General information

Designation

Polyetherimide (Unfilled)

Tradenames

Colorrx, Dynapath, Enviroplas, Extem, Geo-Tech, LNP Colorcomp, Luvocom, Meldin, Quadrant, Tempalux, Ultem, Ultron, Unitem

Typical uses

High temperature switchgear; microwave cookware; electrical connectors; lamp housings; under-bonnet components.

Composition overview

Compositional summary

(-N-[CO2]-C6H3-O-C6H4-[CH3]2-C6H4-O-C6H3-[CO]2-N-C6H4-)n

Material family	Plastic (thermoplastic, amorphous)
Base material	PEI (Polyether imide)
Polymer code	PEI

Composition detail (polymers and natural materials)

Polymer	100			%

Price

Price	17.6			USD/kg
Price per unit volume	* 2.22e4	-	2.25e4	USD/m^3

Physical properties

Density	1.26e3	-	1.28e3	kg/m^3

Mechanical properties

Young's modulus	2.89	-	3.04	GPa
Yield strength (elastic limit)	* 73.5	-	81.1	MPa
Tensile strength	91.9	-	101	MPa
Elongation	55.8	-	64.5	% strain
Compressive modulus	3.22	-	3.38	GPa
Compressive strength	* 144	-	159	MPa
Flexural modulus	3.22	-	3.38	GPa
Flexural strength (modulus of rupture)	144	-	159	MPa
Shear modulus	* 1.04	-	1.09	GPa
Bulk modulus	* 4.51	-	4.73	GPa
Poisson's ratio	* 0.385	-	0.401	
Shape factor	4.6			

Hardness - Vickers	* 22	-	24	HV
Hardness - Rockwell M	109	-	110	
Hardness - Rockwell R	* 121	-	134	
Fatigue strength at 10^7 cycles	* 33.9	-	44.1	MPa
Mechanical loss coefficient (tan delta)	* 0.0132	-	0.0138	

Impact & fracture properties

Fracture toughness	* 1.99	-	4.03	MPa.m^0.5
Impact strength, notched 23 °C	3.81	-	4.2	kJ/m^2
Impact strength, notched -30 °C	3.81	-	4.2	kJ/m^2

Thermal properties

Glass temperature	215	-	217	°C
Heat deflection temperature 0.45MPa	207	-	210	°C
Heat deflection temperature 1.8MPa	197	-	200	°C
Maximum service temperature	161	-	179	°C
Minimum service temperature	* -49	-	-29	°C
Thermal conductivity	0.123	-	0.13	W/m.°C
Specific heat capacity	* 1.47e3	-	1.53e3	J/kg.°C
Thermal expansion coefficient	84.6	-	101	µstrain/°C

Electrical properties

Electrical resistivity	3.3e22	-	3e23	µohm.cm
Dielectric constant (relative permittivity)	3.1	-	3.3	
Dissipation factor (dielectric loss tangent)	0.0019	-	0.0021	
Dielectric strength (dielectric breakdown)	18.9	-	20.5	MV/m
Comparative tracking index	100	-	250	V

Magnetic properties

Magnetic type	Non-magnetic

Optical properties

Refractive index	1.65	-	1.67	
Transparency	Transparent			

Critical materials risk

Contains >5wt% critical elements?	No

Absorption & permeability

Water absorption @ 24 hrs	0.227	-	0.275	%

Processing properties

Polymer injection molding	Acceptable			
Polymer extrusion	Acceptable			
Polymer thermoforming	Acceptable			
Linear mold shrinkage	0.5	-	0.7	%
Melt temperature	309	-	430	℃
Mold temperature	70	-	170	℃
Molding pressure range	69	-	138	MPa

Durability

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

Primary production energy, CO2 and water

Embodied energy, primary production	* 197	-	217	MJ/kg
CO2 footprint, primary production	* 10.6	-	11.7	kg/kg
Water usage	* 490	-	541	l/kg

Processing energy, CO2 footprint & water

Polymer extrusion energy	* 6.12	-	6.76	MJ/kg
Polymer extrusion CO2	* 0.459	-	0.507	kg/kg
Polymer extrusion water	* 4.95	-	7.42	l/kg
Polymer molding energy	* 26.9	-	29.8	MJ/kg
Polymer molding CO2	* 2.02	-	2.23	kg/kg
Polymer molding water	* 16	-	24	l/kg
Coarse machining energy (per unit wt removed)	* 1.61	-	1.78	MJ/kg
Coarse machining CO2 (per unit wt removed)	* 0.121	-	0.133	kg/kg
Fine machining energy (per unit wt removed)	* 11.8	-	13	MJ/kg
Fine machining CO2 (per unit wt removed)	* 0.885	-	0.978	kg/kg
Grinding energy (per unit wt removed)	* 23.1	-	25.5	MJ/kg
Grinding CO2 (per unit wt removed)	* 1.73	-	1.92	kg/kg

Recycling and end of life

Recycle	✓

Embodied energy, recycling	* 66.8	-	73.8	MJ/kg
CO2 footprint, recycling	* 3.6	-	3.98	kg/kg
Recycle fraction in current supply	0.1			%
Downcycle	✓			
Combust for energy recovery	✓			
Heat of combustion (net)	* 28.8	-	30.3	MJ/kg
Combustion CO2	* 2.68	-	2.82	kg/kg
Landfill	✓			
Biodegrade	✗			

Links

ProcessUniverse
Producers
Reference
Shape