more endurance

Torlon® POLYAMIDE-IMIDE

version 1.1

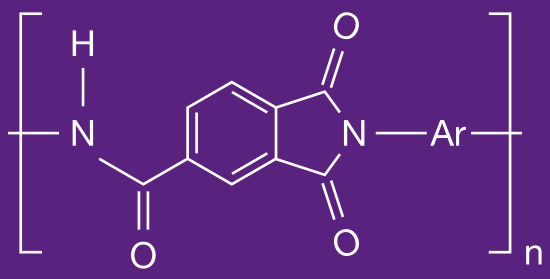
SOLVAY
Advanced Polymers

MORE PLASTICS WITH MORE PERFORMANCE

Injection Molding Grades of Torlon® PAI

High-strength grades of Torlon PAI deliver metal-like performance and are routinely specified for precision components used in repetitive-use, load-bearing operations. Grades reinforced with glass fiber and carbon fiber retain their strength and stiffness at high temperature with the added benefit of low creep and excellent fatigue resistance.

Wear-resistant grades deliver just the right combination of mechanical and tribological properties. This, combined with inherent heat and chemical resistance, makes them an effective alternative to metal in high-temperature friction and wear applications—even when lubrication is marginal or non-existent. Select grades can perform in lubricated environments at exceptionally high pressures and velocities.



High-Strength Grades

4203L	General purpose, unfilled
5030	Glass fiber, high stiffness, very low creep
7130	Carbon fiber, very high stiffness, excellent fatigue resistance

Wear-Resistant Grades

4275	Designed for high speeds
4301	General purpose, high compressive strength
4435	Designed for high pressures and velocities
4630	Exceptional wear resistance, dry
4645	Exceptional wear resistance, lubricated

Specialty Molding Grade

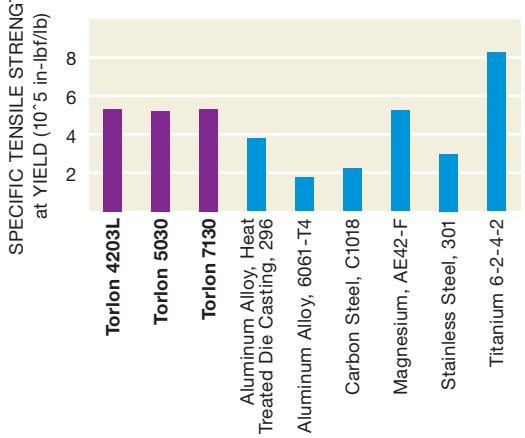
4601	Designed for undercut tooling applications such as deep groove bearings

Torlon® PAI: more staying power at top temperatures

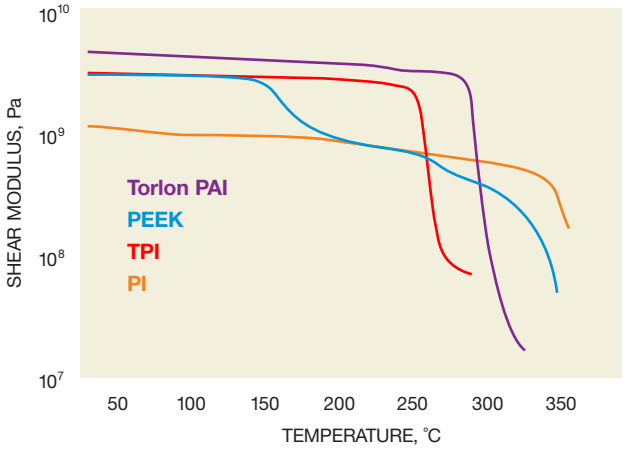
Torlon® polyamide-imide (PAI) has the highest strength and stiffness at elevated temperature of any thermoplastic commercially available. For over 30 years, it has been recognized for long-lasting performance in severe service environments and a distinct combination of properties.

- Exceptional strength and stiffness up to 275°C
- Outstanding wear resistance
- Superior toughness from cryogenic up to 275°C
- Resistant to strong acids and most organics
- Inherent flame resistance
- Low CLTE

SPECIFIC TENSILE STRENGTH COMPARISON to METAL



MECHANICAL PERFORMANCE at HIGH TEMPERATURE*



More Design Freedom

Torlon products featured in this brochure can be processed using conventional injection molding techniques and offer a distinct processing advantage for high-volume production. Torlon resin is also available in extrusion and compression molding grades used to produce a variety of stock shapes for machining and low-volume production. Powder grades of Torlon PAI are specially designed to manufacture high-temperature adhesives, composite matrices, coatings and films.

Visit www.solvayadvancedpolymers.com for detailed product and processing information. For a list of recommended processors, please contact your Solvay representative.

**Data generated by Dynamic Mechanical Thermal Analysis (DMTA).*

typical properties of injection r

Property[1]	units	high-strength grades: 4203L *Unfilled*	5030 *Glass Fiber*	7130 *Carbon Fiber*	specialty molding grade: 4601 *Proprietary*
Tensile Strength ASTM D 638	kpsi MPa	22.0 152	32.1 221	32.0 221	17.5 121
Tensile Modulus ASTM D 638	kpsi GPa	650 4.5	2,110 14.5	2,400 16.5	610 4.2
Tensile Elongation ASTM D 638	%	7.6	2.3	1.5	4.1
Flexural Strength ASTM D 790	kpsi MPa	34.9 241	48.3 333	50.7 350	26.4 182
Flexural Modulus ASTM D 790	kpsi GPa	730 5.0	1,700 11.7	2,400 16.5	650 4.5
Compressive Strength ASTM D 695	kpsi MPa	32.1 221	38.3 264	36.9 254	
Shear Strength ASTM D 732	kpsi MPa	18.5 128	20.1 139	17.3 119	15.6 108
Izod Impact, Notched ASTM D 256	ft-lb/in J/m	2.7 144	1.5 80	0.9 48	4.3 230
Izod Impact, Unnotched ASTM D 4812	ft-lb/in J/m	20 1,070	10 530	6 320	7 370
Heat Deflection Temperature at 264 psi, ASTM D 648	°C °F	278 532	282 540	282 540	284 543
CLTE[2] ASTM D 696	ppm/°C ppm/°F	31 17	16 9	9 5	
Volume Resistivity ASTM D 257	ohm-cm	$2x10^7$	$2x10^7$		
Specific Gravity ASTM D 792		1.42	1.61	1.48	1.39
Water Absorption, 24 hours ASTM D 570	%	0.33	0.24	0.26	
Coefficient of Friction, Dry at 50 fpm (0.25 m/s), ASTM D 3702					0.29
Coefficient of Friction, Dry at 800 fpm (4 m/s), ASTM D 3702					
Wear Factor, Dry[3] at 50 fpm (0.25 m/s), ASTM D 3702	10^{-10} in^3min/ft-lb-hr 10^{-8} mm^3/Nm				
Wear Factor, Dry[3] at 800 fpm (4 m/s), ASTM D 3702	10^{-10} in^3min/ft-lb-hr 10^{-8} mm^3/Nm				
Wear Factor, Lubricated[4] ASTM D 3702	10^{-10} in^3min/ft-lb-hr 10^{-8} mm^3/Nm				63 111

[1] *Actual properties of individual batches will vary within specification limits.*
[2] *Coefficient of Linear Thermal Expansion measured in flow direction from 0-150°C.*
[3] *PV of 25,000 psi x fpm (876 KPa x m/s)*
[4] *In automotive transmission fluid at 150°C, 75 fpm (0.38 m/s) and 1000 psi (6896 KPa)*

molding grades of Torlon® PAI

wear-resistant grades

Property[1]	units	4275 *G/PTFE*	4301 *G/PTFE*	4435 *Proprietary*	4630 *G/PTFE*	4645 *CF/PTFE*
Tensile Strength ASTM D 638	kpsi MPa	16.9 117	16.4 113	13.6 94	11.8 81	16.6 114
Tensile Modulus ASTM D 638	kpsi GPa	1,280 8.8	990 6.8	2,100 14.5	1,080 7.4	2,700 18.6
Tensile Elongation ASTM D 638	%	2.6	3.3	1.0	1.9	0.8
Flexural Strength ASTM D 790	kpsi MPa	30.2 208	31.2 215	22.0 152	19.0 131	22.4 154
Flexural Modulus ASTM D 790	kpsi GPa	1,060 7.3	1,000 6.9	2,150 14.8	990 6.8	1,800 12.4
Compressive Strength ASTM D 695	kpsi MPa	17.8 123	24.1 166	20.0 138	14.4 99	22.8 157
Shear Strength ASTM D 732	kpsi MPa	11.1 77	16.1 111	8.7 60		12.4 85
Izod Impact, Notched ASTM D 256	ft-lb/in J/m	1.6 85	1.2 64	0.8 43	0.9 48	0.7 37
Izod Impact, Unnotched ASTM D 4812	ft-lb/in J/m	5 270	8 430	4 210	3 160	2 110
Heat Deflection Temperature at 264 psi, ASTM D 648	°C °F	280 536	279 534	278 532	280 536	281 538
CLTE[2] ASTM D 696	ppm/°C ppm/°F	25 14	25 14	14 8	4 2	4 2
Volume Resistivity[3] ASTM D 257	ohm-cm	$8x10^{15}$	$8x10^{15}$	$2x10^{7}$		
Specific Gravity ASTM D 792		1.51	1.46	1.59	1.56	1.57
Water Absorption, 24 hours ASTM D 570	%	0.33	0.28	0.12	0.18	0.25
Coefficient of Friction, Dry at 50 fpm (0.25 m/s), ASTM D 3702		0.31	0.31	0.29	0.32	
Coefficient of Friction, Dry at 800 fpm (4 m/s), ASTM D 3702		0.29	0.39	0.27	0.32	
Wear Factor, Dry[4] at 50 fpm (0.25 m/s), ASTM D 3702	10^{-10} in^3min/ft-lb-hr 10^{-8} mm^3/Nm	13 23	14 24	21 37	6 11	
Wear Factor, Dry[4] at 800 fpm (4 m/s), ASTM D 3702	10^{-10} in^3min/ft-lb-hr 10^{-8} mm^3/Nm	18 32	17 30	17 30	14 24	
Wear Factor, Lubricated[5] ASTM D 3702	10^{-10} in^3min/ft-lb-hr 10^{-8} mm^3/Nm	7 12				2 3

[1] *Actual properties of individual batches will vary within specification limits.*

[2] *Coefficient of Linear Thermal Expansion measured in flow direction from 0-150°C.*

[3] *Although 4275 and 4301 have high volume resistivity, they contain graphite particles which under certain conditions can conduct electricity.*

[4] *PV of 25,000 psi x fpm (876 KPa x m/s)*

[5] *In automotive transmission fluid at 150°C, 75 fpm (0.38 m/s) and 1000 psi (6896 KPa)*

more of the performance you need

Gears

- Fatigue resistance
- High strength and rigidity
- Dimensional stability
- Chemical resistance
- Creep resistance
- Noise reduction

Seals

- Thermal stability
- High compressive strength
- Creep resistance
- Conformability (non-leaking)
- Dimensional stability
- Self-lubricating

Bushings

- Low coefficient of friction
- Thermal stability
- High compressive strength
- Chemical resistance
- Long-life performance

Washers

- Thermal stability
- High compressive strength
- Creep resistance
- Dimensional stability
- Self-lubricating

Slides

- Self-lubricating
- Impact resistance
- Mechanical strength
- Thermal stability

Fasteners

- Exceptional strength
- High elongation
- Chemical resistance
- Dimensional stability
- Non-corrosive

Health and Safety Information
Material Safety Data Sheets (MSDS) for products of Solvay Advanced Polymers are available upon request from your sales representative or by e-mailing us at advancedpolymers@solvay.com. Always consult the appropriate MSDS before using any of our products.

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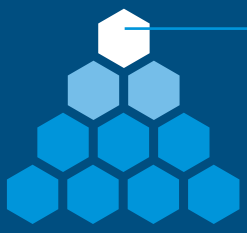

Spire™ Ultra Polymers

KetaSpire™ polyetheretherketone (PEEK)
AvaSpire™ modified PEEK
PrimoSpire™ self-reinforced polyphenylene
EpiSpire™ high-temperature sulfone
Torlon® polyamide-imide

www.solvayadvancedpolymers.com

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