PA6 (cast)

General information

Overview

Note: Polyamides are moisture sensitive. Density, mechanical, impact, and electrical properties on this datasheet are for material conditioned at 50% relative humidity and 23°C. These are more typical of in-use performance than the properties of the dry material. Other properties are for the dry-as-molded material.

Designation

Polyamide (Nylon) (Type 6, Cast)

Tradenames

Erlaton, Nycast

Typical uses

Gears; cams; rollers; bearings; nuts and bolts; power tool housing; electrical connectors; combs; coil formers; fuel tanks for cars; kitchen utensils.

Composition overview

Compositional summary

(NH(CH2)5C0)n

Material family	Plastic (thermoplastic, semi-crystalline)
Base material	PA6 (Polyamide/nylon 6)
Polymer code	PA6

Composition detail (polymers and natural materials)

Polymer	100			%

Price

Price	* 1.85	-	2.03	USD/lb

Physical properties

Density	* 0.0412	-	0.0419	lb/in^3

Mechanical properties

Young's modulus	0.229	-	0.286	10^6 psi
Yield strength (elastic limit)	7.43	-	9.25	ksi
Tensile strength	* 9.38	-	11.5	ksi
Elongation	61.5	-	88.5	% strain
Elongation at yield	* 5.58	-	10.6	% strain
Compressive modulus	* 0.245	-	0.27	10^6 psi
Compressive strength	* 11.9	-	13.1	ksi
Flexural modulus	* 0.235	-	0.28	10^6 psi
Flexural strength (modulus of rupture)	7.83	-	9.57	ksi
Shear modulus	* 0.0922	-	0.097	10^6 psi
Shear strength	* 5.63	-	6.87	ksi
Bulk modulus	* 0.292	-	0.322	10^6 psi
Poisson's ratio	0.34	-	0.36	
Shape factor	4.17			
Hardness - Vickers	* 16.4	-	18.1	HV
Hardness - Rockwell M	* 122	-	135	
Hardness - Rockwell R	* 122	-	135	
Hardness - Brinell	16.1	-	20.2	ksi
Hardness - Shore D	* 83.3	-	86.7	
Fatigue strength at 10^7 cycles	* 3.96	-	4.38	ksi
Mechanical loss coefficient (tan delta)	* 0.0189	-	0.0209	

Impact & fracture properties

Fracture toughness	*	3.12	-	3.46	ksi.in^0.5
Impact strength, notched 23 °C		0.00624	-	0.0121	BTU/in^2

Thermal properties

Melting point		441	-	460	°F
Glass temperature		111	-	133	°F
Heat deflection temperature 0.45MPa		399	-	430	°F
Heat deflection temperature 1.8MPa		331	-	399	°F
Maximum service temperature		194	-	266	°F
Minimum service temperature		-83.2	-	-65.2	°F
Thermal conductivity	*	0.17	-	0.177	BTU.ft/hr.ft^2.°F
Specific heat capacity		0.334	-	0.358	BTU/lb.°F
Thermal expansion coefficient		49	-	51	µstrain/°F

Electrical properties

Electrical resistivity		2e17	-	5e18	µohm.cm
Dielectric constant (relative permittivity)		5.48	-	7.72	
Dissipation factor (dielectric loss tangent)		0.077	-	0.203	
Dielectric strength (dielectric breakdown)		348	-	592	V/mil
Comparative tracking index		600			V

Optical properties

Refractive index		1.56	-	1.57	
Transparency		Translucent			

Magnetic properties

Magnetic type		Non-magnetic			

Bio-data

RoHS (EU) compliant grades?		✓			
Food contact		Yes			

Absorption & permeability

Water absorption @ 24 hrs		0.8	-	1.3	%
Water absorption @ sat		5.2	-	6.8	%
Humidity absorption @ sat		1.9	-	2.5	%
Water vapor transmission		0.958	-	1.73	g.mm/m².day
Permeability (O2)		1.58	-	2.92	cc.mil/day.(100.in^2).atm

Processing properties

Polymer injection molding		Unsuitable			
Polymer extrusion		Unsuitable			
Polymer thermoforming		Unsuitable			
Linear mold shrinkage	*	0.1	-	1	%

Durability

Water (fresh)	Excellent
Water (salt)	Acceptable
Weak acids	Unacceptable
Strong acids	Unacceptable
Weak alkalis	Limited use
Strong alkalis	Limited use
Organic solvents	Acceptable

Oxidation at 500C	Unacceptable			
UV radiation (sunlight)	Fair			
Flammability	Slow-burning			

Primary production energy, CO2 and water

Embodied energy, primary production	5.25e4	-	5.76e4	BTU/lb

Sources

120 MJ/kg (Kemna et al. 2005); 120 MJ/kg (PlasticsEurope, 2010); 121 MJ/kg (Hammond and Jones, 2008); 123 MJ/kg (Patel, 2003); 156 MJ/kg (Song, Youn, Gutowski, 2009)

CO2 footprint, primary production	8.51	-	9.38	lb/lb

Sources

8.56 kg/kg (Kemna et al. 2005); 9.1 kg/kg (PlasticsEurope, 2010); 9.14 kg/kg (Hammond and Jones, 2008)

NOx creation	* 0.0164	-	0.0181	lb/lb
SOx creation	* 0.0492	-	0.0544	lb/lb
Water usage	* 4.87e3	-	5.37e3	in^3/lb

Processing energy, CO2 footprint & water

Polymer extrusion energy	* 3.25e3	-	3.58e3	BTU/lb
Polymer extrusion CO2	* 0.604	-	0.666	lb/lb
Polymer extrusion water	* 153	-	230	in^3/lb
Polymer molding energy	* 8.36e3	-	9.21e3	BTU/lb
Polymer molding CO2	* 1.56	-	1.71	lb/lb
Polymer molding water	* 357	-	535	in^3/lb
Coarse machining energy (per unit wt removed)	* 617	-	682	BTU/lb
Coarse machining CO2 (per unit wt removed)	* 0.108	-	0.119	lb/lb
Fine machining energy (per unit wt removed)	* 4.34e3	-	4.79e3	BTU/lb
Fine machining CO2 (per unit wt removed)	* 0.757	-	0.836	lb/lb
Grinding energy (per unit wt removed)	* 8.47e3	-	9.36e3	BTU/lb
Grinding CO2 (per unit wt removed)	* 1.48	-	1.63	lb/lb

Recycling and end of life

Recycle	✓			
Embodied energy, recycling	* 1.78e4	-	1.96e4	BTU/lb
CO2 footprint, recycling	* 2.89	-	3.19	lb/lb
Recycle fraction in current supply	0.672	-	0.742	%
Downcycle	✓			
Combust for energy recovery	✓			
Heat of combustion (net)	* 1.3e4	-	1.36e4	BTU/lb
Combustion CO2	* 2.28	-	2.39	lb/lb
Landfill	✓			
Biodegrade	✗			

Recycle mark

Geo-economic data for principal component

Principal component	Nylon			
Annual world production	3.46e6	-	3.83e6	ton/yr
Reserves	8.6e7	-	9.51e7	l. ton

Eco-indicators for principal component

Eco-indicator 95	286	millipoints/lb
Eco-indicator 99	225	millipoints/lb

Links

ProcessUniverse

Producers

Reference

Shape