



# Torlon<sup>®</sup> 4645

polyamide-imide

Torlon 4645, an injection-moldable, wear-resistant grade of polyamide-imide (PAI), has been formulated to give outstanding wear resistance in lubricated wear applications.

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.

Potential applications for Torlon 4645 polyamide-imide include thrust washers, seal rings, sliding vanes, bobbins, bushings, clutch rollers, and pistons.

## Typical Properties<sup>(1)</sup> by ASTM Test Methods

Property	Test Method	US Customary Units		SI Units	
<b>MECHANICAL</b>					
Tensile Strength	D 638	16.6	kpsi	114	MPa
Tensile Modulus	D 638	2,700	kpsi	18.6	GPa
Tensile Elongation	D 638	0.8	%	0.8	%
Flexural Modulus	D 790	1,800	kpsi	12.4	GPa
Flexural Strength	D 790	22.4	kpsi	154	MPa
Izod Impact Strength, Notched	D 256	0.7	ft-lb/in	38	J/m
Izod Impact Strength, Unnotched	D 4812	2	ft-lb/in	130	J/m
Compressive Strength	D 695	22.8	kpsi	157	MPa
Shear Strength	D 732				
at 23°C (73°F)		12.4	kpsi	85	MPa
at 150°C (302°F)		8.8	kpsi	61	MPa
<b>THERMAL</b>					
Heat Deflection Temperature	D 648				
at 264 psi (1.8 MPA)		538	°F	281	°C
<b>GENERAL</b>					
Specific Gravity	D 792	1.57		1.57	
Water Absorption, 24 hours	D 570	0.25	%	0.25	%
<b>FRICTION AND WEAR</b>					
Wear Factor <sup>(2)</sup> Lubricated	D 3702	1.6	10 <sup>-10</sup> in <sup>3</sup> -min/ft-lb-hr	3.2	10 <sup>-8</sup> mm <sup>3</sup> /N-m

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

<sup>(2)</sup> Automotive transmission fluid at 150°C (302°F), 75 fpm (0.38 m/s) and 1,000 psi (6.89 MPa)

### Drying

Drying Torlon resin to a moisture content of 500 ppm or lower is required to avoid molding problems, like 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 177°C (350°F), 4 hours at 150°C (300°F), or 16 hours at 121°C (250°F).

### 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.

### Post-cure

Torlon polymers are unique in that they are supplied at a relatively low molecular weight to facilitate processing, and the molded parts must be post-cured to achieve a high molecular weight and optimum properties. The post-curing process involves placing the molded articles in a forced air oven and thermally treating them to a series of increasing temperatures for various times. Contact your Solvay Advanced Polymers' representative for a specific recommendation for post-curing your part.

### Standard Packaging and Labeling

Torlon 4645 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.

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

**USA** +1.800.621.4590

**International** +1.770.772.8577

#### Emergency Spill Information

**USA** +1.800.424.9300 / +1.703.527.3887 (CHEMTREC)

**Europe** +44 208.762.8322 (CARECHEM)

**China** +86.10.5100.3039

**All other Asian countries** +65.633.44.177

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

**USA** +1.800.621.4557 / +1.770.772.8760

**Europe** +49.211.5135.9000

**Japan** +81.3.5425.4300

**China & Southeast Asia** +86.21.5080.5080

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