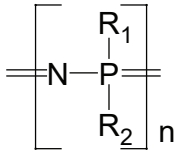
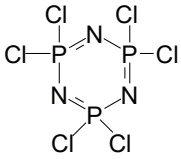
PZ polyphosphazene

PARAMETER	UNIT	VALUE	REFERENCES
GENERAL			
Common name	-	polyphosphazene	
CAS name	-	poly[nitrilo[bis(2,2,2-trifluoroethoxy)phosphoranylidyne]]; poly[nitrilo(diphenoxyphosphoranylidyne)]	
Acronym	-	PZ	
CAS number	-	28212-50-2; 28212-48-8	
Formula			Allcock, H R, Current Opinion Solid State Mater. Sci., 10, 231-240, 2006.
HISTORY			
Person to discover	-	Allcock, H R	
Date	-	1965	
Details	-	Allcock's group published numerous papers and books on the subject	
SYNTHESIS			
Monomer(s) structure	-		
Monomer(s) CAS number(s)	-	940-71-6	
Monomer(s) molecular weight(s)	dalton, g/mol, amu	347.66	
Method of synthesis	-	thermal ring-opening polymerization of hexachlorophosphazene followed by esterification of the intermediate poly(dichlorophosphazene) with either amines or sodium salts of alcohols	
Temperature of polymerization	°C	250	
Time of polymerization	h	20	
Number average molecular weight, M_n	dalton, g/mol, amu	132,000-173,000	
Mass average molecular weight, M_w	dalton, g/mol, amu	10,000-5,000,000	Nakamura, H; Masuko, T; Kojima, M; Magill, J H, Macromol. Chem. Phys., 200, 2519-24, 1999.
STRUCTURE			
Crystallinity	%	19.96-52.35	Hazendonk, P; deDenus, C; Iuga, A; Cahoon, P; Nilsson, B; Iuga, D, J. Inorg. Organometal. Polym. Mater., 16, 4, 343-57, 2006.
Cell type (lattice)	-	orthorhombic (α and γ), monoclinic (β)	Hazendonk, P; deDenus, C; Iuga, A; Cahoon, P; Nilsson, B; Iuga, D, J. Inorg. Organometal. Polym. Mater., 16, 4, 343-57, 2006.
Cell dimensions	nm	a:b:c=1.014:0.935:0.486 (α); a:b:c=2.06:0.94:0.486 (γ); a:b:c=1.003:0.937:0.486 (β); a:b:c=1.19:1.19:0.486 (hexagonal mesophase)	Hazendonk, P; deDenus, C; Iuga, A; Cahoon, P; Nilsson, B; Iuga, D, J. Inorg. Organometal. Polym. Mater., 16, 4, 343-57, 2006.

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PARAMETER	UNIT	VALUE	REFERENCES
Polymorphs	-	α, β, γ	Hazendonk, P; deDenus, C; Iuga, A; Cahoon, P; Nilsson, B; Iuga, D, J. Inorg. Organometal. Polym. Mater., 16, 4, 343-57, 2006.
PHYSICAL PROPERTIES			
Density at 20°C	g cm^{-3}	1.63-1.74	
Refractive index, 20°C	-	1.6-1.75	
Melting temperature, DSC	°C	110-249	
Thermal expansion coefficient, 23-80°C	10^{-4} $°C^{-1}$	1.9-10.7	Nakamura, H; Masuko, T; Kojima, M; Magill, J H, Macromol. Chem. Phys., 200, 2519-24, 1999.
Glass transition temperature	°C	7 to -82	Hazendonk, P; deDenus, C; Iuga, A; Cahoon, P; Nilsson, B; Iuga, D, J. Inorg. Organometal. Polym. Mater., 16, 4, 343-57, 2006; Allegra, G; Meille, S V, Macromolecules, 37, 3487-96, 2004.
Surface free energy	mJ m^{-2}	15.8	
CHEMICAL RESISTANCE			
Good solvent	-	water (some)	
PROCESSING			
Applications	-	flame retardation, fuel cells, fuel hoses, medical (bone regeneration, stomach wall regeneration), membranes, waterproofing	
Outstanding properties	-	thermal stability	
BLENDS			
Suitable polymers	-	PDMS, PI, PLA, PTFE (composite)	
ANALYSIS			
NMR (chemical shifts)	ppm	C, H, F, and P data included in ref.	Hazendonk, P; deDenus, C; Iuga, A; Cahoon, P; Nilsson, B; Iuga, D, J. Inorg. Organometal. Polym. Mater., 16, 4, 343-57, 2006.
x-ray diffraction peaks	degree	diffraction data in ref.	Tang, H; Pintauro, P N, Eur. Polym. J., 35, 1023-35, 1999.