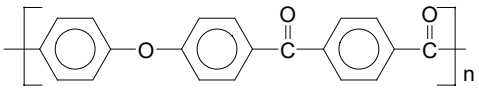
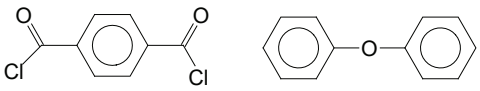
PEKK polyetherketoneketone

PARAMETER	UNIT	VALUE	REFERENCES
GENERAL			
Common name	-	poly(4,4'-oxydiphenylene m-phenylene diketone), polyetherketoneketone	
CAS name	-	poly(oxy-1,4-phenylenecarbonyl-1,4-phenylenecarbonyl-1,4-phenylene)	
Acronym	-	PEKK	
CAS number	-	74970-25-5	
Linear formula			
HISTORY			
Person to discover	-	Bonner, W H	Bonner, W H, US Patent 3,065,205, DuPont, 1962.
Date	-	1962	
Details	-	reported synthesis of PEEK in DuPont labs	
SYNTHESIS			
Monomer(s) structure	-		
Monomer(s) CAS number(s)	-	100-20-9; 101-84-8	
Monomer(s) molecular weight(s)	dalton, g/mol, amu	203.02; 170.21	
Method of synthesis	-	by Fiedel-Crafts acylation, Bonner condensed isophthaloyl chloride or terephthaloyl chloride with diphenyl ether using nitrobenzene as solvent and aluminum trichloride as a catalyst	
Catalyst	-	aluminum tetrachloride	
STRUCTURE			
Crystallinity	%	0-35	
Cell type (lattice)	-	orthorhombic	
Cell dimensions	nm	a:b:c=0.766:0.611:1.576	
Rapid crystallization temperature	°C	240-270	de Vries, H, Influence of processing parameters on mechanical properties of PEKK, NRL, 2006.
Crystallization half-time	min	7-9	de Vries, H, Influence of processing parameters on mechanical properties of PEKK, NRL, 2006.
Processing parameters for maximum crystallinity	-	340-350°C, <3°C/min cooling rate	de Vries, H, Influence of processing parameters on mechanical properties of PEKK, NRL, 2006.
COMMERCIAL POLYMERS			
Some manufacturers	-	CoorsTec; Arkema; RTP	
Trade names	-	PEKK; OXPEKK PEKK	
PHYSICAL PROPERTIES			
Density at 20°C	g cm^{-3}	1.28-1.31; 1.44-1.6 (20-40% glass fiber)	
Color	-	amber	
Melting temperature, DSC	°C	304-391	

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PARAMETER	UNIT	VALUE	REFERENCES
Thermal expansion coefficient, 23-80°C	10^{-4} °C^{-1}	0.21-0.38	
Thermal conductivity, melt	W m^{-1} K^{-1}	0.25	
Glass transition temperature	°C	154-171	Martin-Franch, P; Martin, T; Tunnicliffe, D L; Das-Gupta, D K, Sensors Actuators A: Phys., 99, 3, 236-43, 2002.
Heat of fusion	kJ kg^{-1}	57.5	
Long term service temperature	°C	260	
Heat deflection temperature at 1.8 MPa	°C	141-175; >299 to >316 (20-40% glass fiber)	
Dielectric constant at 1000 Hz/1 MHz	-	3.3-3.6/	
Dissipation factor at 1000 Hz	E-4	40	
Volume resistivity	ohm-m	1E14	
Surface resistivity	ohm	2E16	
Electric strength K20/P50, d=0.60.8 mm	kV mm^{-1}	24	
Coefficient of friction	-	0.17-0.18 (dynamic); 0.26-0.28 (static)	
MECHANICAL & RHEOLOGICAL PROPERTIES			
Tensile strength	MPa	90-110; 134-190 (20-40% glass fiber)	
Tensile modulus	MPa	3,450-4,400; 8,960-13,800 (20-40% glass fiber)	
Elongation	%	12; 1.9-2.5 (20-40% glass fiber)	
Flexural strength	MPa	138-193; 214-280 (20-40% glass fiber)	
Flexural modulus	MPa	3,380-4,600; 7,580-12,400 (20-40% glass fiber)	
Compressive strength	MPa	103-207	
Izod impact strength, unnotched, 23°C	J m^{-1}	480-900 (20-40% glass fiber)	
Izod impact strength, notched, 23°C	J m^{-1}	43-69; 50-110 (20-40% glass fiber)	
Shear strength	MPa	138	
Poisson's ratio	-	0.40	
Rockwell hardness	-	M88	
Shrinkage	%	0.01-1.4; 0.2-0.3 (20-40% glass fiber)	
Melt index, 380°C/8.4 kg	g/10 min	25-120	
Water absorption, 24h at 23°C	%	0.2-0.3	
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	-	good	
Ketones	-	very good	

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PARAMETER	UNIT	VALUE	REFERENCES
FLAMMABILITY			
Limiting oxygen index	% O_2	40	
NBS smoke chamber density	-	10	
Char at 500°C	%	60.7	Lyon, R E; Walters, R N, J. Anal. Appl. Pyrolysis, 71, 27-46, 2004.
Heat of combustion	J g^{-1}	31,150	Walters, R N; Hacket, S M; Lyon, R E, Fire Mater., 24, 5, 245-52, 2000.
UL 94 rating	-	V-0; V-0 (20-40% glass fiber)	
PROCESSING			
Typical processing methods	-	compression molding, injection molding	
Preprocess drying: temperature/ time/residual moisture	°C/h/%	149-232/3/0.1	
Processing temperature	°C	377-382 (20-40% glass fiber)	
Processing pressure	MPa	103-138 (injection)	
Applications	-	bearings, body implants, capillary tubing, composites, tubing	
Outstanding properties	-	biocompatibility, chemical resistance, low smoke toxicity	
BLENDS			
Suitable polymers	-	PI	