382	N/mm ²	n'	=	0.084	-
ϵ_g	=	0.200	%	σ'_f	=	1049	N/mm ²
N _T	=	857	cycles	ϵ'_f	=	1.259	-
T _{σ}	=	1.039	-	b	=	-0.066	-
T _{ϵ_p}	=	1.588	-	c	=	-0.797	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

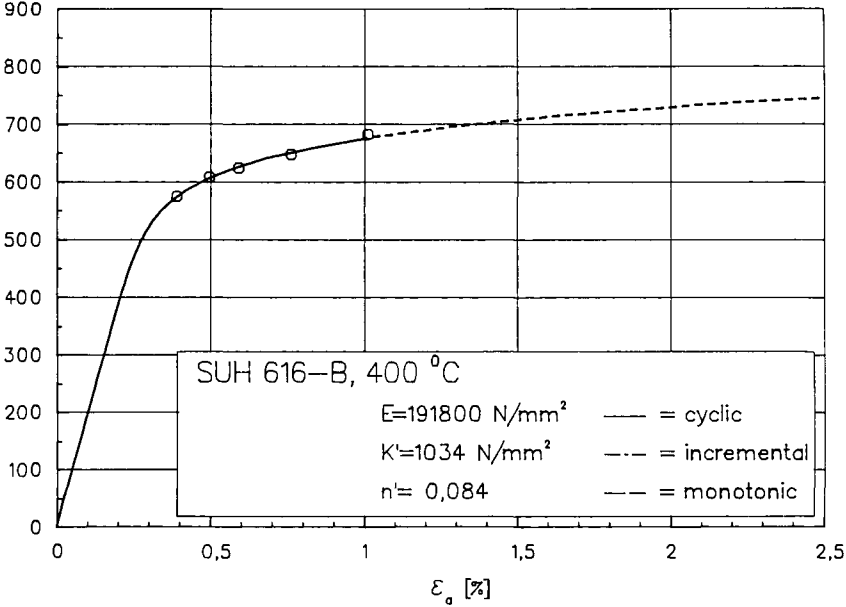
Loading condition :
Specimen : cylindrical, Ø 6 mm
Specimen location : in rolling direction
Gauge length : 30 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

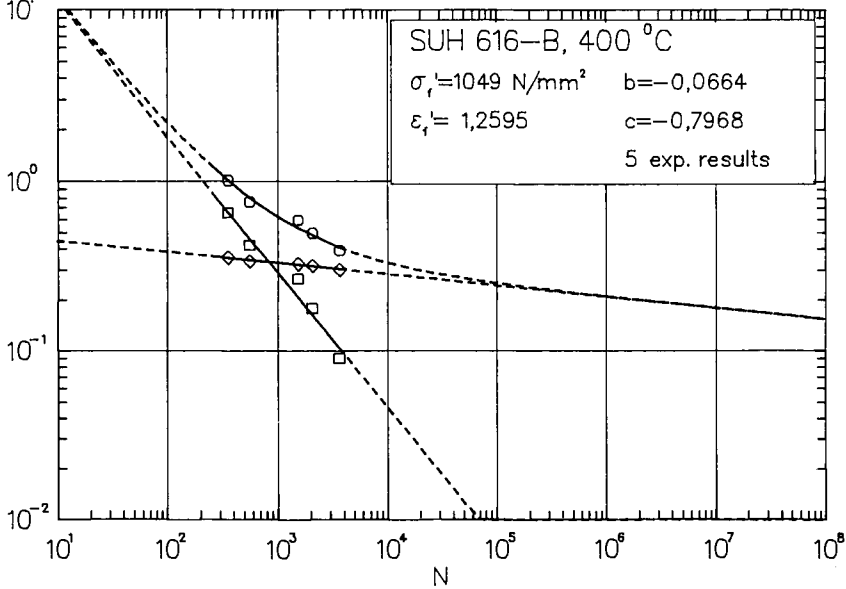
Loading condition : total strain control, R _{ϵ} = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.40 (%/min)
Waveform : triangular

Remarks :

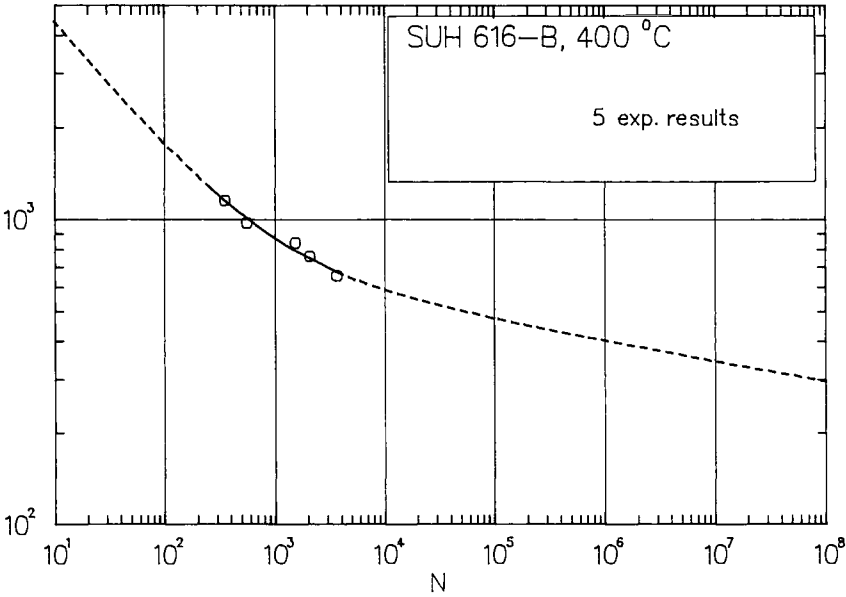
σ_a [N/mm²]



ε_a [%]



PSWT [N/mm²]



Material : SUH 616-B, 400°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	682.8	0.0	1.0100	353.0
2.0000	648.0	0.0	0.7600	556.0
3.0000	623.9	0.0	0.5900	1527.0
4.0000	608.2	0.0	0.4950	2064.0
5.0000	574.9	0.0	0.3900	3634.0

X 20 CrMo 12 1	1.4935	SUH 616-B
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Heat treatment : 1052°C/80', quenched, 640°C/100', air
Test temperature : +500°C
Semifinished material : bar, Ø 50 mm
Reference : [4.4]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	W	V
0.25	0.40	0.80	0.016	0.005	0.68	11.40	0.90	0.99	0.28

Monotonic properties

E	=	185850	N/mm ²	ν	=	-
R _{p0.2}	=	538	N/mm ²	K	=	N/mm ²
R _m	=	700	N/mm ²	n	=	-
A ₅	=	22	%	σ _f	=	N/mm ²
Z	=	71	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	507	N/mm ²	K'	=	1151	N/mm ²
σ _g	=	270	N/mm ²	n'	=	0.132	-
ε _g	=	0.148	%	σ' _f	=	1103	N/mm ²
N _T	=	1311	cycles	ε' _f	=	0.468	-
T _σ	=	1.054	-	b	=	-0.093	-
T _{εp}	=	2.548	-	c	=	-0.647	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

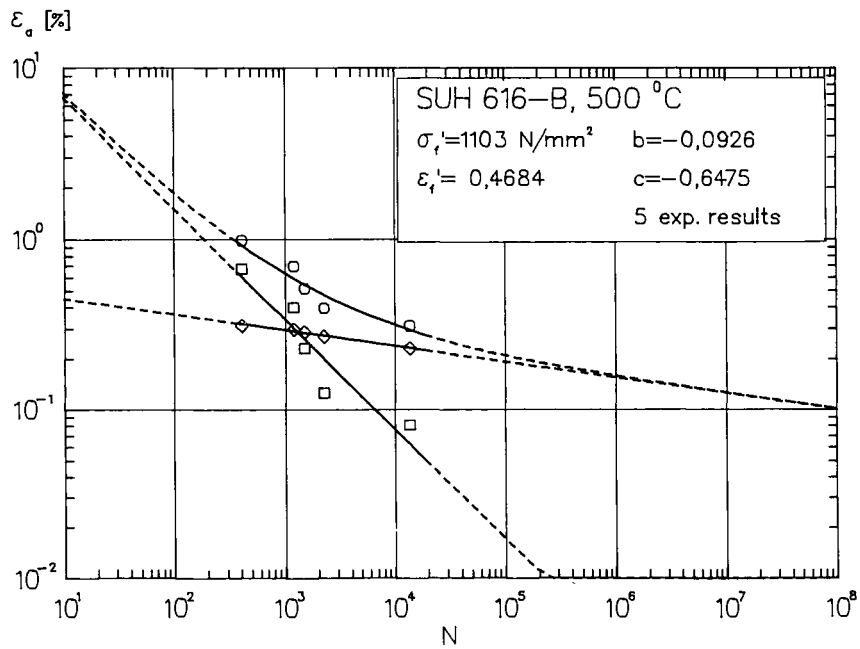
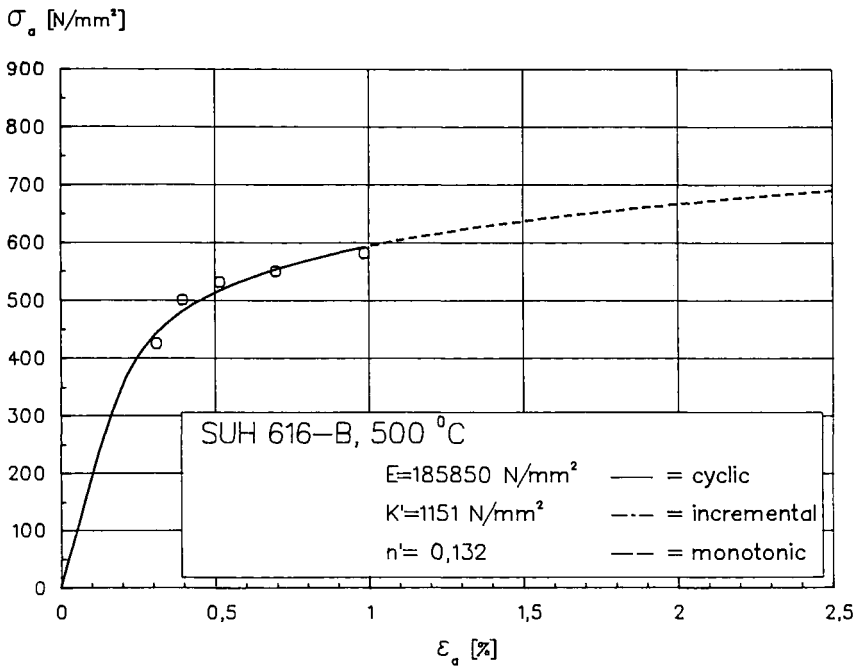
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 6 mm
Specimen location : in rolling direction
Gauge length : 30 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

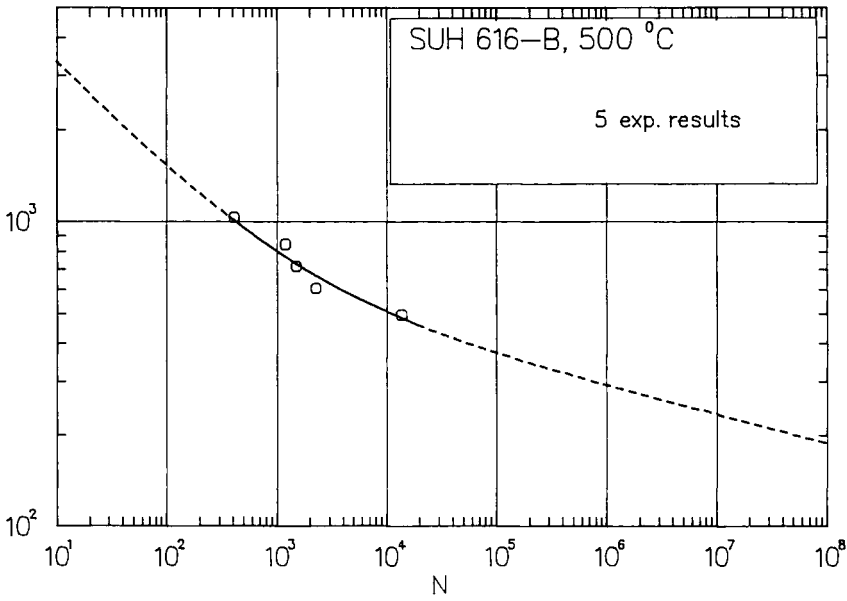
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUH 616-B, 500 °C

Spec. no	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	582.2	0.0	0.9850	406.0
2.0000	550.3	0.0	0.6950	1192.0
3.0000	531.7	0.0	0.5150	1493.0
4.0000	500.8	0.0	0.3950	2256.0
5.0000	425.8	0.0	0.3100	13611.0

X 20 CrMo 12 1	1.4935	SUH 616-B
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Heat treatment : 1052°C/80', quenched, 640°C/100', air
 Test temperature : +500°C
 Semifinished material : bar, Ø 50 mm
 Reference : [4.4]
 Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	W	V
0.25	0.40	0.80	0.016	0.005	0.68	11.40	0.90	0.99	0.28

Monotonic properties

E	=	185850	N/mm ²	ν	=	-
R _{p0.2}	=	538	N/mm ²	K	=	N/mm ²
R _m	=	700	N/mm ²	n	=	-
A ₅	=	22	%	σ_f	=	N/mm ²
Z	=	71	%	ϵ_f	=	-

Cyclic properties

R'p0.2	=	465	N/mm ²	K'	=	910	N/mm ²
σ_s	=	292	N/mm ²	n'	=	0.108	-
ϵ_s	=	0.160	%	σ'_f	=	855	N/mm ²
N _T	=	1903	cycles	ϵ'_f	=	0.576	-
T _{σ}	=	1.044	-	b	=	-0.071	-
T _{ϵ_p}	=	1.204	-	c	=	-0.657	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

Monotonic test

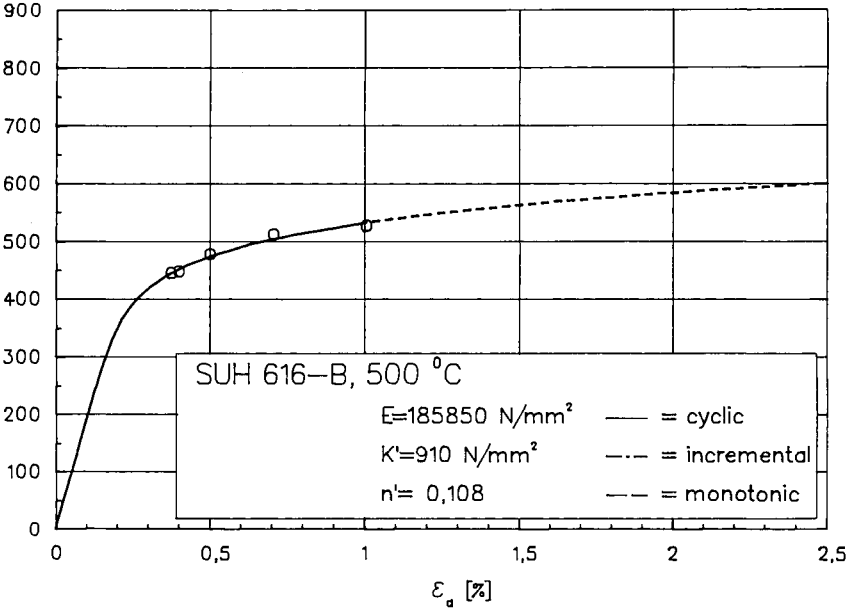
Loading condition :
 Specimen : cylindrical, Ø 6 mm
 Specimen location : in rolling direction
 Gauge length : 30 mm
 Testing machine :
 Strain rate : 0.3 and 7.5 (%/min)

Cyclic test

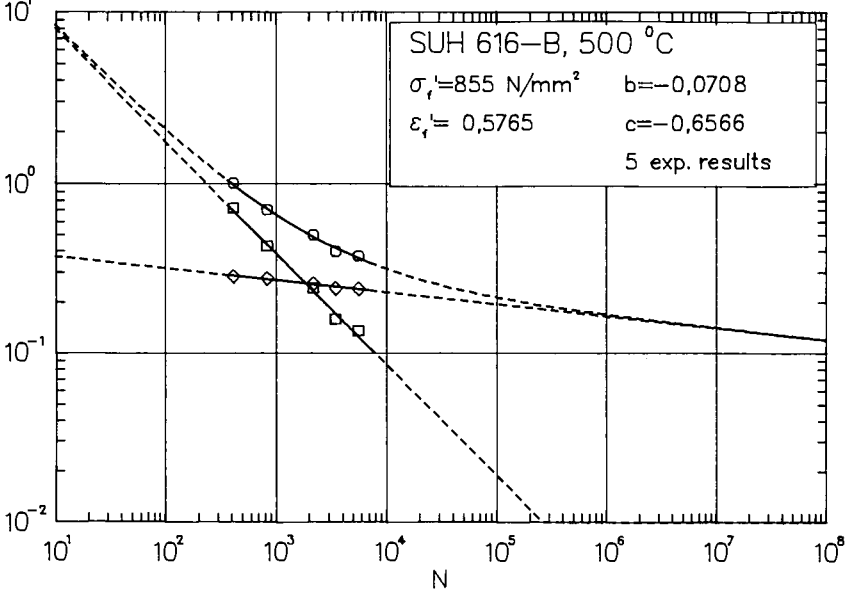
Loading condition : total strain control, R_e = -1
 Specimen : cylindrical, Ø 6 mm
 Surface : mechanically polished
 Specimen location : in rolling direction
 Gauge length : 15 mm
 Testing machine : servohydraulic, max. 50 kN
 Frequency :
 Strain rate : 0.40 (%/min)
 Waveform : triangular

Remarks :

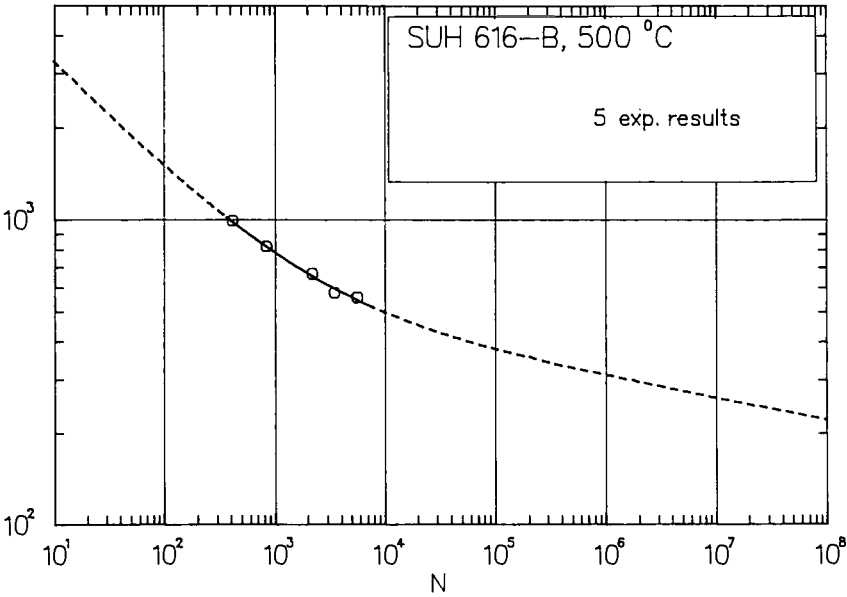
σ_a [N/mm²]



ϵ_a [%]



PSWT [N/mm²]



Material : SUH 616-B, 500°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	527.3	0.0	1.0050	411.0
2.0000	512.6	0.0	0.7050	831.0
3.0000	478.2	0.0	0.5000	2176.0
4.0000	448.3	0.0	0.4000	3448.0
5.0000	445.4	0.0	0.3750	5584.0

X 20 CrMo 12 1	1.4935	SUH 616-B
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Heat treatment : 1052°C/80', quenched, 640°C/100', air
Test temperature : +600°C
Semifinished material : bar, Ø 50 mm
Reference : [4.4]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	W	V
0.25	0.40	0.80	0.016	0.005	0.68	11.40	0.90	0.99	0.28

Monotonic properties

E	=	166950	N/mm ²	ν	=	-
R _{p0.2}	=	356	N/mm ²	K	=	N/mm ²
R _m	=	492	N/mm ²	n	=	-
A ₅	=	36	%	σ _f	=	N/mm ²
Z	=	92	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	369	N/mm ²	K'	=	859	N/mm ²
σ _g	=	198	N/mm ²	n'	=	0.136	-
ε _g	=	0.120	%	σ' _f	=	844	N/mm ²
N _T	=	2460	cycles	ε' _f	=	0.823	-
T _σ	=	1.031	-	b	=	-0.096	-
T _{εp}	=	1.234	-	c	=	-0.694	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

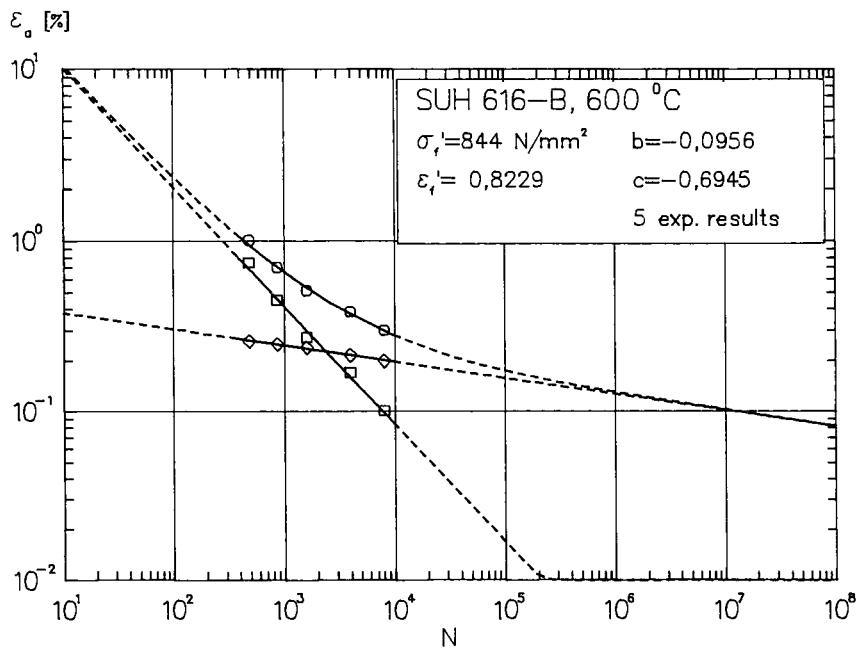
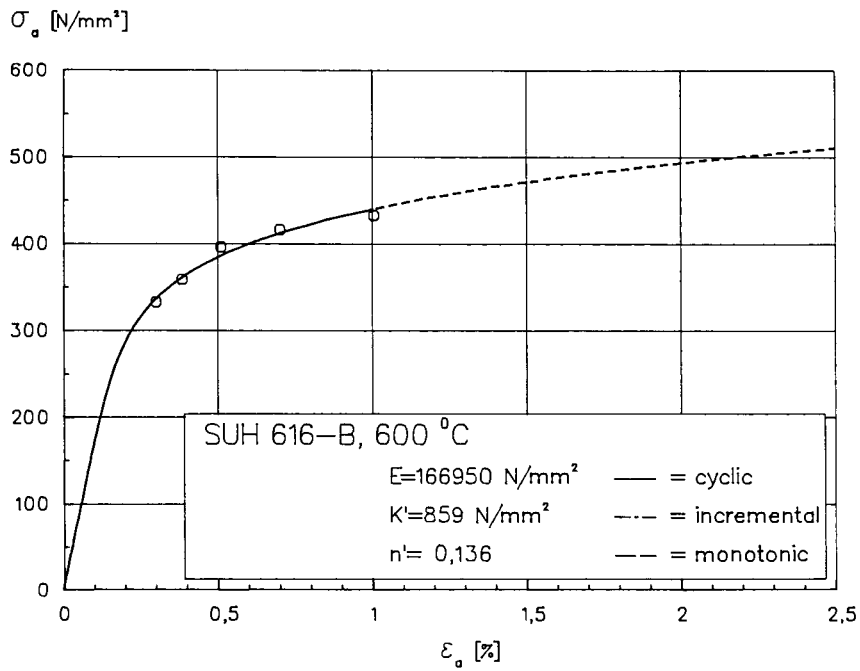
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 6 mm
Specimen location : in rolling direction
Gauge length : 30 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

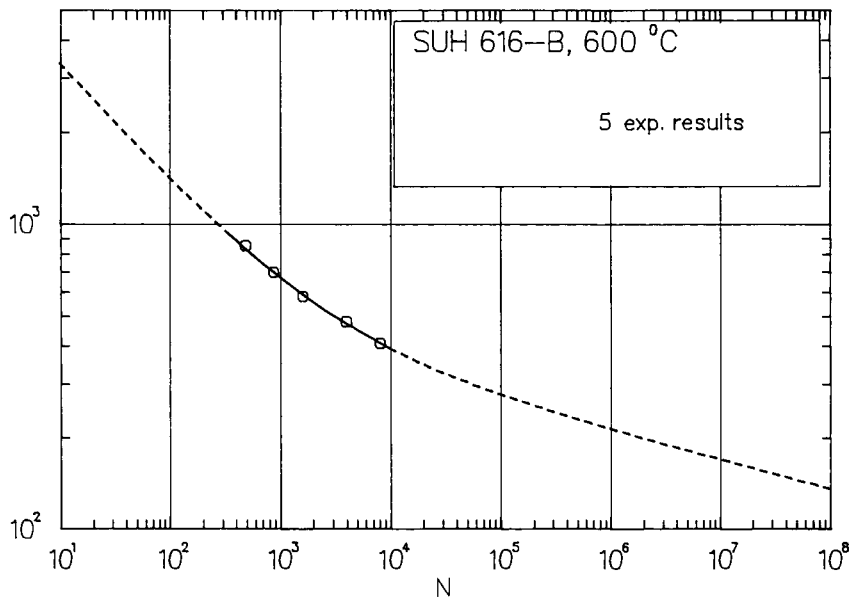
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 40 (%/min)
Waveform : triangular

Remarks :



PSWT [N/mm²]



Material : SUH 616-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	433.1	0.0	1.0050	482.0
2.0000	415.9	0.0	0.7000	864.0
3.0000	396.3	0.0	0.5100	1597.0
4.0000	358.6	0.0	0.3850	3948.0
5.0000	332.6	0.0	0.3000	7977.0

X 20 CrMo 12 1	1.4935	SUH 616-B
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Heat treatment : 1052°C/80', quenched, 640°C/100', air
Test temperature : +600°C
Semifinished material : bar, Ø 50 mm
Reference : [4.4]
Year : 1978

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	W	V
0.25	0.40	0.80	0.016	0.005	0.68	11.40	0.90	0.99	0.28

Monotonic properties

E	=	166950	N/mm ²	v	=	-
R _{p0.2}	=	356	N/mm ²	K	=	N/mm ²
R _m	=	492	N/mm ²	n	=	-
A ₅	=	36	%	σ _f	=	N/mm ²
Z	=	92	%	ε _f	=	-

Cyclic properties

R' _{p0.2}	=	280	N/mm ²	K'	=	355	N/mm ²
σ _g	=	236	N/mm ²	n'	=	0.038	-
ε _g	=	0.144	%	σ' _f	=	356	N/mm ²
N _T	=	4921	cycles	ε' _f	=	0.888	-
T _σ	=	1.046	-	b	=	-0.027	-
T _{εp}	=	1.267	-	c	=	-0.683	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion : complete rupture

σ/ε-values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

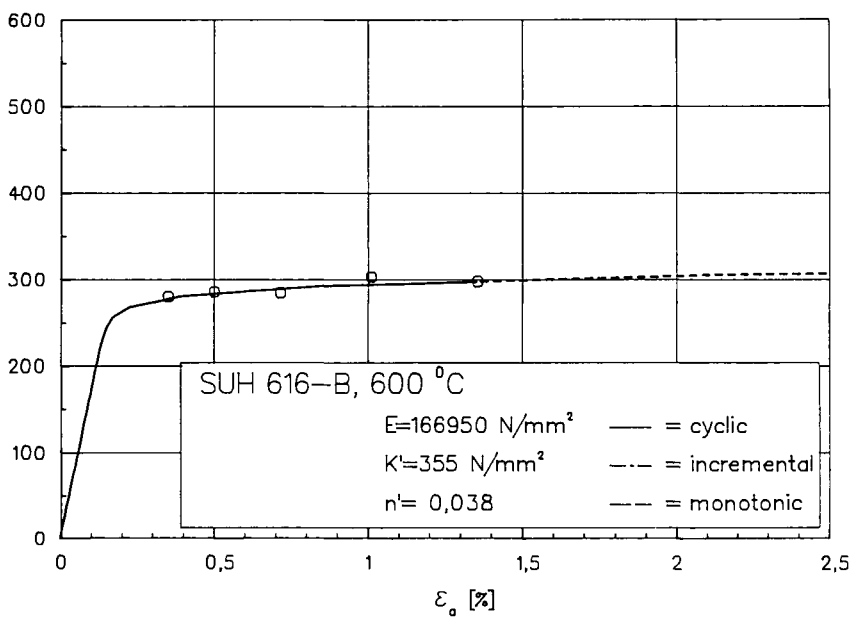
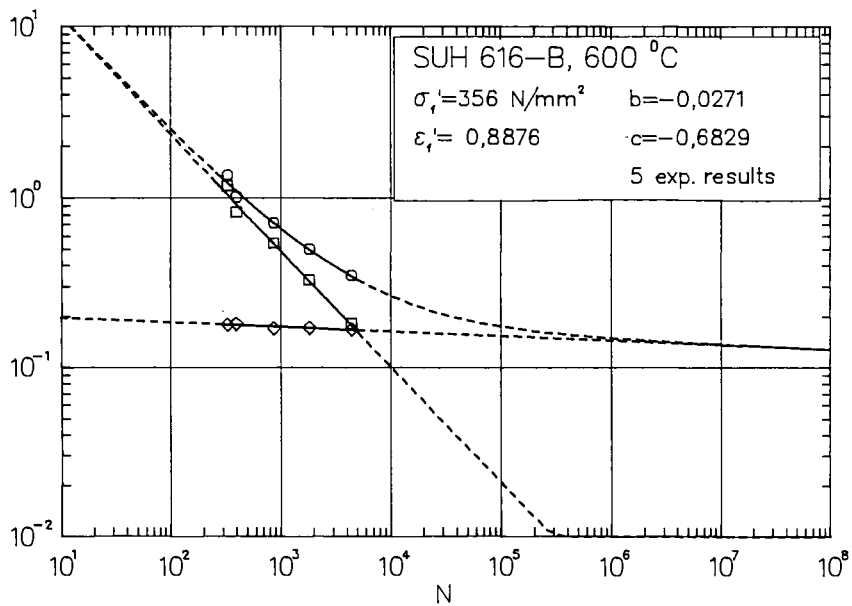
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 6 mm
Specimen location : in rolling direction
Gauge length : 30 mm
Testing machine :
Strain rate : 0.3 and 7.5 (%/min)

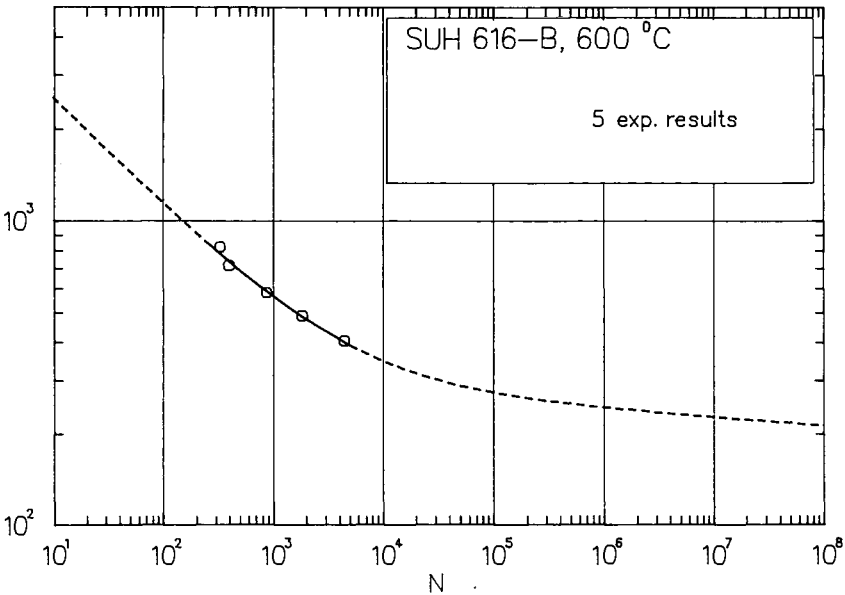
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, Ø 6 mm
Surface : mechanically polished
Specimen location : in rolling direction
Gauge length : 15 mm
Testing machine : servohydraulic, max. 50 kN
Frequency :
Strain rate : 0.40 (%/min)
Waveform : triangular

Remarks :

σ_a [N/mm²] ϵ_a [%]

PSWT [N/mm²]



Material : SUH 616-B, 600°C

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	298.2	0.0	1.3550	328.0
2.0000	303.1	0.0	1.0100	396.0
3.0000	285.0	0.0	0.7150	863.0
4.0000	286.0	0.0	0.5000	1824.0
5.0000	280.6	0.0	0.3500	4407.0

X25 CrNiMn 25 20	AISI 310
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Heat treatment : hot rolled, pickled and annealed by supplier
 Test temperature : +23°C
 Semifinished material : blanks, Ø 19 mm
 Reference : [3.27]
 Year : 1963

Hardness : Rockwell B-75 to 81

Chemical composition

C	Mn	Si	Cr	Ni
0.25	2.00	1.50	25.0	20.5

Microstructure :

Monotonic properties

E	=	193340	N/mm ²	ν	=	0.30	-
R _{p0.2}	=	220	N/mm ²	K	=	754	N/mm ²
R _m	=	642	N/mm ²	n	=	0.228	-
A ₅	=		%	σ _f	=	1360	N/mm ²
Z	=	63	%	ε _f	=	1.01	-

Monotonic test

Loading condition :
 Specimen : hourglass shaped, Ø 6.35 mm
 Specimen location : in rolling direction
 Gauge length : diametral
 Testing machine : Rhiele, universal testing machine
 Strain rate :

Cyclic properties

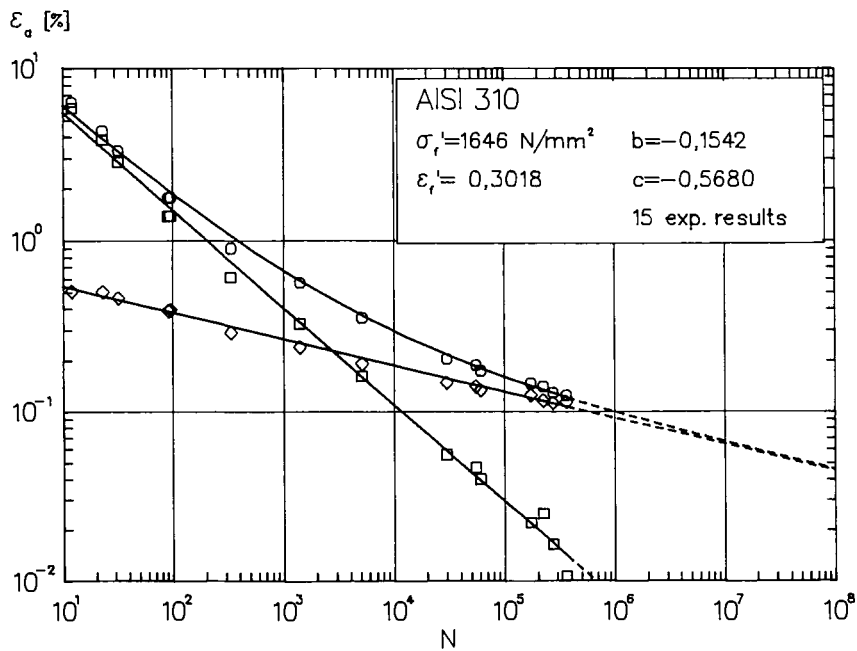
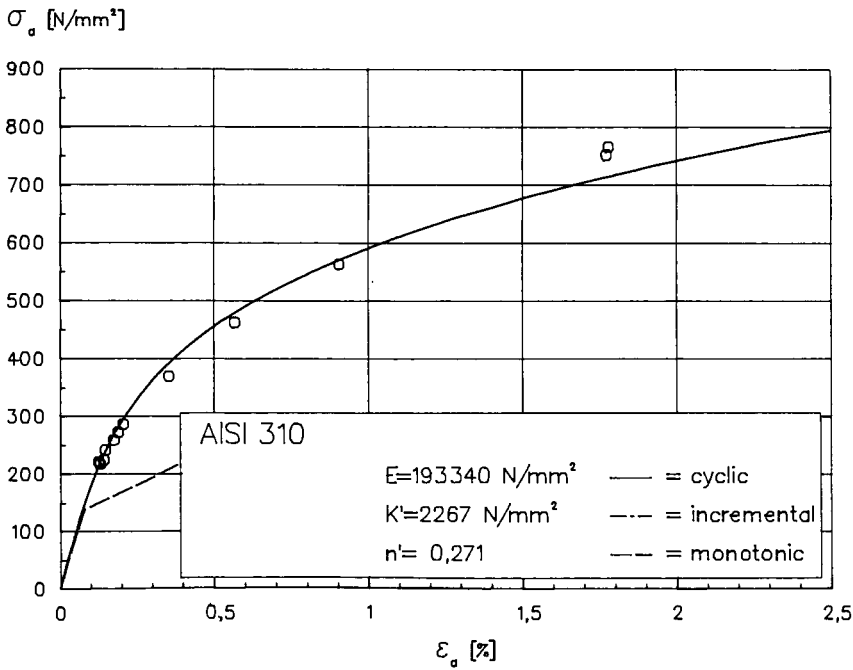
R _{p0.2}	=	421	N/mm ²	K'	=	2267	N/mm ²
σ _g	=	158	N/mm ²	n'	=	0.271	-
ε _g	=	0.087	%	σ' _f	=	1646	N/mm ²
N _T	=	2780	cycles	ε' _f	=	0.302	-
T _σ	=	1.140	-	b	=	-0.154	-
T _{εp}	=	1.474	-	c	=	-0.568	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Cyclic test

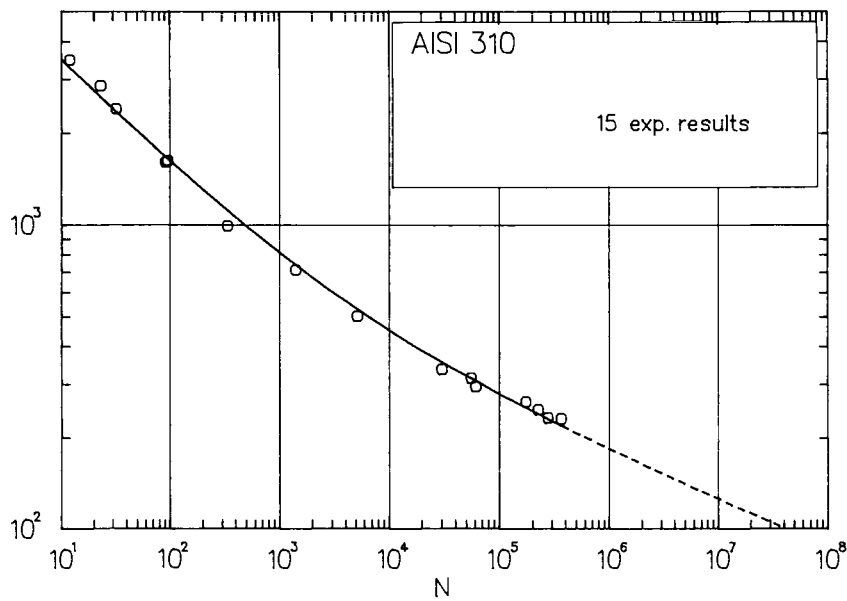
Loading condition : total diametral strain control, R_{ed} = -1
 Specimen : hourglass shaped, Ø 6.35 mm
 Surface : machined
 Specimen location : in rolling direction
 Gauge length : diametral
 Testing machine : self designed
 Frequency :
 Strain rate :
 Waveform :

Failure criterion : complete rupture
 σ/ε-values valid for : half failure life
 Remarks :

Remarks :



PSWT [N/mm²]



Material : AISI 310

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	980.4	0.0	6.3560	12.0
2.0000	973.5	0.0	4.3520	23.0
3.0000	897.5	0.0	3.3250	32.0
4.0000	752.5	0.0	1.7720	91.0
5.0000	766.3	0.0	1.7780	95.0
6.0000	562.7	0.0	0.9030	335.0
7.0000	462.6	0.0	0.5670	1400.0
8.0000	369.4	0.0	0.3530	5120.0
9.0000	286.5	0.0	0.2040	30000.0
10.0000	272.7	0.0	0.1880	55200.0
11.0000	258.9	0.0	0.1740	61000.0
12.0000	241.6	0.0	0.1470	173000.0
13.0000	224.4	0.0	0.1410	223000.0
14.0000	217.5	0.0	0.1290	274000.0
15.0000	220.9	0.0	0.1250	363000.0

X 40 CrMoV 20 5		H-11 Mod
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Heat treatment : hot worked, 700°C/3h, 650°C/2h, 1040°C/1h, air
 Test temperature : +23°C
 Semifinished material : bar, Ø 15.75 mm
 Reference : [4.9]
 Year : 1974

Hardness : Rockwell C: 60

Chemical composition

C	Si	Mn	P	S	Ni	Cr	Mo	Cu	V
0.43	1.00	0.40	0.020	0.020	0.25	5.25	1.40	0.35	0.60

Microstructure :

Monotonic properties

E	=	213000	N/mm ²	ν	=	0.281	-
R _{p0.2}	=	2030	N/mm ²	K	=	4584	N/mm ²
R _m	=	2576	N/mm ²	n	=	0.133	-
A ₅	=		%	σ _f	=		N/mm ²
Z	=	33	%	ε _f	=		-

Monotonic test

Loading condition :
 Specimen : Ø 5.8 mm
 Specimen location :
 Gauge length :
 Testing machine :
 Strain rate :

Cyclic properties

R' _{p0.2}	=	2536	N/mm ²	K'	=	4577	N/mm ²
σ _g	=	1094	N/mm ²	n'	=	0.095	-
ε _g	=	0.514	%	σ' _f	=	4569	N/mm ²
N _T	=	26	cycles	ε' _f	=	0.426	-
T _σ	=	1.180	-	b	=	-0.094	-
T _{εp}	=	3.524	-	c	=	-0.844	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Cyclic test

Loading condition : total strain control, R_ε = -1
 Specimen : Ø 5.8 mm
 Surface :
 Specimen location :
 Gauge length :
 Testing machine :
 Frequency :
 Strain rate :
 Waveform :

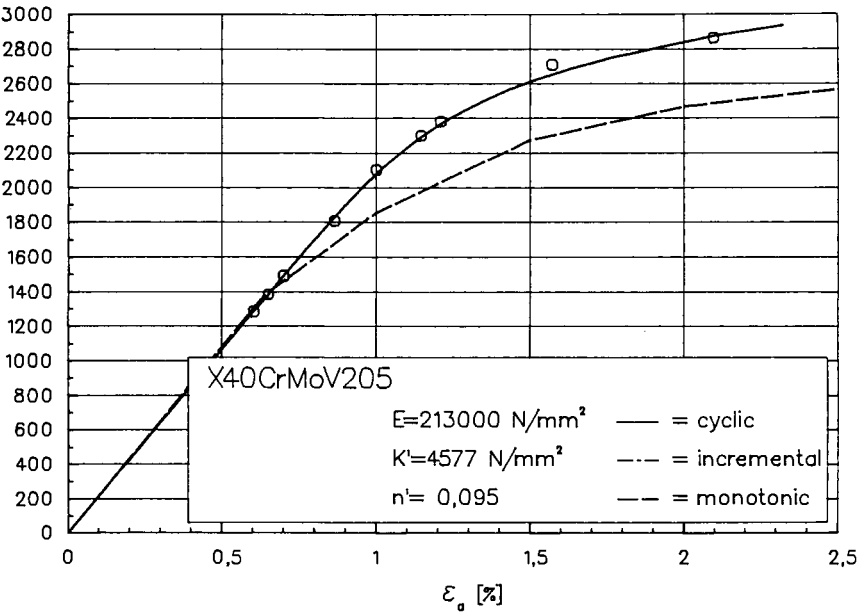
Failure criterion :

σ/ε-values valid for :

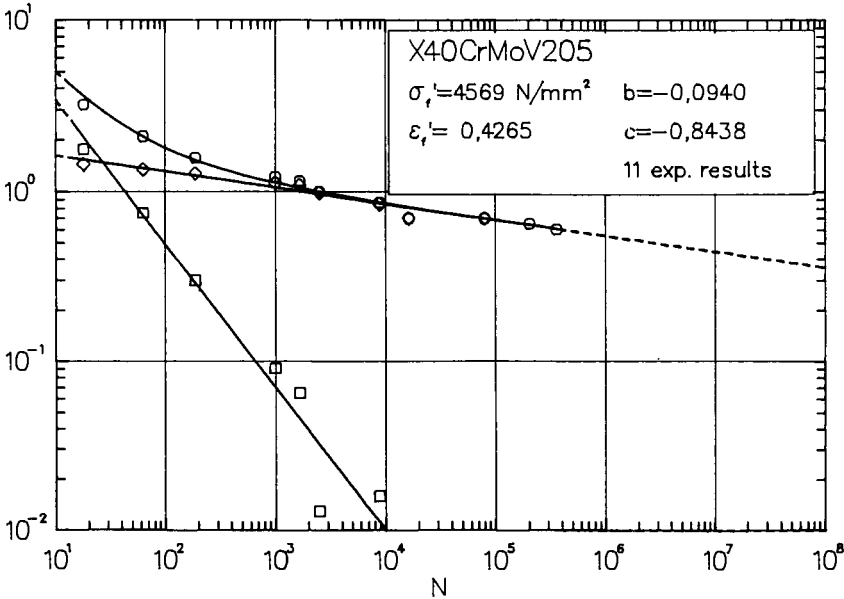
Remarks : chem. composition due to max. requirement in ASM 6487

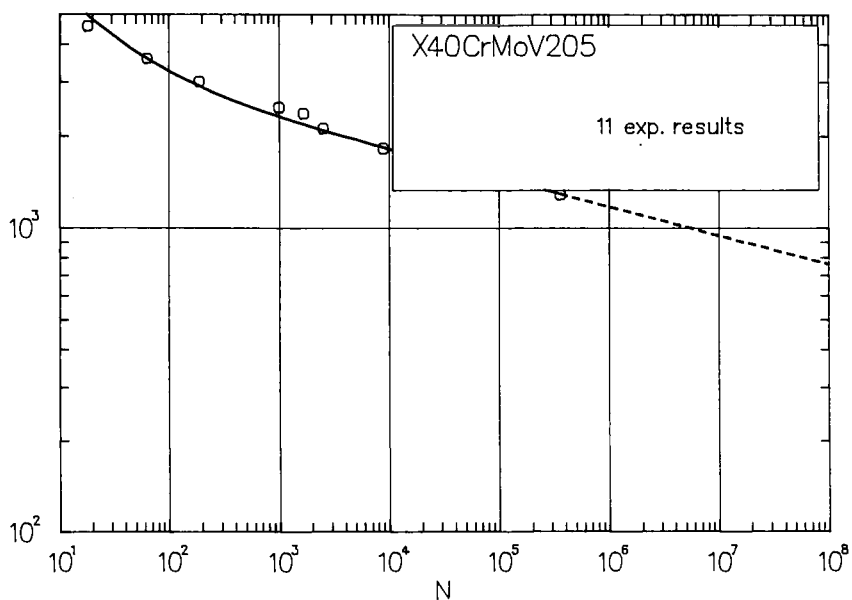
Remarks :

σ_e [N/mm²]



ϵ_e [%]



PSWT [N/mm²]

Material : X40CrMoV205

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	3065.1	0.0	3.2050	18.0
2.0000	2862.7	0.0	2.0970	63.0
3.0000	2709.4	0.0	1.5710	188.0
4.0000	2381.3	0.0	1.2090	1000.0
5.0000	2300.4	0.0	1.1450	1660.0
6.0000	2102.3	0.0	1.0000	2512.0
7.0000	1808.4	0.0	0.8650	8790.0
8.0000	1491.0	0.0	0.7000	16284.0
9.0000	1491.0	0.0	0.7000	79792.0
10.0000	1384.5	0.0	0.6500	203236.0
11.0000	1284.4	0.0	0.6030	356451.0

		Cu
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Heat treatment : 850°C, water, 315°C/3h, 805°C/1h, argon
Test temperature : +23°C
Semifinished material :
Reference : [4.14]
Year : 1982

Chemical composition

Cu

99.94

Monotonic properties

E	=	138000	N/mm ²	ν	=	-
R _{p0.2}	=	115	N/mm ²	K	=	248 N/mm ²
R _m	=		N/mm ²	n	=	0.132
A ₅	=	%		σ_f	=	N/mm ²
Z	=	%		ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	84	N/mm ²	K'	=	321 N/mm ²
σ'_g	=	40	N/mm ²	n'	=	0.217
ϵ'_g	=	0.037	%	σ'_f	=	257 N/mm ²
N _T	=	86962	cycles	ϵ'_f	=	0.250
T _{σ}	=	1.187	-	b	=	-0.122
T _{ep}	=	2.295	-	c	=	-0.528
Incremental step test :				K'	=	N/mm ²
				n'	=	-

Failure criterion :

σ/ϵ -values valid for : half failure life

Remarks :

Hardness :

Microstructure : grain size: 12 μ m

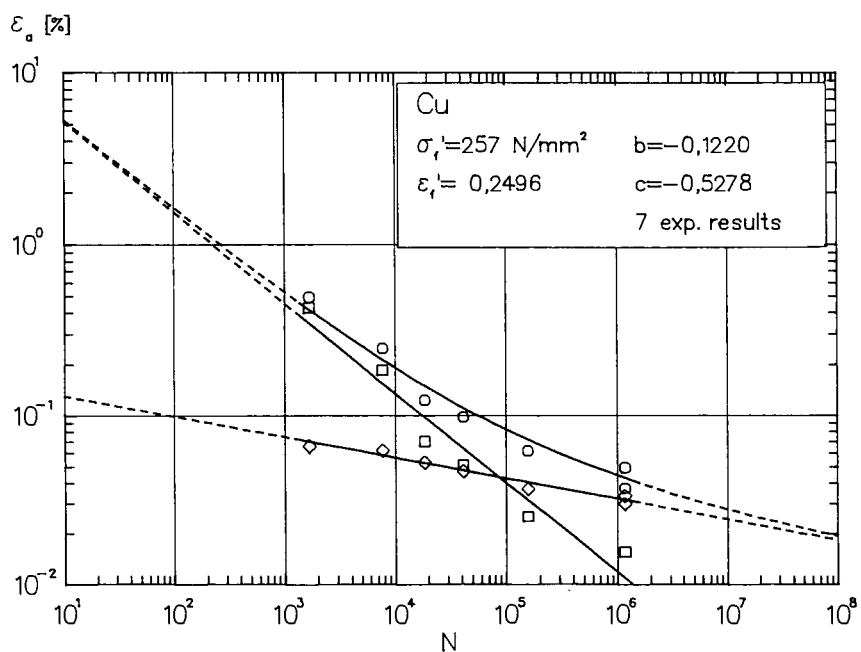
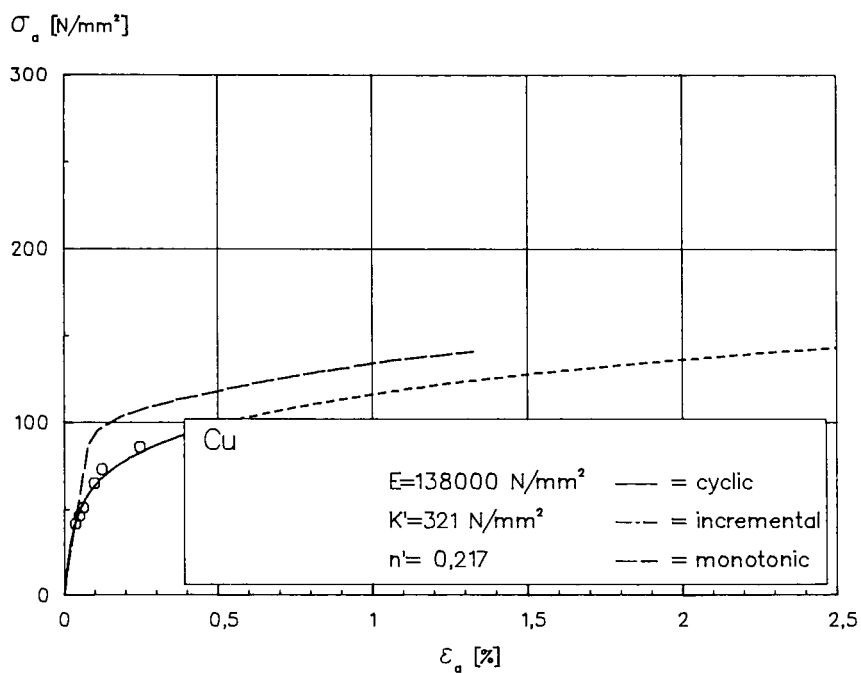
Monotonic test

Loading condition :
Specimen : cylindrical $\varnothing$ 6.35 mm
Specimen location :
Gauge length : 15.5 mm
Testing machine : servohydraulic
Strain rate :

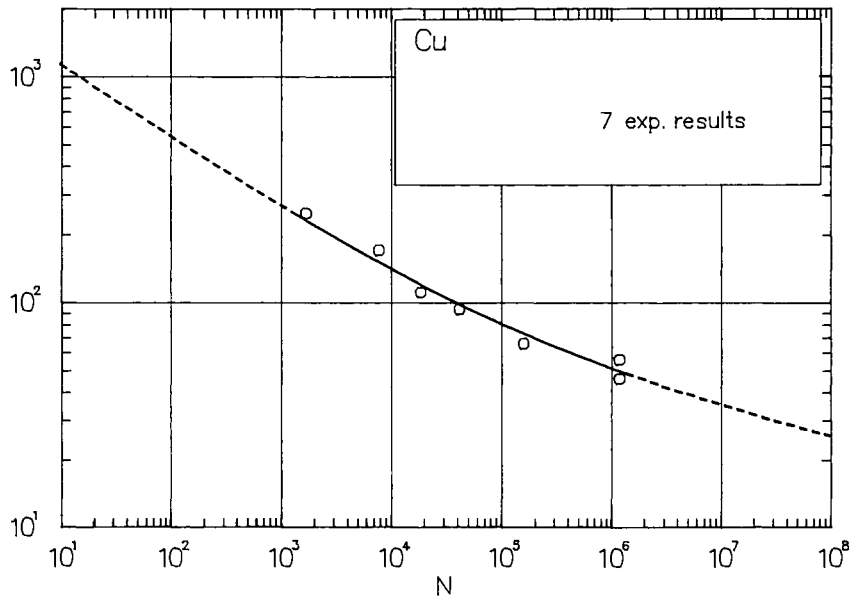
Cyclic test

Loading condition : total strain control, $R_g = -1$
Specimen : cylindrical, 6.35 mm
Surface : mech. and chem. polished
Specimen location :
Gauge length : 15.5 mm
Testing machine : servohydraulic
Frequency : 1)
Strain rate :
Waveform : sawtooth

Remarks : 1) product of frequency and strain was 0.00125 s⁻¹



PSWT [N/mm²]



Material : Cu

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	90.9	0.0	0.4940	1671.0
2.0000	85.8	0.0	0.2470	7667.0
3.0000	72.9	0.0	0.1230	18424.0
4.0000	64.8	0.0	0.0980	41246.0
5.0000	50.8	0.0	0.0620	157092.0
6.0000	46.1	0.0	0.0490	1162478.0
7.0000	41.3	0.0	0.0370	1162478.0

		Cu
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Heat treatment : 850°C, water, 805°C/1h, argon
 Test temperature : +23°C
 Semifinished material :
 Reference : [4.14]
 Year : 1982

Chemical composition

Cu

99.94

Monotonic properties

E	=	138000	N/mm ²	ν	=	-
R _{p0.2}	=	70	N/mm ²	K	=	235 N/mm ²
R _m	=		N/mm ²	n	=	0.150 -
A ₅	=	%		σ_f	=	N/mm ²
Z	=	%		ϵ_f	=	-

Cyclic properties

R _{p0.2}	=	81	N/mm ²	K'	=	437 N/mm ²
σ_g	=	35	N/mm ²	n'	=	0.272 -
ϵ_g	=	0.034	%	σ'_f	=	206 N/mm ²
N _T	=	71001	cycles	ϵ'_f	=	0.085 -
T _{σ}	=	1.222	-	b	=	-0.116 -
T _{ϵP}	=	2.093	-	c	=	-0.456 -
Incremental step test :				K'	=	N/mm ²
				n'	=	-

Failure criterion :

σ/ϵ -values valid for : half failure life

Remarks :

Hardness :

Microstructure : grain size: 120 μ m

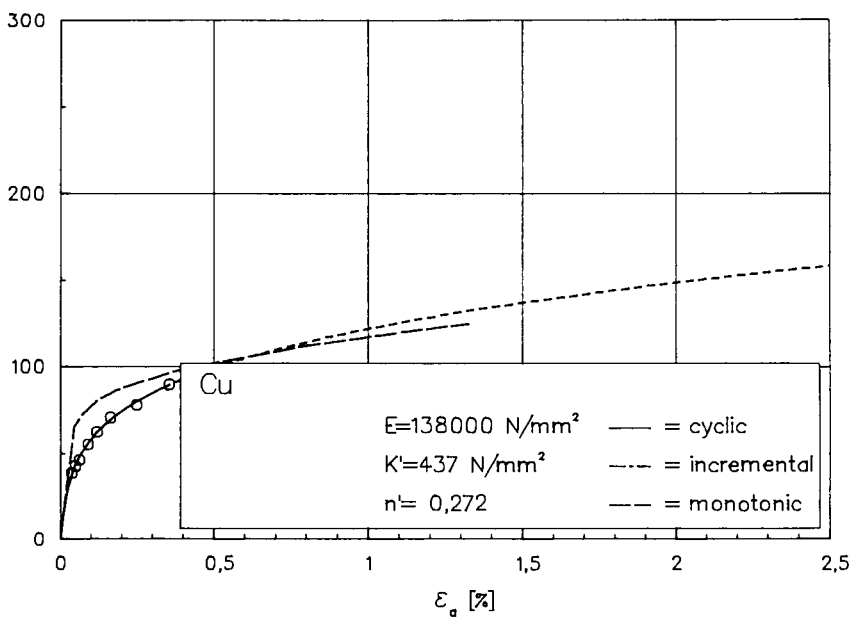
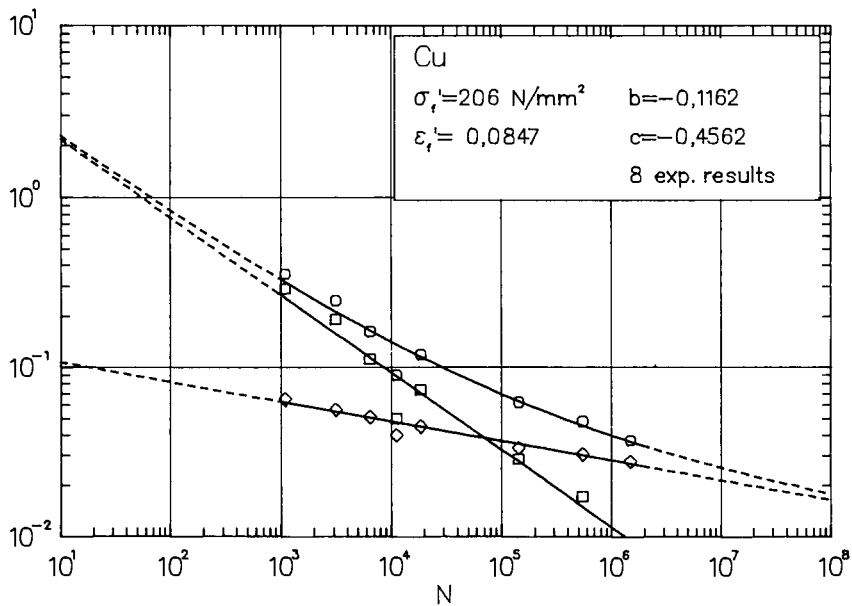
Monotonic test

Loading condition :
 Specimen : cylindrical ϕ 6.35 mm
 Specimen location :
 Gauge length : 15.5 mm
 Testing machine : servohydraulic
 Strain rate :

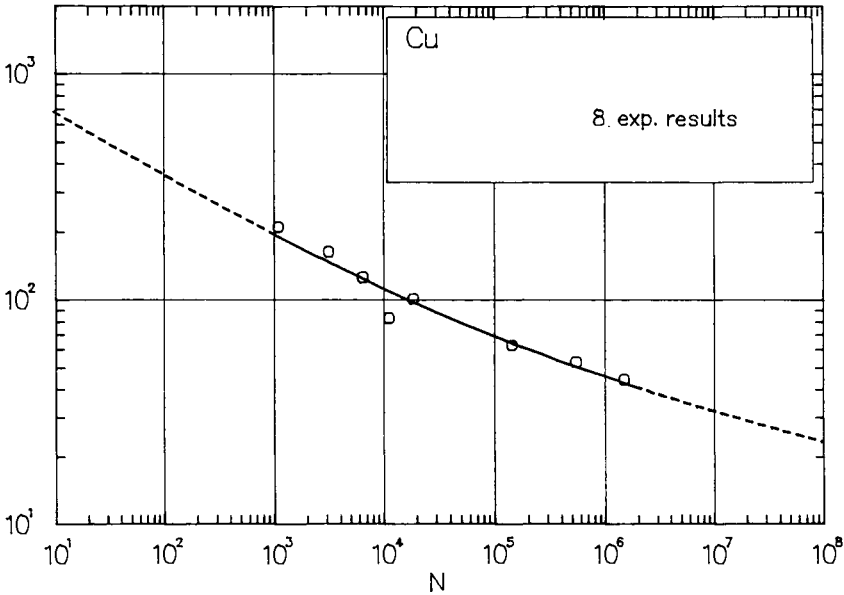
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, 6.35 mm
 Surface : mech. and chem. polished
 Specimen location :
 Gauge length : 15.5 mm
 Testing machine : servohydraulic
 Frequency : 1)
 Strain rate :
 Waveform : sawtooth

Remarks : 1) product of frequency and strain was 0.00125 s⁻¹

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : Cu

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	89.7	0.0	0.3550	1093.0
2.0000	77.9	0.0	0.2480	3134.0
3.0000	70.5	0.0	0.1630	6422.0
5.0000	55.1	0.0	0.0900	11121.0
4.0000	62.2	0.0	0.1190	18424.0
6.0000	46.0	0.0	0.0620	142510.0
7.0000	42.3	0.0	0.0480	542769.0
8.0000	38.2	0.0	0.0370	1476490.0

		Cu
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Heat treatment : annealed 600°C/1h
Test temperature : +23°C
Semifinished material :
Reference : [4.15]
Year : 1974

Chemical composition

Cu
99.99

Monotonic properties

E	=	140000	N/mm ²	v	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=	212	N/mm ²	n	=	-
A ₅	=	%		σ _f	=	824 N/mm ²
Z	=	81	%	ε _f	=	1.71 -

Cyclic properties

R _{p0.2}	=	125	N/mm ²	K'	=	323	N/mm ²
σ _g	=	83	N/mm ²	n'	=	0.153	-
ε _g	=	0.064	%	σ' _f	=	316	N/mm ²
N _T	=	127643	cycles	ε' _f	=	256.55	-
T _α	=	1.061	-	b	=	-0.088	-
T _{ep}	=	1.000	-	c	=	-1.023	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion :
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

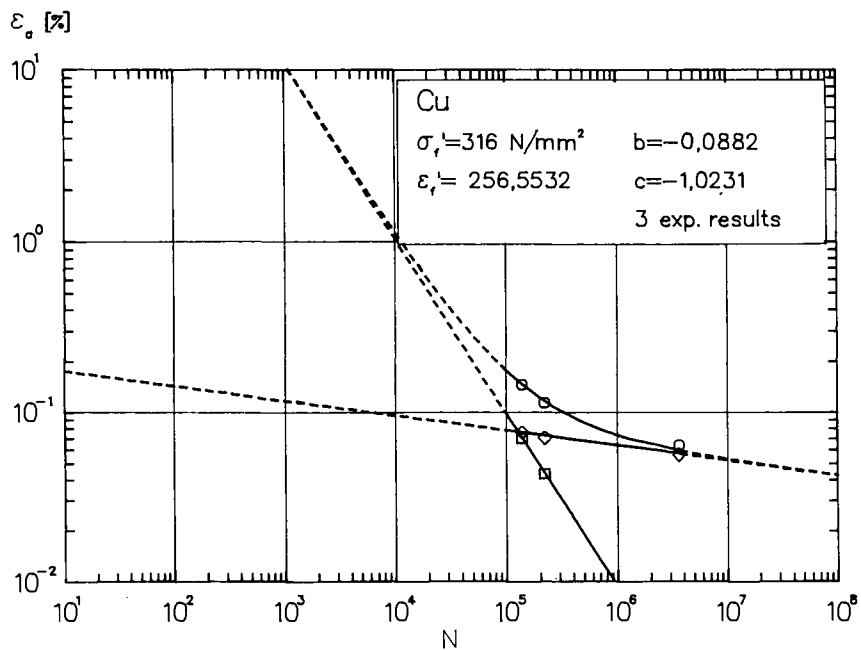
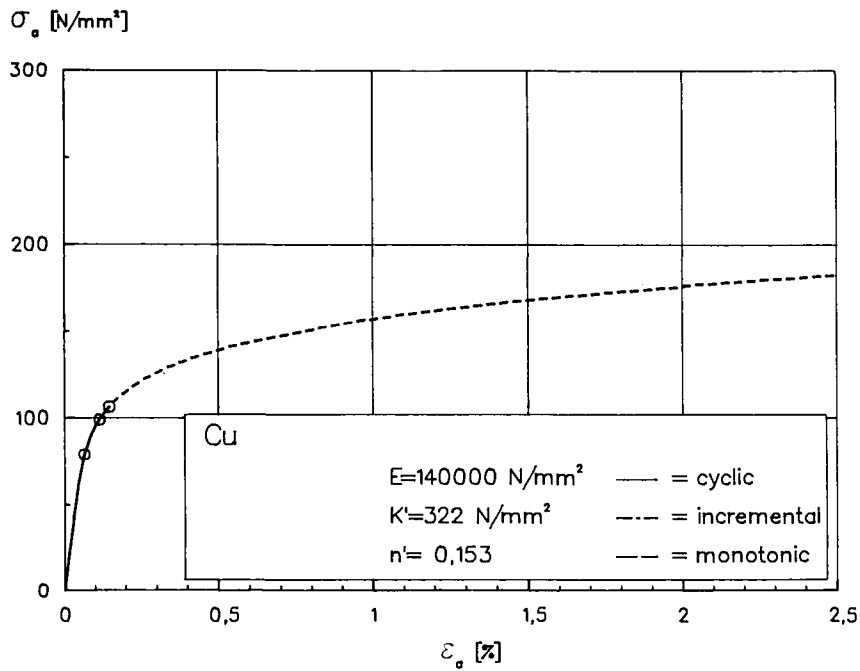
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 4 mm
Specimen location :
Gauge length : 25 mm
Testing machine : Zwick, electronic
Strain rate : 6 (%/min)

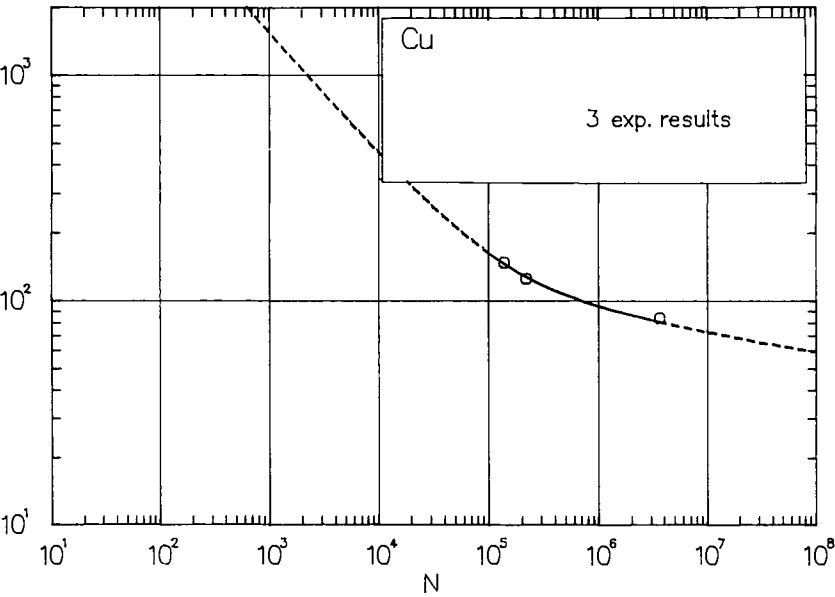
Cyclic test

Loading condition : plastic strain control, R_{ep}=-1
Specimen : cylindrical, Ø 4 mm
Surface :
Specimen location :
Gauge length : 25 mm
Testing machine : Amsler, modified electronics
Frequency : 80 Hz
Strain rate :
Waveform :

Remarks :



PSWT [N/mm²]



Material : Cu

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	106.5	0.0	0.1460	137382.0
2.0000	98.9	0.0	0.1140	219472.0
3.0000	78.8	0.0	0.0640	3619268.0

		Cu
--	--	----

Heat treatment : annealed 600°C/1h
 Test temperature : +23°C
 Semifinished material :
 Reference : [4.15]
 Year : 1974

Chemical composition

Cu

99.99

Monotonic properties

E	=	140000	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=	212	N/mm ²	n	=	-
A ₅	=		%	σ_f	=	824 N/mm ²
Z	=	81	%	ϵ_f	=	1.71 -

Cyclic properties

R' _{p0.2}	=	115	N/mm ²	K'	=	172	N/mm ²
σ'_g	=	86	N/mm ²	n'	=	0.066	-
ϵ'_g	=	0.072	%	σ'_f	=	279	N/mm ²
N _T	=	24856	cycles	ϵ'_f	=	0.141	-
T _{σ}	=	1.090	-	b	=	-0.077	-
T _{ep}	=	1.000	-	c	=	-0.471	-
Incremental step test :				K'	=	N/mm ²	
				n'	=	-	

Failure criterion :

σ/ϵ -values valid for : half failure life

Remarks : Young's modulus estimated

Hardness :

Microstructure :

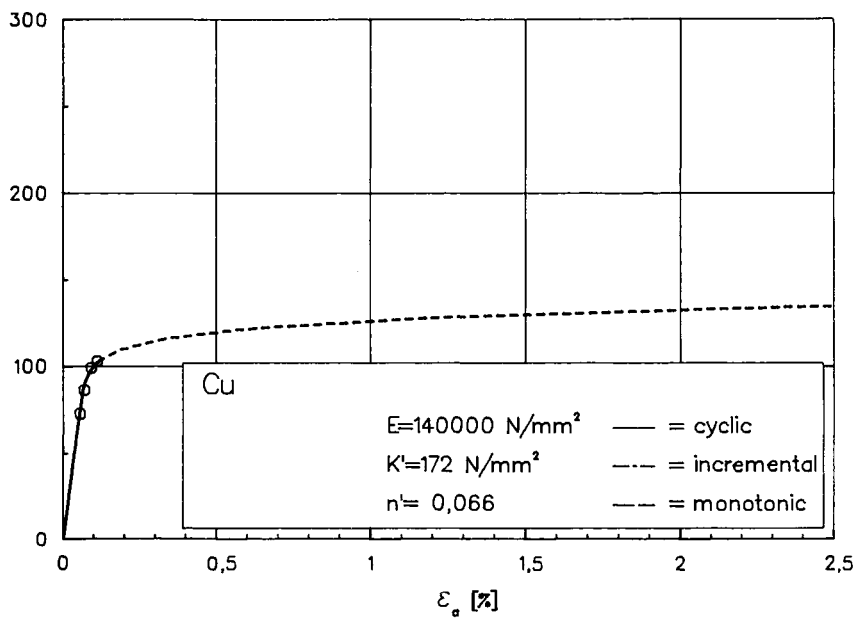
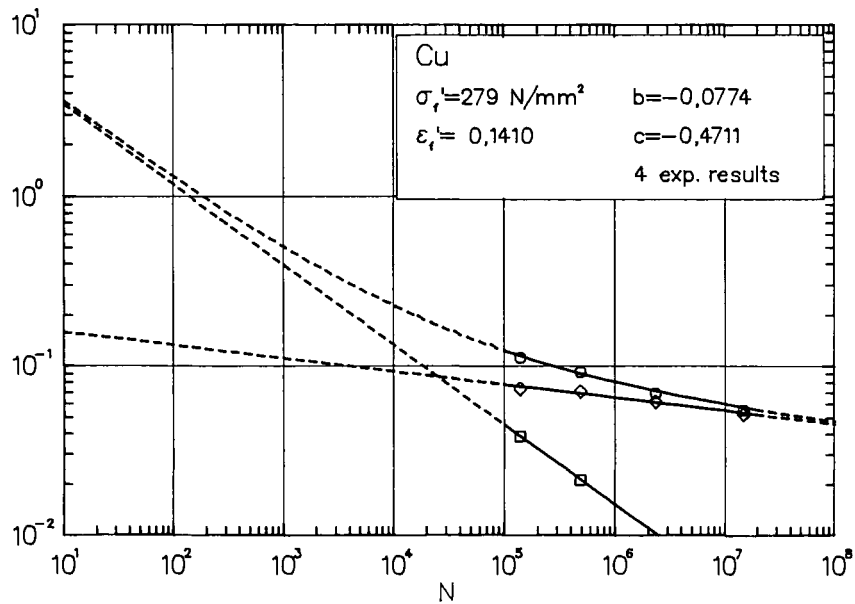
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 4 mm
 Specimen location :
 Gauge length : 25 mm
 Testing machine : Zwick, electronic
 Strain rate : 6 (%/min)

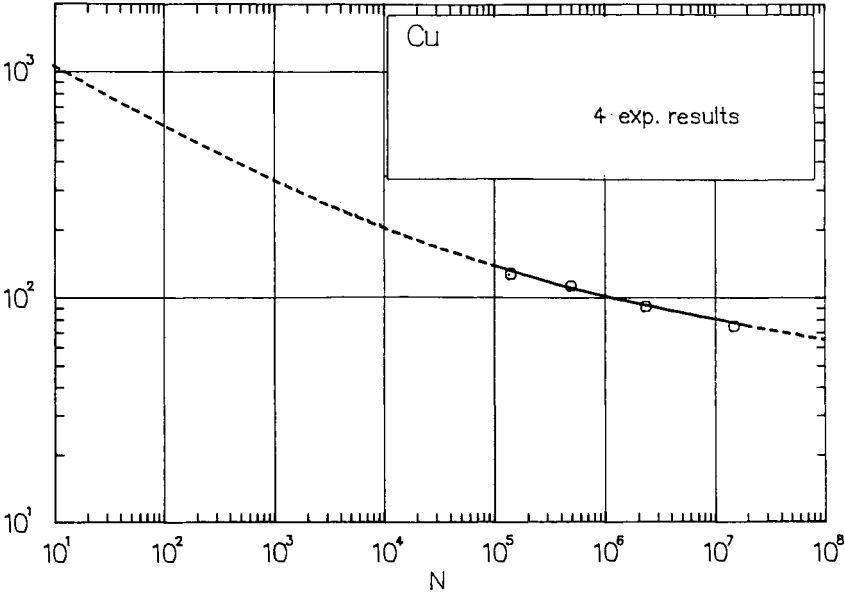
Cyclic test

Loading condition : stress control, R₀ = -1
 Specimen : cylindrical, Ø 4 mm
 Surface :
 Specimen location :
 Gauge length : 25 mm
 Testing machine : Amsler, modified electronics
 Frequency : 80 Hz
 Strain rate :
 Waveform :

Remarks :

σ_e [N/mm²] ε_e [%]

PSWT [N/mm²]



Material : Cu

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	103.0	0.0	0.1120	138950.0
2.0000	99.1	0.0	0.0920	489549.0
3.0000	86.3	0.0	0.0690	2329952.0
4.0000	72.6	0.0	0.0550	14839818.0

		Cu
--	--	----

Heat treatment :
Test temperature : +23°C
Semifinished material :
Reference : [4.17]
Year : 1983

Hardness :

Chemical composition

Microstructure :

Monotonic properties

E	=	140000	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=	%		σ _f	=	N/mm ²
Z	=	%		e _f	=	-

Monotonic test

Loading condition :
Specimen :
Specimen location :
Gauge length :
Testing machine :
Strain rate :

Cyclic properties

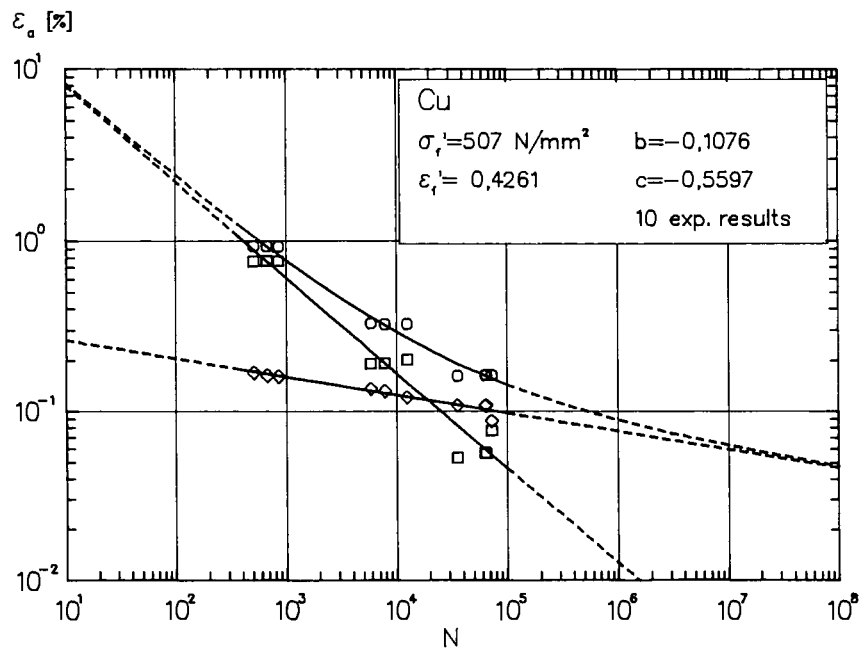
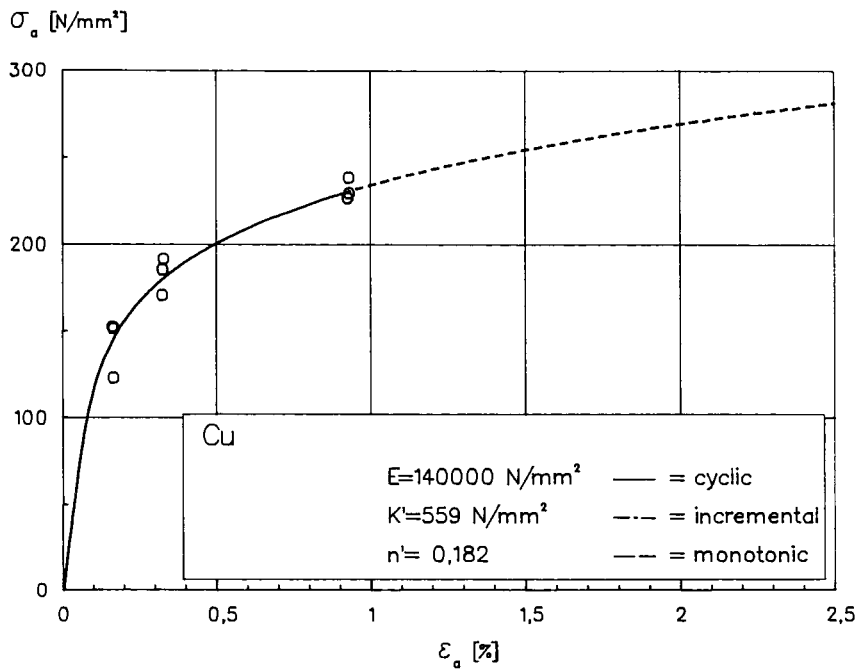
R' _{p0.2}	=	181	N/mm ²	K'	=	560	N/mm ²
σ _g	=	99	N/mm ²	n'	=	0.182	-
ε _g	=	0.079	%	σ' _f	=	507	N/mm ²
N _T	=	18943	cycles	e' _f	=	0.426	-
T _σ	=	1.167	-	b	=	-0.108	-
T _{εp}	=	1.886	-	c	=	-0.560	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Cyclic test

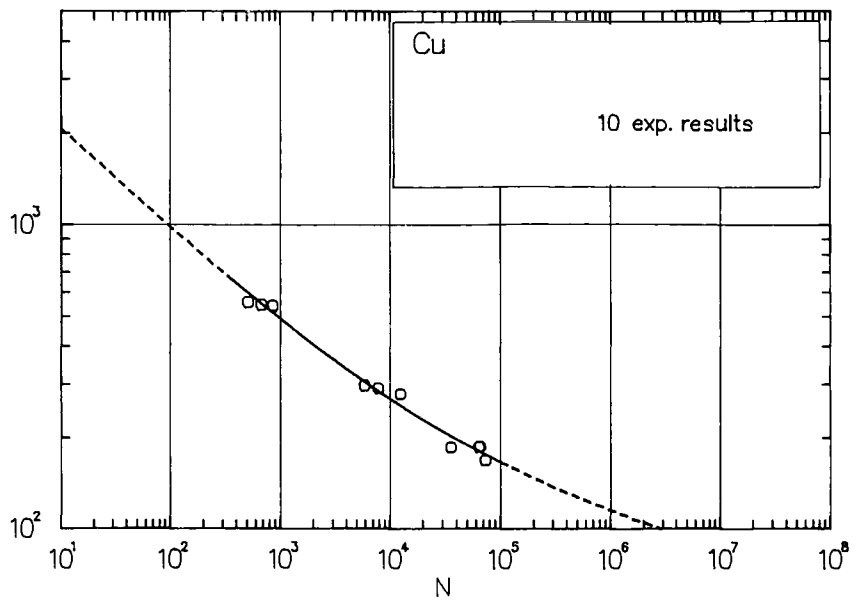
Loading condition :
Specimen :
Surface :
Specimen location :
Gauge length :
Testing machine :
Frequency :
Strain rate :
Waveform :

Failure criterion : defined by back extrapolation technique
σ/ε-values valid for : half failure life
Remarks : Young's modulus estimated

Remarks :



PSWT [N/mm²]



Material : Cu

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
35.0000	238.4	0.0	0.9300	508.0
26.0000	229.4	0.0	0.9300	672.0
17.0000	226.7	0.0	0.9250	853.0
14.0000	191.6	0.0	0.3280	5836.0
27.0000	185.4	0.0	0.3250	7806.0
16.0000	170.2	0.0	0.3250	12445.0
21.0000	152.3	0.0	0.1620	35698.0
29.0000	151.3	0.0	0.1650	63404.0
28.0000	151.9	0.0	0.1650	64654.0
15.0000	123.0	0.0	0.1650	72676.0

		Cu
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Heat treatment :
 Test temperature : +23°C
 Semifinished material :
 Reference : [4.17]
 Year : 1983

Hardness :

Chemical composition

Microstructure :

Monotonic properties

E	=	140000	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=		N/mm ²	n	=	-
A ₅	=		%	σ_f	=	N/mm ²
Z	=		%	ϵ_f	=	-

Monotonic test

Loading condition :
 Specimen :
 Specimen location :
 Gauge length :
 Testing machine :
 Strain rate :

Cyclic properties

R' _{p0.2}	=	187	N/mm ²	K'	=	501	N/mm ²
σ_s	=	103	N/mm ²	n'	=	0.158	-
ϵ_g	=	0.078	%	σ'_f	=	456	N/mm ²
N _T	=	9407	cycles	ϵ'_f	=	0.548	-
T _{σ}	=	1.016	-	b	=	-0.098	-
T _{ep}	=	1.202	-	c	=	-0.619	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Cyclic test

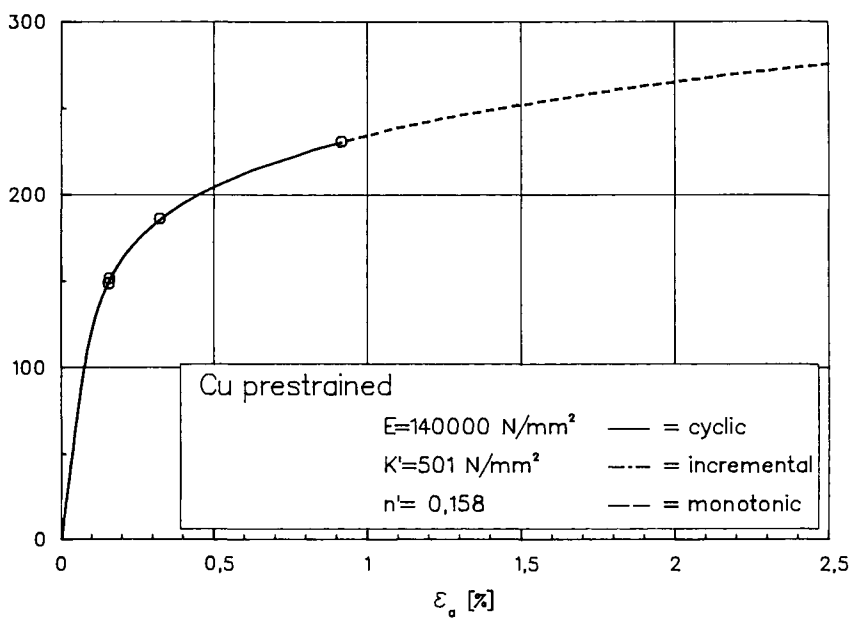
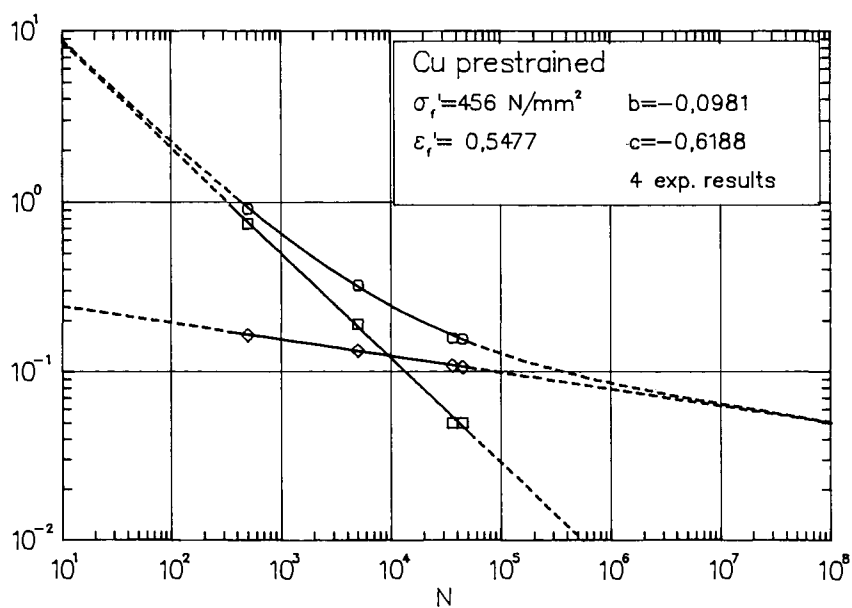
Loading condition : total strain control, R_ε = -1
 Specimen :
 Surface :
 Specimen location :
 Gauge length :
 Testing machine :
 Frequency :
 Strain rate :
 Waveform :

Failure criterion : defined by back extrapolation technique

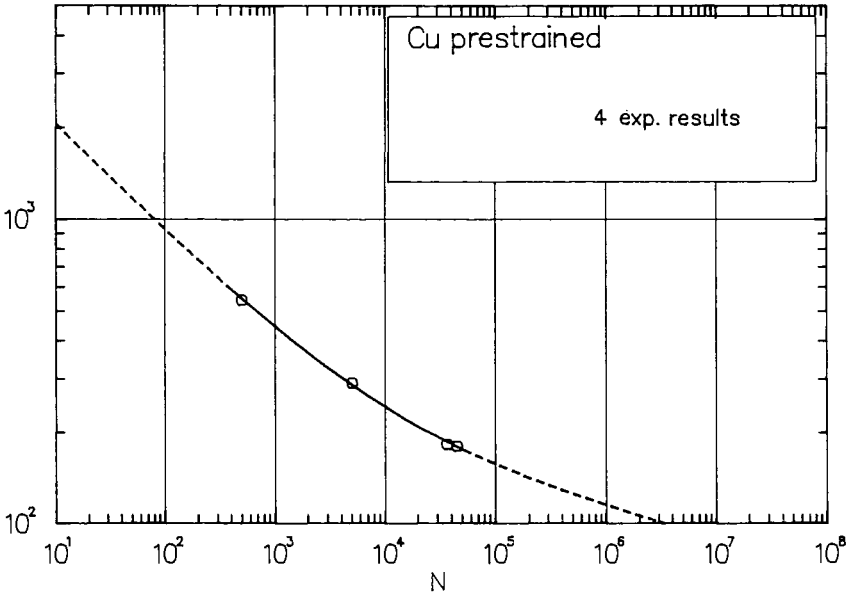
σ/ϵ -values valid for : half failure life

Remarks : tests initially prestrained, Young's modulus estimated

Remarks :

σ_e [N/mm²] ε_e [%]

PSWT [N/mm²]



Material : Cu prestrained

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
4.0000	230.8	0.0	0.9150	500.0
32.0000	186.1	0.0	0.3230	5019.0
37.0000	151.6	0.0	0.1580	36550.0
36.0000	148.8	0.0	0.1560	44878.0

X CuZn 69 31		
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Heat treatment : annealed 600°C/1h
Test temperature : +23°C
Semifinished material :
Reference : [4.15]
Year : 1974

Chemical composition

Cu Zn
68.99 31.00

Monotonic properties

E	=	140000	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=	305	N/mm ²	n	=	-
A ₅	=	%		σ_f	=	1030 N/mm ²
Z	=	81	%	ε_f	=	1.69 -

Cyclic properties

R' _{p0.2}	=	167	N/mm ²	K'	=	811	N/mm ²
σ_g	=	119	N/mm ²	n'	=	0.254	-
ε_g	=	0.128	%	σ'_f	=	443	N/mm ²
N _T	=	329248	cycles	ε'_f	=	0.440	-
T _{σ}	=	1.034	-	b	=	-0.087	-
T _{ep}	=	1.000	-	c	=	-0.455	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion :
 σ/ε -values valid for : half failure life
Remarks : Young's modulus estimated

Hardness :

Microstructure :

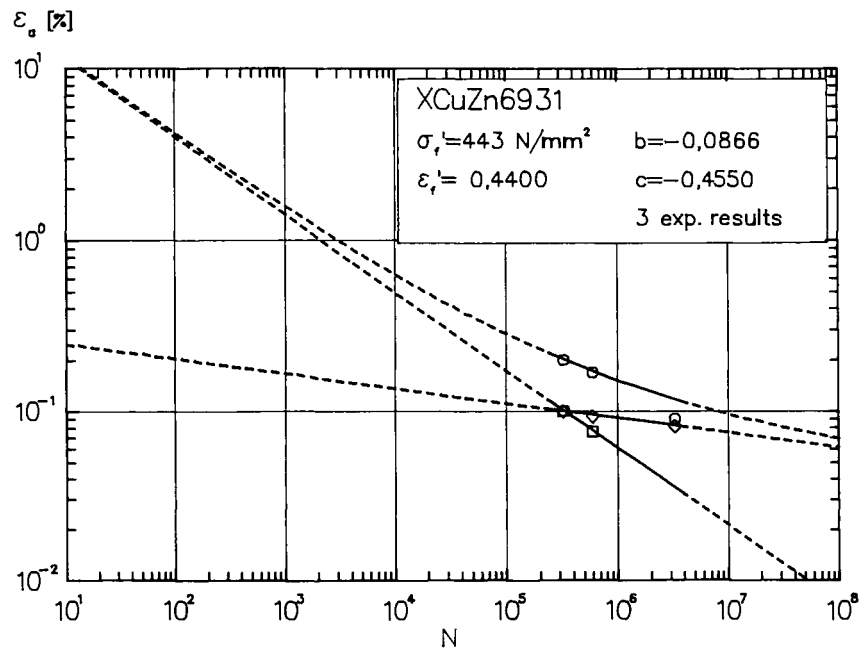
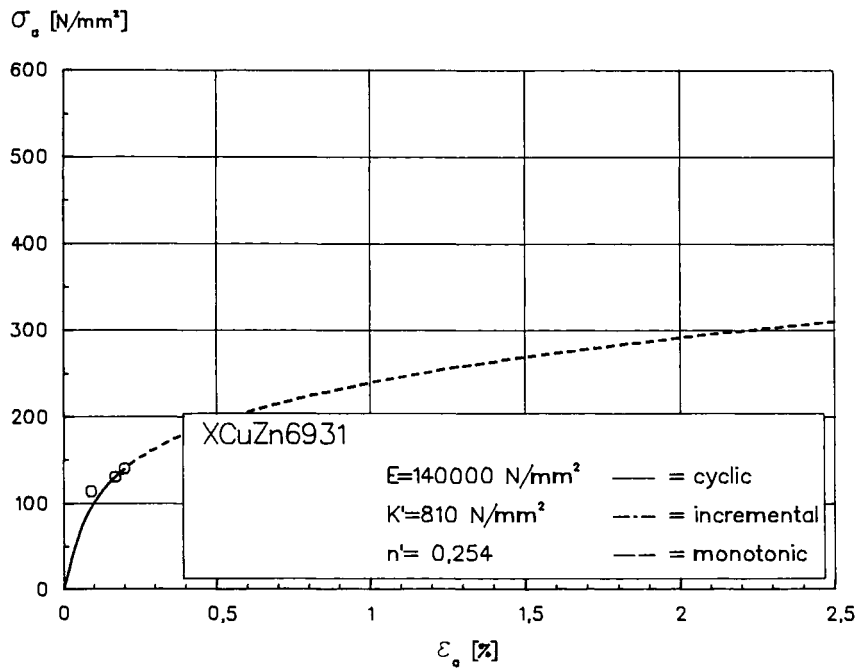
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 4 mm
Specimen location :
Gauge length : 25 mm
Testing machine : Zwick, electronic
Strain rate : 6 (%/min)

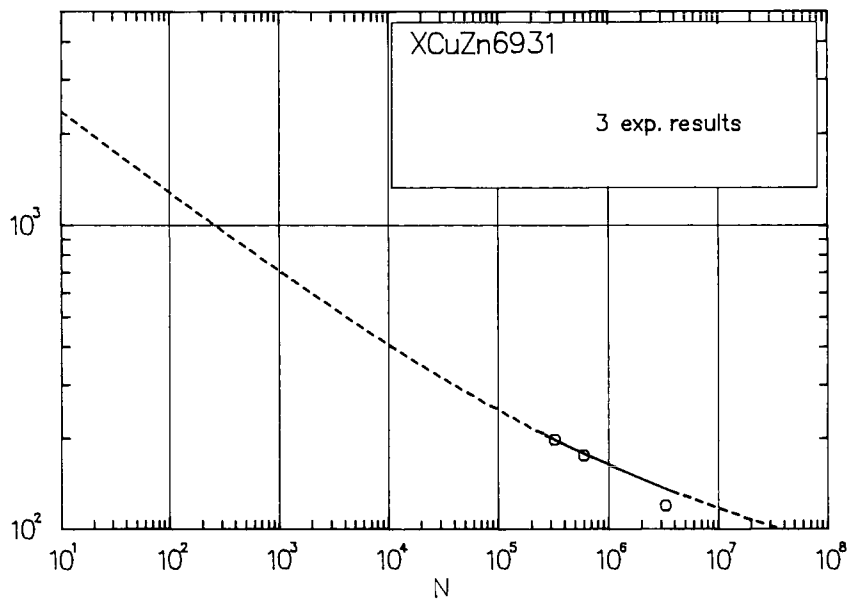
Cyclic test

Loading condition : plastic strain control, R_{ep}=-1
Specimen : cylindrical, Ø 4 mm
Surface :
Specimen location :
Gauge length : 25 mm
Testing machine : Amsler, modified electronics
Frequency : 80 Hz
Strain rate :
Waveform :

Remarks :



PSWT [N/mm²]



Material : XCuZn6931

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	140.1	0.0	0.2000	323353.0
2.0000	130.5	0.0	0.1690	594557.0
3.0000	114.0	0.0	0.0900	3281928.0

X CuZn 69 31		
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Heat treatment : annealed 600°C/1h
 Test temperature : +23°C
 Semifinished material :
 Reference : [4.15]
 Year : 1974

Chemical composition

Cu Zn

68.99 31.00

Monotonic properties

E	=	140000	N/mm ²	ν	=	-
R _{p0.2}	=		N/mm ²	K	=	N/mm ²
R _m	=	305	N/mm ²	n	=	-
A ₅	=		%	σ_f	=	1030 N/mm ²
Z	=	81	%	ε_f	=	1.69 -

Cyclic properties

R' _{p0.2}	=	159	N/mm ²	K'	=	282 N/mm ²
σ_g	=	114	N/mm ²	n'	=	0.092 -
ε_g	=	0.091	%	σ'_f	=	357 N/mm ²
N _T	=	31511	cycles	ε'_f	=	0.672 -
T _{σ}	=	1.070	-	b	=	-0.075 -
T _{ep}	=	1.000	-	c	=	-0.579 -
Incremental step test :				K'	=	N/mm ²
				n'	=	-

Failure criterion :

σ/ε -values valid for : half failure life

Remarks :

Hardness :

Microstructure :

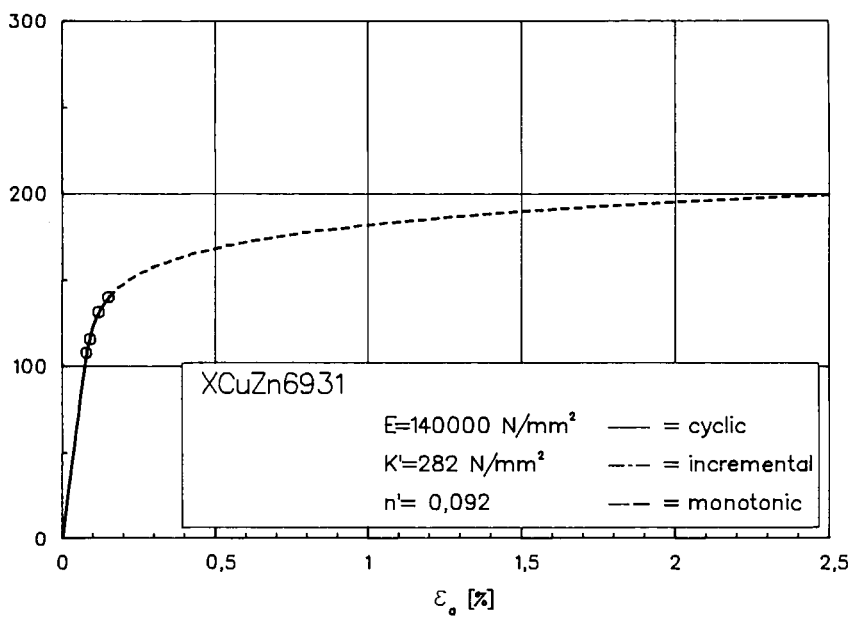
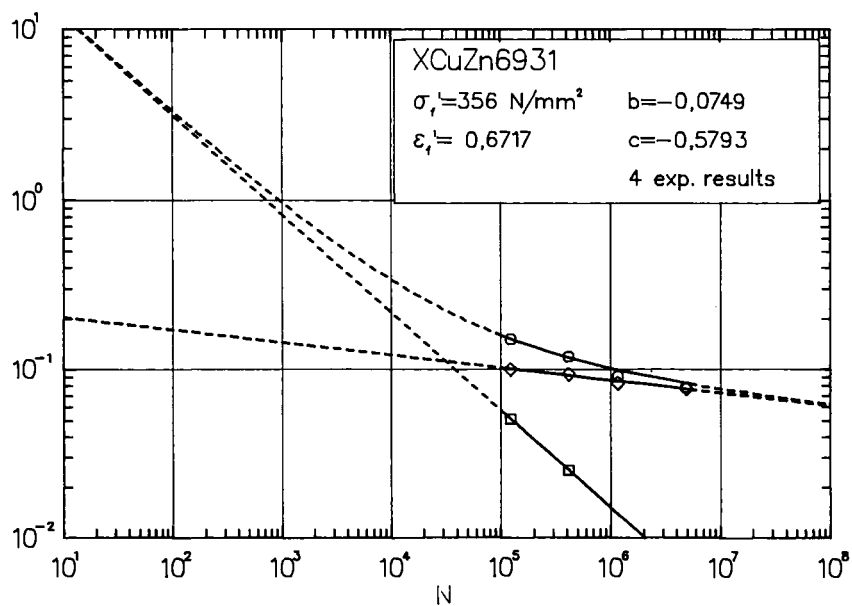
Monotonic test

Loading condition :
 Specimen : cylindrical, Ø 4 mm
 Specimen location :
 Gauge length : 25 mm
 Testing machine : Zwick, electronic
 Strain rate : 6 (%/min)

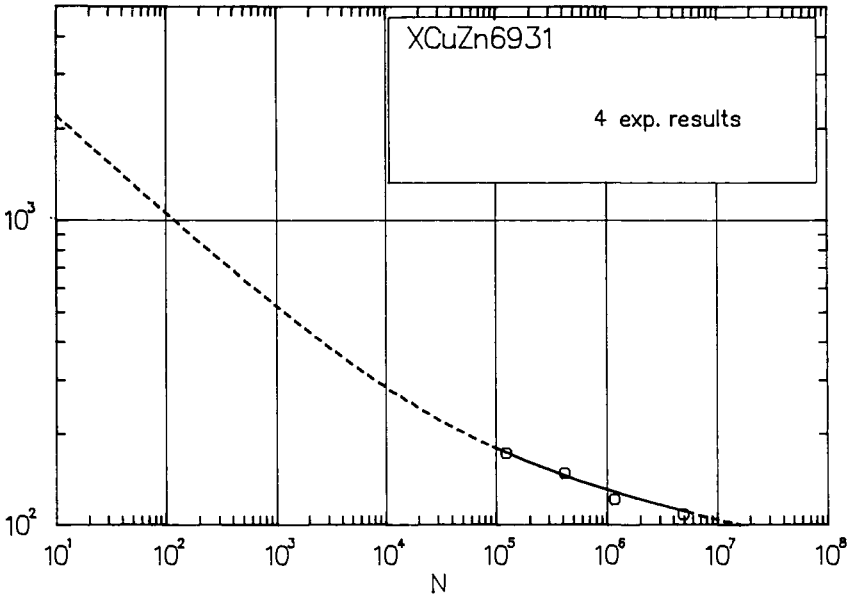
Cyclic test

Loading condition : stress control, R _{σ} = -1
 Specimen : cylindrical, Ø 4 mm
 Surface :
 Specimen location :
 Gauge length : 25 mm
 Testing machine : Amsler, modified electronics
 Frequency : 80 Hz
 Strain rate :
 Waveform :

Remarks :

σ_e [N/mm²] ε_e [%]

PSWT [N/mm²]



Material : XCuZn6931

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	140.3	0.0	0.1510	122122.0
2.0000	131.4	0.0	0.1190	412187.0
3.0000	115.8	0.0	0.0910	1159180.0
4.0000	107.9	0.0	0.0780	4861748.0

X CuNi 70 30		
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Heat treatment : 600°C/1h, 420°C/3h
Test temperature : +23°C
Semifinished material :
Reference : [4.14]
Year : 1982

Chemical composition

Cu Zn
70. 30.

Monotonic properties

E	=	126500	N/mm ²	ν	=	-
R _{p0.2}	=	170	N/mm ²	K	=	217 N/mm ²
R _m	=		N/mm ²	n	=	0.072 -
A ₅	=		%	σ_f	=	N/mm ²
Z	=		%	ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	106	N/mm ²	K'	=	270 N/mm ²
σ_g	=	63	N/mm ²	n'	=	0.150 -
ϵ_g	=	0.062	%	σ'_f	=	288 N/mm ²
N _T	=	78651	cycles	ϵ'_f	=	0.529 -
T _{σ}	=	1.285	-	b	=	-0.100 -
T _{ep}	=	1.711	-	c	=	-0.555 -
Incremental step test :				K'	=	N/mm ²
				n'	=	-

Failure criterion :
 σ/ϵ -values valid for : half failure life
Remarks :

Hardness :

Microstructure : grain size: 12 μ m

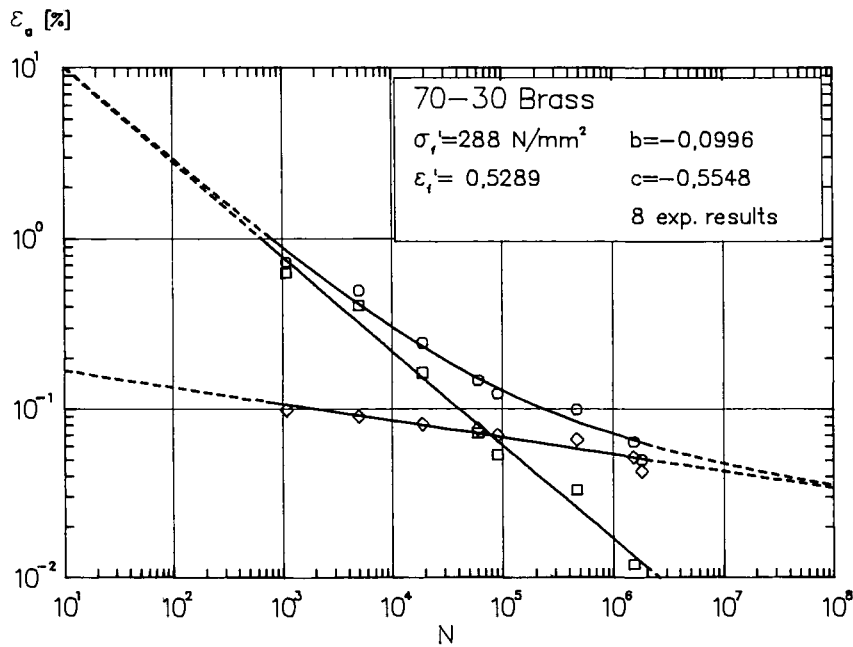
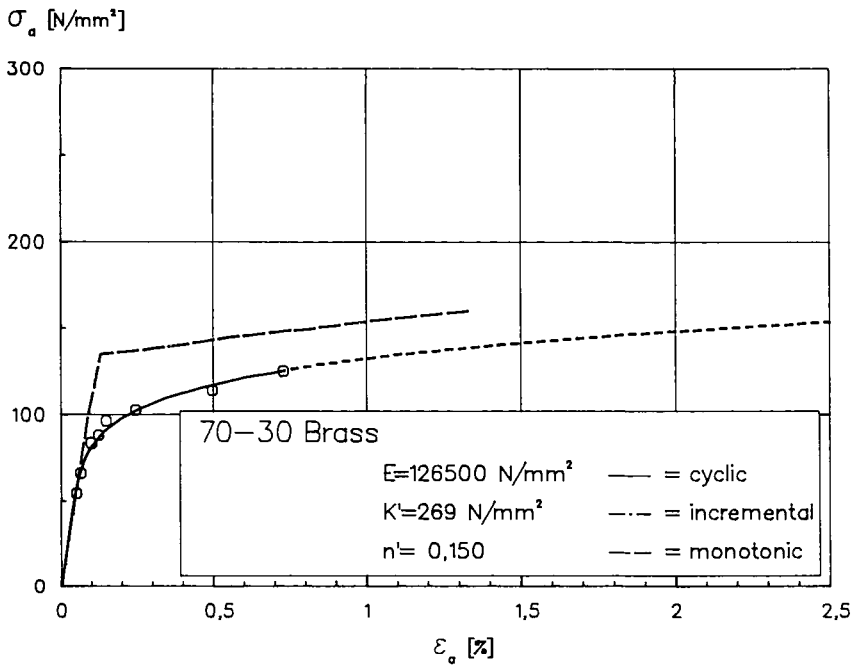
Monotonic test

Loading condition :
Specimen : cylindrical $\varnothing$ 6.35 mm
Specimen location :
Gauge length : 15.5 mm
Testing machine : servohydraulic
Strain rate :

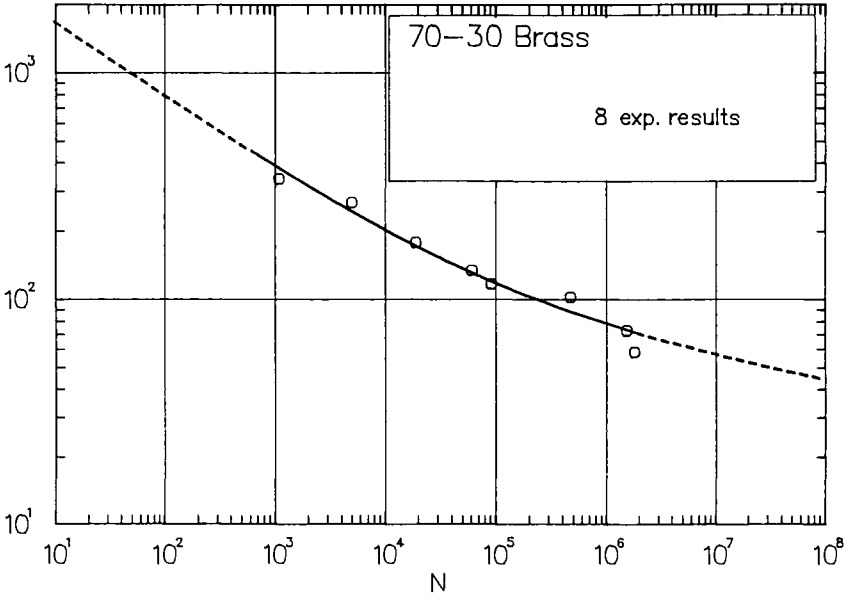
Cyclic test

Loading condition : total strain control, R_ε = -1
Specimen : cylindrical, 6.35 mm
Surface : mech. and chem. polished
Specimen location :
Gauge length : 15.5 mm
Testing machine : servohydraulic
Frequency : 1)
Strain rate :
Waveform : sawtooth

Remarks : 1) product of frequency and strain was 0.00125 s⁻¹



PSWT [N/mm²]



Material : 70-30 Brass

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	125.3	0.0	0.7280	1087.0
2.0000	114.1	0.0	0.4970	4991.0
3.0000	102.7	0.0	0.2450	18896.0
4.0000	96.4	0.0	0.1480	60509.0
5.0000	88.1	0.0	0.1230	90441.0
6.0000	83.4	0.0	0.0990	470682.0
7.0000	65.8	0.0	0.0640	1519911.0
8.0000	54.1	0.0	0.0500	1796989.0

X CuNi 70 30		
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Heat treatment : 600°C/1h, 620°C/1h
 Test temperature : +23°C
 Semifinished material :
 Reference : [4.14]
 Year : 1982

Chemical composition

Cu Zn
 70. 30.

Monotonic properties

E	=	126500	N/mm ²	ν	=	-
R _{p0.2}	=	70	N/mm ²	K	=	139 N/mm ²
R _m	=		N/mm ²	n	=	0.080 -
A ₅	=	%		σ_f	=	N/mm ²
Z	=	%		ϵ_f	=	-

Cyclic properties

R' _{p0.2}	=	99	N/mm ²	K'	=	284 N/mm ²
σ_g	=	56	N/mm ²	n'	=	0.170 -
ϵ_g	=	0.056	%	σ'_f	=	304 N/mm ²
N _T	=	93972	cycles	ϵ'_f	=	0.509 -
T _{σ}	=	1.258	-	b	=	-0.111 -
T _{ϵ_p}	=	3.320	-	c	=	-0.551 -
Incremental step test :				K'	=	N/mm ²
				n'	=	-

Failure criterion :
 σ/ϵ -values valid for : half failure life
 Remarks :

Hardness :

Microstructure : grain size: 120 μ m

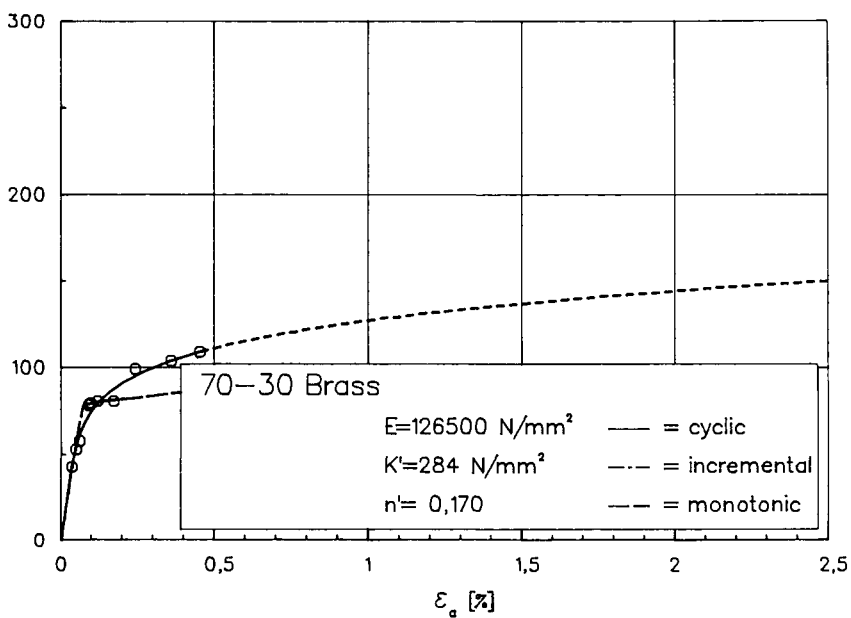
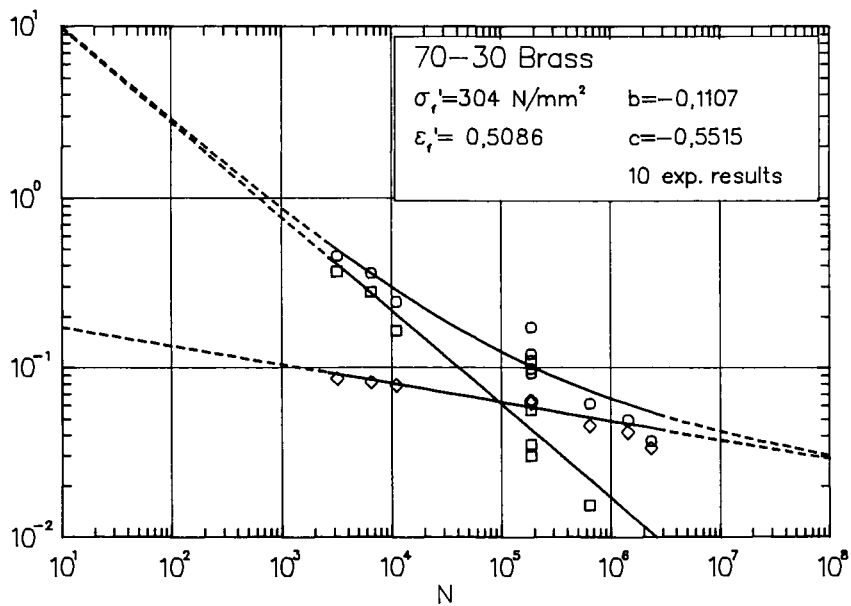
Monotonic test

Loading condition :
 Specimen : cylindrical $\varnothing$ 6.35 mm
 Specimen location :
 Gauge length : 15.5 mm
 Testing machine : servohydraulic
 Strain rate :

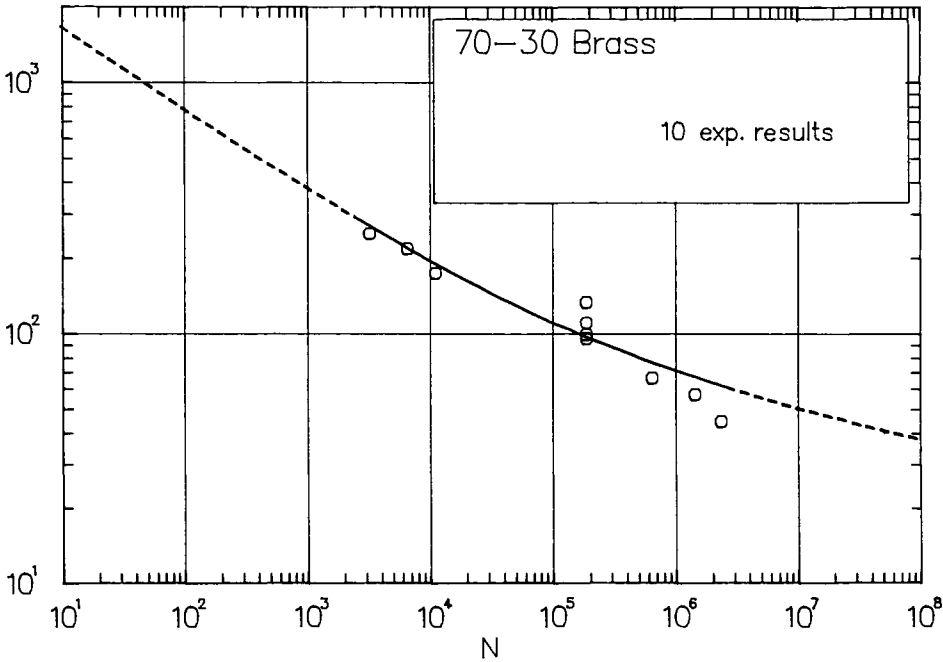
Cyclic test

Loading condition : total strain control, R _{ϵ} = -1
 Specimen : cylindrical, 6.35 mm
 Surface : mech. and chem. polished
 Specimen location :
 Gauge length : 15.5 mm
 Testing machine : servohydraulic
 Frequency : 1)
 Strain rate :
 Waveform : sawtooth

Remarks : 1) product of frequency and strain was 0.00125 s⁻¹

σ_a [N/mm²] ε_a [%]

PSWT [N/mm²]



Material : 70-30 Brass

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	109.0	0.0	0.4540	3190.0
2.0000	103.8	0.0	0.3600	6497.0
3.0000	99.1	0.0	0.2430	11023.0
4.0000	80.6	0.0	0.1730	185879.0
5.0000	80.6	0.0	0.1200	185879.0
6.0000	79.4	0.0	0.0980	185879.0
7.0000	78.3	0.0	0.0920	185879.0
8.0000	57.6	0.0	0.0610	642232.0
9.0000	52.6	0.0	0.0490	1425103.0
10.0000	42.4	0.0	0.0370	2319448.0

X 15 Be 98		Beryllium
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Heat treatment : vacuum hot-pressed QMV beryllium
Test temperature : +23°C
Semifinished material : blanks, Ø 19 mm
Reference : [4,12]
Year : 1963

Chemical composition

C	Mg	Si	Al	Fe	BeO	Be
0.15	0.08	0.12	0.16	0.18	2.0	98.0

Monotonic properties

E	=	290010	N/mm ²	ν	=	0.024	-
R _{p0.2}	=	262	N/mm ²	K	=	694	N/mm ²
R _m	=	324	N/mm ²	n	=	0.156	-
A ₅	=		%	σ _f	=	329	N/mm ²
Z	=	2	%	ε _f	=	0.017	-

Cyclic properties

R' _{p0.2}	=	373	N/mm ²	K'	=	1328	N/mm ²
σ _g	=	126	N/mm ²	n'	=	0.204	-
ε _g	=	0.044	%	σ' _f	=	508	N/mm ²
N _T	=	50	cycles	ε' _f	=	0.009	-
T _σ	=	1.223	-	b	=	-0.091	-
T _{εp}	=	2.790	-	c	=	-0.451	-
Incremental step test :				K'	=		N/mm ²
				n'	=		-

Failure criterion : complete rupture
σ/ε-values valid for : half failure life
Remarks :

Hardness : Rockwell B-75 to 90

Microstructure :

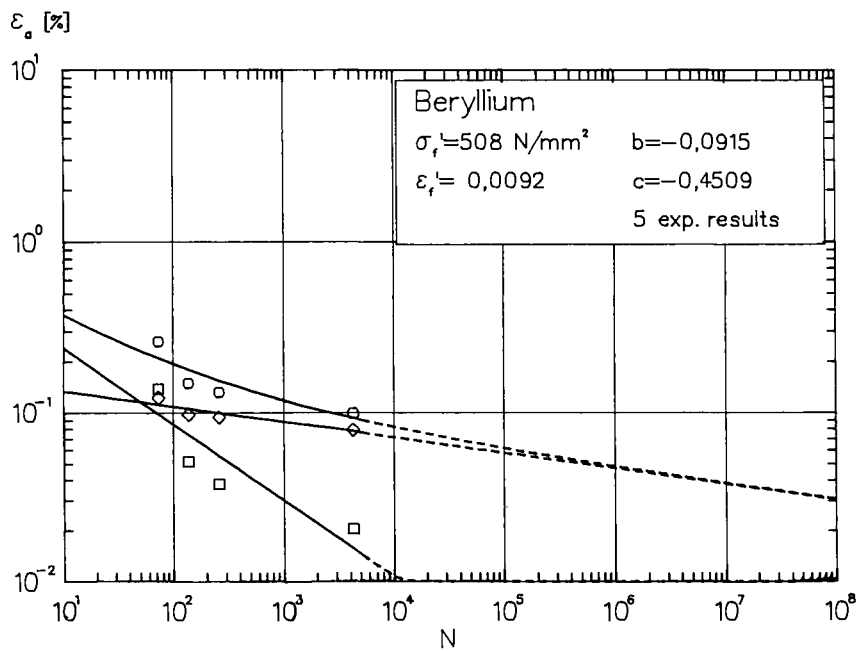
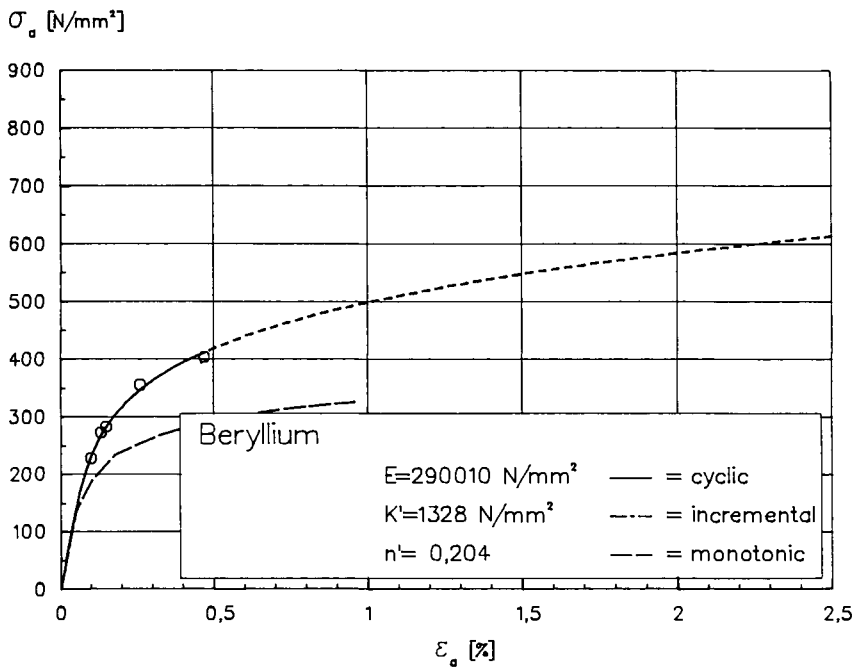
Monotonic test

Loading condition :
Specimen : cylindrical, Ø 6.35 mm
Specimen location : in rolling direction
Gauge length : 38.1 mm
Testing machine : Rhiele, universal testing machine
Strain rate :

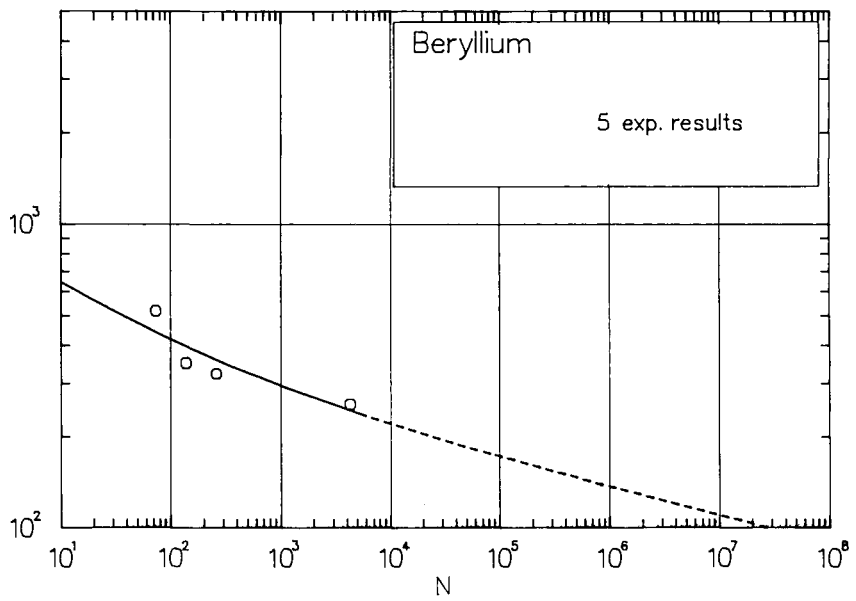
Cyclic test

Loading condition : total diametral strain control, R_{ed} = -1
Specimen : cylindrical, Ø 6.35 mm
Surface : machined
Specimen location : in rolling direction
Gauge length : diametral
Testing machine : self designed
Frequency :
Strain rate :
Waveform :

Remarks :



PSWT [N/mm²]



Material : Beryllium

Spec. no.	Stress amplitude [MPa]	Mean stress [MPa]	Strain amplitude [%]	Cycles to failure
1.0000	403.9	0.0	0.4700	6.0
2.0000	355.6	0.0	0.2610	73.0
3.0000	283.1	0.0	0.1490	138.0
4.0000	272.7	0.0	0.1320	260.0
5.0000	227.8	0.0	0.0990	4260.0