PPS (general purpose)

General information

Designation

Polyphenylene Sulfide (Unfilled)

Tradenames

Celstran, China, Coolpoly, Durafide, Electrafil, Fortron, Freqtis, Hifill, Infino, Luvocom, Nemcon, Ryton, Tedur, Therma-Tech, Torelina, Tripps

Typical uses

Electrical components; chemical pumps; under-bonnet components; coatings for chemical and/or abrasion resistance.

Composition overview

Compositional summary

(S-(C6H4))n

Material family	Plastic (thermoplastic, semi-crystalline)
Base material	PPS (Polyphenylene sulfide)
Polymer code	PPS

Composition detail (polymers and natural materials)

Polymer	100			%

Price

Price	* 6	-	8	USD/kg

Physical properties

Density	1.34e3	-	1.36e3	kg/m^3

Mechanical properties

Young's modulus	3.23	-	3.39	GPa
Yield strength (elastic limit)	64	-	67.2	MPa
Tensile strength	48.3	-	86.2	MPa
Elongation	1	-	6	% strain
Compressive modulus	* 3.23	-	3.39	GPa
Compressive strength	* 105	-	116	MPa
Flexural modulus	3.78	-	4.13	GPa
Flexural strength (modulus of rupture)	* 67.6	-	121	MPa
Shear modulus	* 1.16	-	1.22	GPa
Bulk modulus	* 4.89	-	5.14	GPa
Poisson's ratio	* 0.382	-	0.398	
Shape factor	5.3			
Hardness - Vickers	* 11.6	-	20.7	HV

Hardness - Rockwell R		118	-	130	
Fatigue strength at 10^7 cycles	*	19.3	-	34.5	MPa
Mechanical loss coefficient (tan delta)	*	0.0118	-	0.0124	

Impact & fracture properties

Fracture toughness	*	1.23	-	1.75	MPa.m^0.5
Impact strength, notched 23 °C		1.3	-	2.6	kJ/m^2
Impact strength, unnotched 23 °C		24.5	-	29.7	kJ/m^2

Thermal properties

Melting point		285	-	290	°C
Glass temperature		81	-	97	°C
Heat deflection temperature 0.45MPa		176	-	222	°C
Heat deflection temperature 1.8MPa		100	-	135	°C
Maximum service temperature		250	-	271	°C
Minimum service temperature	*	-55	-	-35	°C
Thermal conductivity		0.23	-	0.29	W/m.°C
Specific heat capacity	*	1.41e3	-	1.47e3	J/kg.°C
Thermal expansion coefficient		48.6	-	88.2	µstrain/°C

Electrical properties

Electrical resistivity		3.3e21	-	3e22	µohm.cm
Dielectric constant (relative permittivity)		3	-	3.2	
Dissipation factor (dielectric loss tangent)		3.8e-4	-	4.2e-4	
Dielectric strength (dielectric breakdown)		15	-	17.7	MV/m
Comparative tracking index		100	-	250	V

Magnetic properties

Magnetic type	Non-magnetic

Optical properties

Transparency	Opaque

Absorption & permeability

Water absorption @ 24 hrs		0.01	-	0.07	%
Water vapor transmission		0.475	-	0.889	g.mm/m².day
Permeability (O2)		5.55	-	8.39	cm³.mm/m².day.atm

Processing properties

Polymer injection molding	Limited use
Polymer extrusion	Limited use
Polymer thermoforming	Unsuitable

Linear mold shrinkage	0.6	-	1.4	%
Melt temperature	257	-	338	°C
Mold temperature	135	-	155	°C
Molding pressure range	13.8	-	20.6	MPa

Durability

Water (fresh)	Excellent
Water (salt)	Excellent
Weak acids	Excellent
Strong acids	Acceptable
Weak alkalis	Excellent
Strong alkalis	Excellent
Organic solvents	Acceptable
Oxidation at 500C	Unacceptable
UV radiation (sunlight)	Good
Flammability	Self-extinguishing

Primary production energy, CO2 and water

Embodied energy, primary production	* 214	-	236	MJ/kg
CO2 footprint, primary production	* 11.6	-	12.8	kg/kg
Water usage	* 52.3	-	57.8	l/kg

Processing energy, CO2 footprint & water

Polymer extrusion energy	* 5.95	-	6.58	MJ/kg
Polymer extrusion CO2	* 0.446	-	0.493	kg/kg
Polymer extrusion water	* 4.88	-	7.32	l/kg
Polymer molding energy	* 22.3	-	24.7	MJ/kg
Polymer molding CO2	* 1.67	-	1.85	kg/kg
Polymer molding water	* 14.1	-	21.2	l/kg
Coarse machining energy (per unit wt removed)	* 1.25	-	1.38	MJ/kg
Coarse machining CO2 (per unit wt removed)	* 0.0939	-	0.104	kg/kg
Fine machining energy (per unit wt removed)	* 8.24	-	9.11	MJ/kg
Fine machining CO2 (per unit wt removed)	* 0.618	-	0.683	kg/kg
Grinding energy (per unit wt removed)	* 16	-	17.7	MJ/kg
Grinding CO2 (per unit wt removed)	* 1.2	-	1.33	kg/kg

Recycling and end of life

Recycle	✓			
Embodied energy, recycling	* 72.6	-	80.2	MJ/kg
CO2 footprint, recycling	* 3.94	-	4.35	kg/kg
Recycle fraction in current supply	0.1			%

Downcycle	✓			
Combust for energy recovery	✓			
Heat of combustion (net)	* 27.7	-	29.1	MJ/kg
Combustion CO2	* 2.38	-	2.5	kg/kg
Landfill	✓			
Biodegrade	✗			

Links

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