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	* 7.71	-	8.39	USD/lb

Physical properties

Density	0.0455	-	0.0462	lb/in^3

Mechanical properties

Young's modulus	0.419	-	0.441	10^6 psi
Yield strength (elastic limit)	* 10.7	-	11.8	ksi
Tensile strength	13.3	-	14.7	ksi
Elongation	55.8	-	64.5	% strain
Compressive modulus	0.467	-	0.49	10^6 psi
Compressive strength	* 20.9	-	23.1	ksi
Flexural modulus	0.467	-	0.49	10^6 psi
Flexural strength (modulus of rupture)	20.9	-	23.1	ksi
Shear modulus	* 0.15	-	0.158	10^6 psi
Bulk modulus	* 0.654	-	0.687	10^6 psi
Poisson's ratio	* 0.385	-	0.401	
Shape factor	4.6			
Hardness - Vickers	* 22.1	-	24.3	HV

Hardness - Rockwell M	109	-	110	
Hardness - Rockwell R	* 121	-	134	
Fatigue strength at 10^7 cycles	* 4.92	-	6.39	ksi
Mechanical loss coefficient (tan delta)	* 0.0132	-	0.0138	

Impact & fracture properties

Fracture toughness	* 1.81	-	3.67	ksi.in^0.5
Impact strength, notched 23 °C	0.00233	-	0.00257	BTU/in^2
Impact strength, notched -30 °C	0.00233	-	0.00257	BTU/in^2

Thermal properties

Glass temperature	419	-	423	°F
Heat deflection temperature 0.45MPa	405	-	410	°F
Heat deflection temperature 1.8MPa	387	-	392	°F
Maximum service temperature	322	-	354	°F
Minimum service temperature	* -56.2	-	-20.2	°F
Thermal conductivity	0.0708	-	0.075	BTU.ft/hr.ft^2.°F
Specific heat capacity	* 0.352	-	0.366	BTU/lb.°F
Thermal expansion coefficient	47	-	56	µstrain/°F

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)	480	-	521	V/mil
Comparative tracking index	100	-	250	V

Magnetic properties

Magnetic type	Non-magnetic

Optical properties

Refractive index	1.65	-	1.67	
Transparency	Transparent			

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	588	-	806	°F
Mold temperature	158	-	338	°F
Molding pressure range	10	-	20	ksi

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	* 8.47e4	-	9.33e4	BTU/lb
CO2 footprint, primary production	* 10.6	-	11.7	lb/lb
Water usage	* 1.36e4	-	1.5e4	in^3/lb

Processing energy, CO2 footprint & water

Polymer extrusion energy	* 2.63e3	-	2.91e3	BTU/lb
Polymer extrusion CO2	* 0.459	-	0.507	lb/lb
Polymer extrusion water	* 137	-	205	in^3/lb
Polymer molding energy	* 1.16e4	-	1.28e4	BTU/lb
Polymer molding CO2	* 2.02	-	2.23	lb/lb
Polymer molding water	* 443	-	665	in^3/lb
Coarse machining energy (per unit wt removed)	* 691	-	764	BTU/lb
Coarse machining CO2 (per unit wt removed)	* 0.121	-	0.133	lb/lb
Fine machining energy (per unit wt removed)	* 5.07e3	-	5.6e3	BTU/lb
Fine machining CO2 (per unit wt removed)	* 0.885	-	0.978	lb/lb
Grinding energy (per unit wt removed)	* 9.94e3	-	1.1e4	BTU/lb
Grinding CO2 (per unit wt removed)	* 1.73	-	1.92	lb/lb

Recycling and end of life

Recycle	✓			
Embodied energy, recycling	* 2.87e4	-	3.17e4	BTU/lb
CO2 footprint, recycling	* 3.6	-	3.98	lb/lb
Recycle fraction in current supply	0.1			%
Downcycle	✓			

Combust for energy recovery	✓				
Heat of combustion (net)	*	1.24e4	-	1.3e4	BTU/lb
Combustion CO2	*	2.68	-	2.82	lb/lb
Landfill	✓				
Biodegrade	✗				

Links

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Reference
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