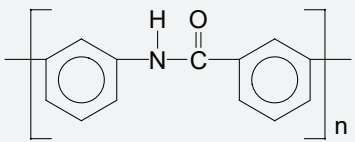
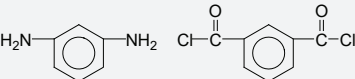


PPTI poly(m-phenylene isophthalamide)

PARAMETER	UNIT	VALUE	REFERENCES
GENERAL			
Common name	-	poly(m-phenylene isophthalamide)	
Acronym	-	PPTI	
CAS number	-	25765-47-3	
Linear formula			
HISTORY			
Person to discover	-	Wilfred Sweeney	
Date	-	1953; 1963, 1967	
Details	-	invention in DuPont Labs; name coined; commercialized	
SYNTHESIS			
Monomer(s) structure	-		
Monomer(s) CAS number(s)	-	108-45-2; 99-63-8	
Monomer(s) molecular weight(s)	dalton, g/mol, amu	108.1; 203.022	
Monomer ratio	-	1:1.88	
Method of synthesis	-	it is prepared from m-phenylenediamine and isophthaloyl chloride in an amide solvent	
Number average molecular weight, M_n	dalton, g/mol, amu	36,800	
STRUCTURE			
Cell type (lattice)	-	triclinic	
Cell dimensions	nm	a:b:c=0.527:0.525:1.13	
Unit cell angles	degree	α : β : γ =111.5:111.4:88	
Number of chains per unit cell	-	1	
COMMERCIAL POLYMERS			
Some manufacturers	-	DuPont	
Trade names	-	Nomex	
PHYSICAL PROPERTIES			
Density at 20°C	g cm ⁻³	1.38 (yarn); 1.47 (crystalline); 1.32 (amorphous)	
Bulk density at 20°C	g cm ⁻³	0.31-1.12 (paper)	
Color	-	creamy white to gold	
Melting temperature, DSC	°C	435-473	
Decomposition temperature	°C	300	
Thermal expansion coefficient, 23-80°C	°C ⁻¹	6.2-18E-6	
Thermal conductivity, melt	W m ⁻¹ K ⁻¹	0.25 (yarn); 0.13-0.14 (paper)	

PPTI poly(m-phenylene isophthalamide)

PARAMETER	UNIT	VALUE	REFERENCES
Glass transition temperature	°C	230-280	
Specific heat capacity	J K ⁻¹ kg ⁻¹	300	
Maximum service temperature	°C	260-300 (yarn); 220 (paper)	
Dielectric constant at 60 Hz/10,000 Hz	-	1.2-2.7/2.6 (paper)	
Dielectric loss factor at 1 kHz	-	0.006	
Dissipation factor at 60 Hz	E-4	30-60 (paper)	
Dissipation factor at 10,000 Hz	E-4	140 (paper)	
Volume resistivity	ohm-m	1E13 to 2E14 (paper)	
Surface resistivity	ohm	2E16 (paper)	
Electric strength K20/P50, d=0.60.8 mm	kV mm ⁻¹	9-32 (paper)	
Contact angle of water, 20°C	degree	42	Ren, X; Zhao, C; Du, S; Wang, T; Luan, Z; Wang, J; Hou, D, J. Environ. Sci., 22, 9, 1335-41, 2010.
MECHANICAL & RHEOLOGICAL PROPERTIES			
Tensile strength	MPa	595-610 (yarn); 41-110 (paper, MD); 29-59 (paper, TD)	
Elongation	%	19-31 (yarn); 3.4-19 (paper)	
Elmendorf tear strength	g μm ⁻¹	0.75-4.25	
Tenacity (fiber)	N tex ⁻¹	0.43-0.44 (yarn)	
Shrinkage	%	1.1-4 (yarn); 0.1-0.9	
Intrinsic viscosity, 30°C	dl g ⁻¹	1.86-2.11	
Water absorption, equilibrium in water at 23°C	%	4-8.3 (yarn, as shipped); 4.5 (yarn, equilibrium)	
CHEMICAL RESISTANCE			
Acid dilute/concentrated	-	poor	
Alcohols	-	very good	
Alkalis	-	poor	
Aliphatic hydrocarbons	-	very good	
Aromatic hydrocarbons	-	very good	
Esters	-	very good	
Greases & oils	-	very good	
Halogenated hydrocarbons	-	good to poor	
Ketones	-	very good	
Good solvent	-	dimethylacetamide, dimethylsulfoxide, DMF, methylpyrrolidone, sulfuric acid	
Non-solvent	-	m-cresol, formic acid, hexamethylphosphoramide	
FLAMMABILITY			
Ignition temperature	°C	>500	
Autoignition temperature	°C		
Limiting oxygen index	% O ₂	27-32	
Char at 500°C	%	48.4	Lyon, R E; Walters, R N, J. Anal. Appl. Pyrolysis, 71, 27-46, 2004.
Heat of combustion	J g ⁻¹	28,100	Walters, R N; Hacket, S M; Lyon, R E, Fire Mater., 24, 5, 245-52, 2000.
Volatile products of combustion	-	CO, CO ₂ , HCN	

PPTI poly(m-phenylene isophthalamide)

PARAMETER	UNIT	VALUE	REFERENCES
TOXICITY			
NFPA: Health, Flammability, Reactivity rating	-	0/1/0	
Carcinogenic effect	-	not listed by ACGIH, NIOSH, NTP	
Mutagenic effect	-	not known	
Reproductive toxicity	-	not known	
Oral rat, LD ₅₀	mg kg ⁻¹	7,500 (para); 11,000 (meta)	
Skin rabbit, LD ₅₀	mg kg ⁻¹	no irritation	
ENVIRONMENTAL IMPACT			
Aquatic toxicity, <i>Daphnia magna</i> , LC ₅₀ , 48 h	mg l ⁻¹	>500	
Aquatic toxicity, <i>Fathead minnow</i> , LC ₅₀ , 48 h	mg l ⁻¹	1,500	
PROCESSING			
Typical processing methods	-	spinning	
Preprocess drying: temperature/time/residual moisture	°C/h/%	100/5	
Applications	-	aircraft parts, automotive (heat shields, spark plug leads), boats, electrical applications, firefighter clothing, hot gas filtration, insulation paper, safety clothing	
Outstanding properties	-	flame resistance	