



Torlon® 4203L

polyamide-imide

Torlon 4203L is an unreinforced, lubricated, pigmented grade of polyamide-imide (PAI) resin. It has the best impact resistance and greatest elongation of all the Torlon grades. Torlon PAI has the highest strength and stiffness of any thermoplastic up to 275°C (525°F). It has outstanding resistance to wear, creep, and chemicals.

Torlon 4203L resin offers outstanding electrical properties, which makes it ideal for high performance parts such as

connectors, switches and relays. In addition Torlon 4203L polyamide-imide can be used in applications such as thrust washers, spline liners, valve seats, bushings, bearings, wear rings, cams and other applications requiring strength at high temperature and resistance to wear.

This injection molding material is available in high flow (HF) and low flow (LF) versions.

Typical Properties⁽¹⁾ by ASTM Test Methods

Property	Test Method	US Customary Units		SI Units	
MECHANICAL					
Tensile Strength	D 638	22.0	kpsi	152	MPa
	D 1708 ⁽²⁾	27.8	kpsi	192	MPa
Tensile Modulus	D 638	650	kpsi	4.5	GPa
	D 1708 ⁽²⁾	710	kpsi	4.9	GPa
Tensile Elongation	D 638	7.6	%	7.6	%
	D 1708 ⁽²⁾	15	%	15	%
Flexural Modulus	D 790				
	at 23°C (73°F)	730	kpsi	5.0	GPa
	at 232°C (450°F)	520	kpsi	3.6	GPa
Flexural Strength	D 790				
	at 23°C (73°F)	34.9	kpsi	241	MPa
	at 232°C (450°F)	17.1	kpsi	118	MPa
Izod Impact Strength, Notched	D 256	2.7	ft-lb/in	140	J/m
Izod Impact Strength, Unnotched	D 4812	20	ft-lb/in	1,070	J/m
Compressive Strength	D 695	32.1	kpsi	221	MPa
Compressive Modulus	D 695	580	kpsi	4.0	GPa
Poisson's Ratio		0.45		0.45	

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Typical Properties⁽¹⁾ by ASTM Test Methods (continued)

Property	Test Method	US Customary Units		SI Units	
THERMAL					
Heat Deflection Temperature	D 648				
at 264 psi (1.8 MPA)		532	°F	278	°C
Thermal Conductivity	C 177	1.8	Btu in/hr- ft ² °F	0.26	W/mK
Coefficient of Thermal Expansion, flow direction	E 831	17	ppm/°F	31	ppm/°C
ELECTRICAL					
Dielectric Strength	D 149	580	V/mil	24	kV/mm
Dielectric Constant	D 150				
at 60 Hz		4.2		4.2	
at 1 MHz		3.9		3.9	
Dissipation Factor	D 150				
at 60 Hz		0.026		0.026	
at 1 MHz		0.031		0.031	
Volume Resistivity	D 257	2 x 10 ¹⁷	ohm-cm	2 x 10 ¹⁷	ohm-cm
Surface Resistivity	D 257	5 x 10 ¹⁸	ohm	5 x 10 ¹⁸	ohm
GENERAL					
Specific Gravity	D 792	1.42		1.42	
Water Absorption, 24 hours	D 570	0.33	%	0.33	%
Mold Shrinkage	D 955	0.60 - 0.85	%	0.60 - 0.85	%

⁽¹⁾ Property values for individual batches will vary within specification limits. Values shown are typical for uncolored resin; colorants may alter values.

⁽²⁾ ASTM Test Method D1708 has been used to measure the tensile properties of PAI and similar materials because the small test specimen conserved material.

Today the most widely used specimen is the Type 1 bar of ASTM D638. These D1708 values are included for historical purposes and they should not be compared to the D638 values.

Drying

Drying Torlon resin to a moisture content of 500 ppm or lower is required to avoid molding problems, such as brittle parts and foaming. The resin should be dried in a circulating air oven equipped with a desiccant system. Place the resin on drying trays in layers no more than 5 to 8 cm (2 to 3") deep. Minimum drying times are 3 hours at 175°C (350°F), 4 hours at 150°C (300°F), or 16 hours at 120°C (250°F). If drying at 175°C (350°F), limit drying time to 16 hours. Dessicant hopper dryers are recommended for the injection molding press.

Standard Packaging and Labeling

Torlon 4203L resin is packaged in lined cardboard boxes containing 25 kg (55.115 pounds) of material. Individual packages will be plainly marked with the product number, color, lot number, and net weight.

Injection Molding

The injection molding press should be equipped with a screw having a length to diameter (L/D) ratio between 18:1 and 24:1 and a compression ratio between 1:1 and 1.5:1. Check devices are not recommended.

Recommended barrel temperatures are 305°C (580°F) in the feed zone increasing to 370°C (700°F) at the nozzle. The mold temperature should be adjusted until the temperature of the surface measures between 200°C (390°F) and 215°C (420°F).

Set the injection pressure to achieve a rapid fill. On most machines, this will be near the maximum injection pressure available. Fill the entire mold with primary injection boost and then drop off to a hold pressure. Begin hold pressure at a high setting of 41 to 55 MPa (6,000 to 8,000 psi), for several seconds, then drop off to 21 to 35 MPa (3,000 to 5,000 psi), for the duration of the hold pressure sequence. This will help minimize or eliminate any internal porosity or sink. If part defects, such as blistering at the gate, color change and degradation, splay and surface delamination, or gas burning at the knit lines and vents, are encountered, the injection fill rate may be too high.

Use moderate back pressure, about 7 MPa (1,000 psi), and lower screw recovery speeds (50-100 rpm). Avoid intermittent feeding and screw slippage which can lead to overheating and possible polymer degradation.

Total cycle time should be as short as possible to reduce residence time in the barrel. Excessive residence time will cause an increase in melt viscosity, reducing flow.

Cycle time consistency is very important for successful molding for Torlon parts and automatic operation is highly recommended.

Molds should be designed for smooth part ejection, avoiding undercuts and providing adequate draft.

Heat Treatment (Post-Cure) After Molding

Torlon polymers are unique in that they are supplied at a relatively low molecular weight to facilitate processing, and the molded parts must be heat treated to achieve a high molecular weight and optimum properties. The heat treatment process is commonly called post-cure and involves placing the molded articles in a forced air oven and subjecting them to a series of elevated temperatures for specific times. Consult the Torlon polyamide-imide Molding Guide for standard post-cure cycles or contact your Solvay Advanced Polymers' representative for the recommended heat treatment program for post-curing your molded article.

For assistance with an emergency involving products of Solvay Advanced Polymers, such as a spill, leak, fire, or explosion, call day or night:

Emergency Health Information

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International +1.770.772.8577

Emergency Spill Information

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For additional product information, technical assistance, and Material Safety Data Sheets (MSDS), call:

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