



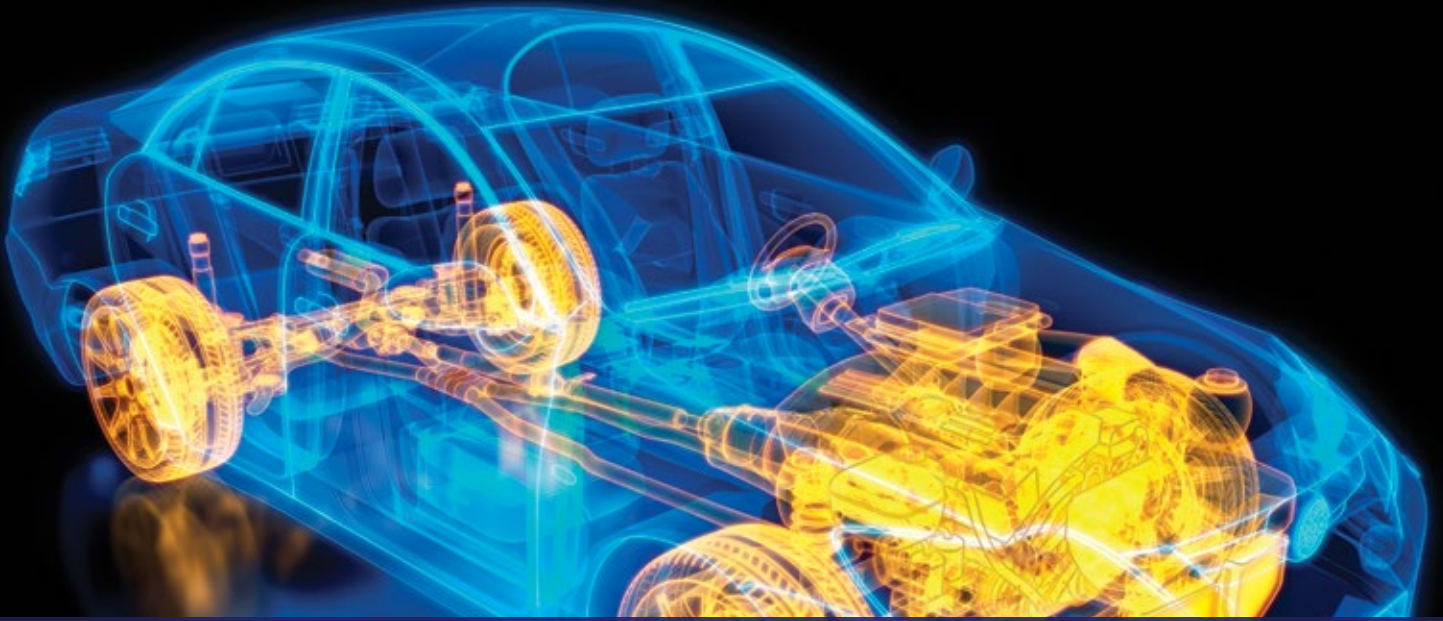
**SOLVAY**

asking more from chemistry®



High-Performance Plastics for  
**Drivetrain Systems**

**SPECIALTY  
POLYMERS**



# Designed for Higher Performance

## Better than Metal

- Light weight for improved fuel efficiency
- Parts consolidation for lower manufacturing and assembly costs
- Noise and vibration dampening
- Compatible with transmission fluids
- Abrasion and corrosion resistance
- High-temperature wear resistance in dry and lubricated environments

## More Transmission Designs

- Dual clutch (DCT)
- Automated manual (AMT)
- Continuously variable (CVT)
- Automatic
- Front wheel drive
- Rear wheel drive
- All wheel drive
- High torque



Smaller, more complex transmissions must deliver higher performance and better fuel economy, yet cost less to manufacture. Solvay's broad selection of high and ultra-high performance plastics can help you meet these challenges.



**Torlon® PAI**  
polyamide-imide

Torlon® PAI provides exceptional wear resistance in both dry and lubricated environments and retains its toughness, high strength and high stiffness up to 275 °C (525 °F). It exhibits outstanding creep and chemical resistance – including strong acids and most organics – and is ideally suited for harsh environments.

**KetaSpire® PEEK**  
polyetheretherketone

KetaSpire® PEEK combines exceptional strength, stiffness, chemical resistance and fatigue resistance with continuous-use up to 240 °C (464 °F), enabling it to replace metal in some of the most severe end-use environments.

**AvaSpire® PAEK**  
polyaryletherketone

AvaSpire® PAEK is a versatile family of polymers that are tailored to provide new and unique combinations of performance and value. Products in the AV-700 Series offers comparable performance to PEEK at up to 30% lower cost.

**Amodel® PPA**  
polyphthalamide

Amodel® PPA is stronger, stiffer and has higher thermal capabilities than standard nylons. It is less sensitive to moisture and retains excellent mechanical properties – including fatigue and creep resistance – when exposed to a wide range of operating temperatures, high humidity and aggressive chemicals.



### Seal Rings

- Excellent sealing and conformability
- High ductility for easier installation of small rings
- Molded-in joint geometries provide cost savings
- Excellent wear properties in dry and lubricated environments



### Thrust Washers, Thrust Bearings, Needle Bearing Replacements

- Low creep
- High compressive strength
- Low coefficient of friction
- Excellent wear properties in dry and lubricated environments
- Suitable for very high pressures and velocities
- Molded-in oil grooves eliminate secondary machining costs



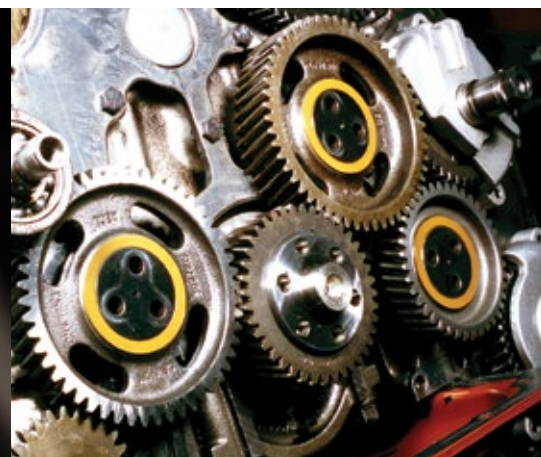
### Check Balls

- Excellent sealing and conformability
- High compressive strength
- Low creep
- Lighter than metal for quicker response
- Non-destructive to metal seat
- Noise reduction



## Wear-Resistant Grades for Drivetrain Systems

		Dry	Lubricated	Seal Rings	Thrust Washers	Check Balls
<b>Torlon® PAI</b>						
4203L	Unfilled, high elongation		√	√ <i>Small rings, high elongation</i>	√ <i>High lubrication</i>	√ <i>Compressive properties</i>
4301	High compressive strength	√	√	√	√	
4275	Designed for high speeds	√	√	√ <i>Best balance</i>	√	
4630	Excellent wear resistance	√ <i>Best performance at high velocity low pressure</i>	√	√	√	
4645	Excellent wear resistance		√ <i>Best performance at high velocity low pressure</i>	√	√	
<b>KetaSpire® PEEK</b>						
KT-820 SL30	Very good wear resistance	√	√	√	√	
KT-820 SL45	Very good wear resistance		√	√	√	
<b>AvaSpire® PAEK</b>						
AV-755 SL45	Very good wear resistance, more cost effective than PEEK		√	√	√ <i>Large rings</i>	
<b>Amodel® PPA</b>						
AT-6130 HS	Good wear resistance, most cost effective		√		√	



## Typical Properties

Property <sup>(1)</sup>	Units	Torlon® 4203L	Torlon® 4301 G/PTFE <sup>(2)</sup>	Torlon® 4275 G/PTFE	Torlon® 4630 G/PTFE	Torlon® 4645 CF/PTFE	ASTM Test Method
Tensile strength	MPa	152	113	117	81	114	D638
	ksi	22.0	16.4	16.9	11.8	16.6	
Tensile modulus	GPa	4.5	6.8	8.8	7.4	18.6	D638
	ksi	4,000	990	1,280	1,080	2,700	
Tensile elongation	%	7.6	3.3	2.6	1.9	0.8	
Flexural strength	MPa	241	215	208	131	154	D790
	ksi	34.9	31.2	30.2	19.0	22.4	
Flexural modulus	GPa	5.0	6.9	7.3	6.8	12.4	D790
	ksi	730	1,000	1,060	990	1,800	
Compressive strength	MPa	221	166	123	99	157	D695
	ksi	32.1	24.1	17.8	14.4	22.8	
Shear strength	MPa	128	111	77		85	D732
	ksi	18.5	16.1	11.1		12.4	
Izod impact strength, notched	J/m	144	64	85	48	37	D256
	ft-lb/in	2.7	1.2	1.6	0.9	0.7	
Izod impact strength, unnotched	J/m	1070	430	270	160	110	D4812
	ft-lb/in	20	8	5	3	2	
CLTE <sup>(3)</sup>	ppm/°C	31	25	25	16	5	D696
	ppm/°F	17	14	14	9	3	
Heat deflection temperature	°C	278	279	280	280	281	D648
	°F	532	534	536	535	538	
Specific gravity		1.42	1.46	1.51	1.56	1.57	D792
Water absorption, 24 hours	%	0.33	0.28	0.33	0.18	0.25	D570
Coefficient of friction, dry 50 fpm and 500 psi (0.254 m/s and 3447 kPa)			0.30	0.30	0.31		D3702
			0.39	0.29	0.31		
Wear factor, dry 0.254 m/s and 3447 kPa (50 fpm and 500 psi)	10 <sup>-8</sup> m <sup>3</sup> /Nm	<sup>(4)</sup> NR	27	26	12	NR	D3702
	10 <sup>-10</sup> in. <sup>3</sup> min/ft-lb-hr	NR	14	13	6	NR	
Wear factor, dry 4.064 m/s and 215 kPa (800 fpm and 31.25 psi)	10 <sup>-8</sup> mm <sup>3</sup> /Nm	NR	34	36	27	NR	D3702
	10 <sup>-10</sup> in. <sup>3</sup> min/ft-lb-hr	NR	17	18	14	NR	
Wear factor, lubricated <sup>(5)</sup>	10 <sup>-8</sup> mm <sup>3</sup> /Nm	55	18	14.1	22	3.2	D3702
	10 <sup>-10</sup> in. <sup>3</sup> min/ft-lb-hr	27	9	7.0	11	1.6	

<sup>(1)</sup> Actual properties of individual batches will vary within specification limits.

<sup>(2)</sup> Abbreviations for additives: G=graphite, CF=carbon fiber, GF=glass fiber

<sup>(3)</sup> Coefficient of Linear Thermal Expansion reported as average for flow direction from 0 °C–150 °C

<sup>(4)</sup> NR=Not Recommended

<sup>(5)</sup> In automotive transmission fluid at 150 °C, 75 fpm and 1000 psi (0.38 m/s and 6896 kPa)

## Typical Properties

Property <sup>(1)</sup>	Units	KetaSpire® KT-820 SL30 CF/G/PTFE <sup>(2)</sup>	KetaSpire® KT-820 SL45 CF/PTFE	AvaSpire® AV-755 SL 45 CF/G	Amodel® AT-6130 HS GF	ASTM Test Method	
Tensile strength	MPa	133	161	169	167	D638	
	ksi	19.3	23.4	24.5	24.2		
Tensile modulus	GPa	11.0	18.3	33.6	8.6	D638	
	ksi	1,590	2,660	4,870	1,250		
Tensile elongation	%	2.8	1.5	0.9	3.2		
Flexural strength	MPa	221	265	250	236	D790	
	ksi	32.0	38.5	36.2	34.2		
Flexural modulus	GPa	10.5	16.6	25.9	7.9	D790	
	ksi	1,530	2,410	3,760	1,140		
Compressive strength	MPa	105	132	97	114	D695	
	ksi	15.3	19.2	14.1	16.5		
Shear strength	MPa	67	79	70	65	D732	
	ksi	9.7	11.5	10.1	9.4		
Izod impact strength, notched	J/m	69	69	37	133	D256	
	ft-lb/in	1.3	1.3	0.7	2.5		
Izod impact strength, unnotched	J/m	530	530	320	1,390	D4812	
	ft-lb/in	10	10	6	26		
CLTE <sup>(3)</sup>	ppm/°C	22	16	7	24	D696	
	ppm/°F	12	9	4	13		
Heat deflection temperature	°C	291	299	278	276	D648	
	°F	556	571	532	529		
Specific gravity		1.45	1.5	1.53	1.34	D792	
Water absorption, 24 hours	%	0.14	0.03	0.01	0.24	D570	
Coefficient of friction, dry	50 fpm and 500 psi (0.254 m/s and 3447 kPa)	0.27		0.23		D3702	
	800 fpm and 31.25 psi (4.064 m/s and 215 kPa)	0.33		0.34	0.29		
Wear factor, dry	0.254 m/s and 3447 kPa (50 fpm and 500 psi)	$10^{-8}$ m <sup>3</sup> /Nm	151	<sup>(4)</sup> NR	NR	NR	D3702
		$10^{-10}$ in. <sup>3</sup> min/ft-lb-hr	75	NR	NR		
	4.064 m/s and 215 kPa (800 fpm and 31.25 psi)	$10^{-8}$ mm <sup>3</sup> /Nm	63	NR	NR	424	D3702
		$10^{-10}$ in. <sup>3</sup> min/ft-lb-hr	32	NR	NR	211	
Wear factor, lubricated <sup>(5)</sup>	$10^{-8}$ mm <sup>3</sup> /Nm	11	5.8	5.4	15.8	D3702	
		$10^{-10}$ in. <sup>3</sup> min/ft-lb-hr	5.5	2.9	2.7		8

<sup>(1)</sup> Actual properties of individual batches will vary within specification limits.

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