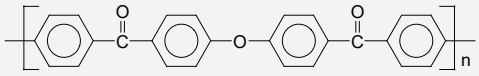
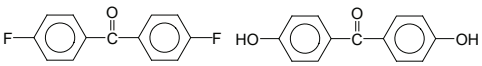
PEK polyetherketone

PARAMETER	UNIT	VALUE	REFERENCES
GENERAL			
Common name	-	polyetherketone, poly(4,4'-oxydiphenylene ketone)	
IUPAC name	-	poly(oxy-1,4-pheleneoxy-1,4-phenylene-carbonyl-1,4-phenylene)	
ACS name	-	poly(oxy-1,4-phenylenecarbonyl-1,4-phenylene)	
Acronym	-	PEK	
CAS number	-	27380-27-4	
Formula			
RTECS number	-	DC0875000	
HISTORY			
Person to discover	-	Staniland, P A	Staniland, P A, US Patent 4,056,511, ICI, Nov. 1, 1977
Date	-	1977	
Details	-	patent for polymerization	
SYNTHESIS			
Monomer(s) structure	-		Fink, J K, High Performance Polymers, William Andrew, 2008.
Monomer(s) CAS number(s)	-	345-92-6; 611-99-4	
Monomer(s) molecular weight(s)	dalton, g/mol, amu	218.2; 214.22	
Monomer ratio	-	equimolar quantities	
Method of synthesis	-	nucleophilic route, ketimine route, or electrophilic process; PEK can be obtained by reaction of 4,4'-difuorobenzophenone with 4,4'-dihydroxybenzophenone in the presence of potassium carbonate, using diphenyl sulfone as solvent	Ben-Haida, A; Colquhoun, H M; Hodge, P; Williams, D J, J. Mater. Chem., 10, 2011-16, 2000.
Temperature of polymerization	°C	0-30	
Catalyst	-	Friedel-Crafts catalyst	Fink, J K, High Performance Polymers, William Andrew, 2008.
STRUCTURE	-		
Crystallinity	%	28-44	Hamdan, S; Swallowe, G M, J. Polym. Sci. B, 34, 699-705, 1996.
Cell type (lattice)	-	orthorhombic	
Cell dimensions	nm	a:b:c=0.763-0.776:0.596-0.6:1.0-1.009	
COMMERCIAL POLYMERS			
Some manufacturers	-	Gharda Chemicals, RTP	
PHYSICAL PROPERTIES			
Density at 20°C	g cm^{-3}	1.26-1.30; 1.272 (amorphous); 1.43 (crystalline); 1.41-1.45 (15-40% glass fiber)	Shekar, R I; Kotresh, T M; Rao, P M D; Kumar, K, J. Appl. Polym. Sci., 112, 2497-2510, 2009.
Color	-	opaque	
Odor		odorless	
Melting temperature, DSC	°C	340-373	
Decomposition temperature	°C	>500	

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PARAMETER	UNIT	VALUE	REFERENCES
Thermal conductivity, 23°C	W m^{-1} K^{-1}	0.29	
Glass transition temperature	°C	152-154	
Specific heat capacity	J K^{-1} kg^{-1}	2,200	
Heat deflection temperature at 1.8 MPa	°C	163-167; 316 (10-40% glass fiber)	
Volume resistivity	ohm-m	1E14	
Surface resistivity	ohm	1E16	
Electric strength K20/P50, d=0.60.8 mm	kV mm^{-1}	16-17	
Comparative tracking index, CTI, test liquid A	-	145-150	
Arc resistance	s	175	
MECHANICAL & RHEOLOGICAL PROPERTIES			
Tensile strength	MPa	105-110; 138-290 (10-40% glass fiber)	
Tensile modulus	MPa	3,700-4,200; 8,274-37,200 (10-40% glass fiber)	
Tensile stress at yield	MPa	110-115	
Elongation	%	10-20; 1.3-3 (10-40% glass fiber)	
Flexural strength	MPa	185-190; 207-427 (10-40% glass fiber)	
Flexural modulus	MPa	4,100-4,200; 6,206-31,000 (10-40% glass fiber)	
Compressive strength	MPa	140	
Charpy impact strength, notched, 23°C	kJ m^{-2}	3.8	
Izod impact strength, unnotched, 23°C	J m^{-1}	NB; 530-800 (10-40% glass fiber)	
Izod impact strength, notched, 23°C	J m^{-1}	55-90 (10-40% glass fiber)	
Shore D hardness	-	86-87	
Rockwell hardness	-	M103	
Shrinkage	%	1-1.3; 0.05-0.4 (10-40% glass fiber)	
Intrinsic viscosity, 25°C	dl g^{-1}	1.05	
Melt viscosity, shear rate=1000 s^{-1}	Pa s	200	
Water absorption, 24h at 23°C	%	0.07; 0.6 (saturation)	
CHEMICAL RESISTANCE			
Acid dilute/concentrated	-	very good	
Alcohols	-	very good	
Alkalis	-	very good	
Aliphatic hydrocarbons	-	very good	
Aromatic hydrocarbons	-	very good	
Esters	-	very good	
Greases & oils	-	very good	
Ketones	-	very good	
FLAMMABILITY			
Ignition temperature	°C	400	

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PARAMETER	UNIT	VALUE	REFERENCES
Char at 500°C	%	52.9-56	Lyon, R E; Walters, R N, J. Anal. Appl. Pyrolysis, 71, 27-46, 2004.
Heat of combustion	J g^{-1}	31.070	Walters, R N; Hacket, S M; Lyon, R E, Fire Mater., 24, 5, 245-52, 2000.
Activation energy of decomposition	kJ mol^{-1}	230	Swallowe, G M; Dawson, P C; Tang, T B; Xu, Q L, J. Mater. Sci., 30, 3853-55, 1995.
UL rating	-	V-0; V-0 (10-40% glass fiber)	
PROCESSING			
Typical processing methods	-	extrusion, injection molding, transfer molding	
Preprocess drying: temperature/time/residual moisture	°C/h/%	150-180/2-6/0.1 (10-40% glass fiber)	
Processing temperature	°C	385-425 (melt) (10-40% glass fiber)	
Processing pressure	MPa	69-138 (10-40% glass fiber)	
Applications	-	automotive, aircraft, coatings, composites, electronics, fiber, food, medical, oil & gas, textiles	
Outstanding properties	-	high tensile, high temperature resistance	