victrex®

HIGH PERFORMANCE PEEK™ POLYMERS

INTRODUCING

VICTREX T-Series Polymers

Combining the best of VICTREX® PEEK™ polymer and Celazole® PBI

With one of the best overall property profiles of any high performance material, VICTREX T-Series polymers are the unique solution for applications requiring superior high temperature resistance, unparalleled compressive strength, excellent tensile and flexural strength and low fatigue properties — all with the cost-effectiveness of a melt processable polymer.

VICTREX T-Series Products

Product	Description/Application
VICTREX TU-60	Unreinforced — for high performance.
VICTREX TF-60V	Glass fiber reinforced — for high strength, insulation, and heat resistance.
VICTREX TL-60	Self-lubricating — for tribological applications.
VICTREX TF-60C	Carbon-filled, high strength, high modulus, and low creep.

For Enhanced Performance at Elevated Temperatures

VICTREX T-Series Polymers:
A competitive advantage vs. PAI and PI wear grades

KEY FEATURES

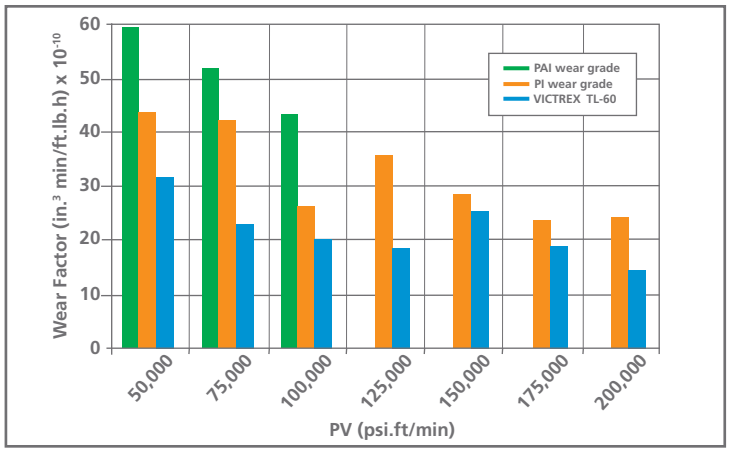
High Temperature Resistance
VICTREX T-Series polymers are the most thermally stable thermoplastics on the market, offering excellent mechanical performance at high temperatures up to 300°C (572°F). This semi-crystalline material retains mechanical properties well above the polymer's glass transition temperature. VICTREX T-Series polymers are currently the highest performing melt processable thermoplastics for use in applications requiring physical property retention and wear resistance at elevated temperatures. They are a great replacement option for metals and non-melt processable high temperature plastics (i.e., polyimides).

Excellent Tribology
VICTREX T-Series polymers are inherently lubricious with a very smooth surface finish. They are low sloughing and offer exceptional abrasion resistance.

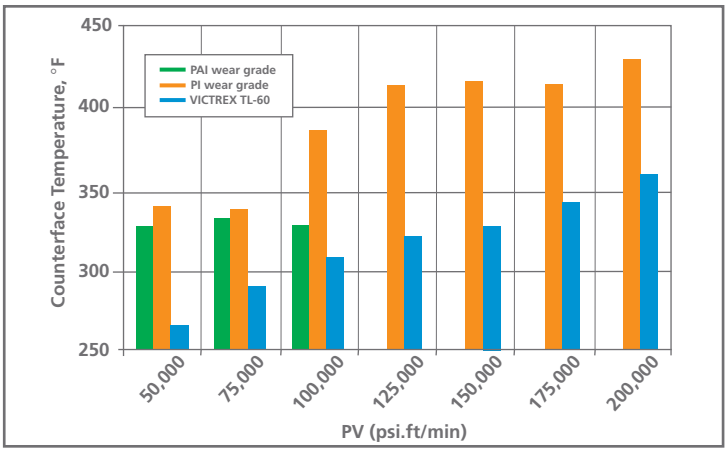
Environmental Resistance Ratings
In high temperature exposure to organic chemicals, molded parts made with VICTREX T-Series polymers offer outstanding chemical resistance and property retention, even after extended exposures. They have excellent resistance to a range of extreme environments that degrade most plastics.

Wear Properties Comparison

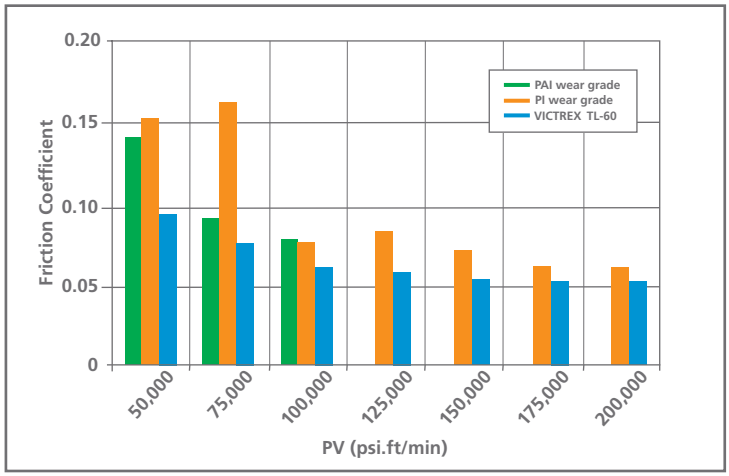
VICTREX TL-60 runs with the lowest Wear Factor (average over 50 ft/min-800 ft/min)



VICTREX TL-60 runs with the lowest Counterface Temperatures (average over 50 ft/min-800 ft/min)



VICTREX TL-60 runs with the lowest Friction Coefficient (average over 50 ft/min-800 ft/min)



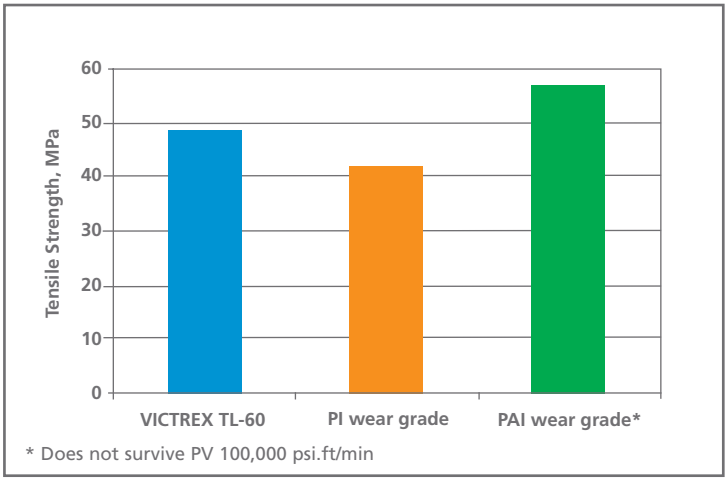
VICTREX T-Series Wear Advantages

Overall, VICTREX T-Series polymers outperformed PAI and PI wear grades in the areas of wear-resistance.

- 20% Lower coefficient of friction
- 70°F lower surface temperature generation
- The PAI wear grade did not survive past 100,000psi.ft/min PV
- The PI wear grade did not survive past the 75,000 psi.ft/min PV condition at 50ft/min
- The VICTREX TL-60 was the only material to survive to 200,000 psi.ft/min PV condition at 50 ft/min

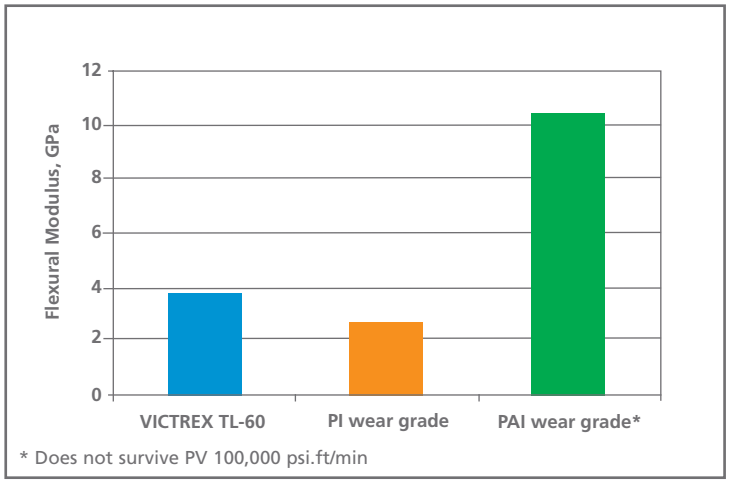
Superior Balance of Mechanical and Tribological Properties at Elevated Temperatures

VICTREX TL-60 Tensile Strength at 225°C (437°F)



* Does not survive PV 100,000 psi.ft/min

VICTREX TL-60 Flexural Modulus at 225°C (437°F)



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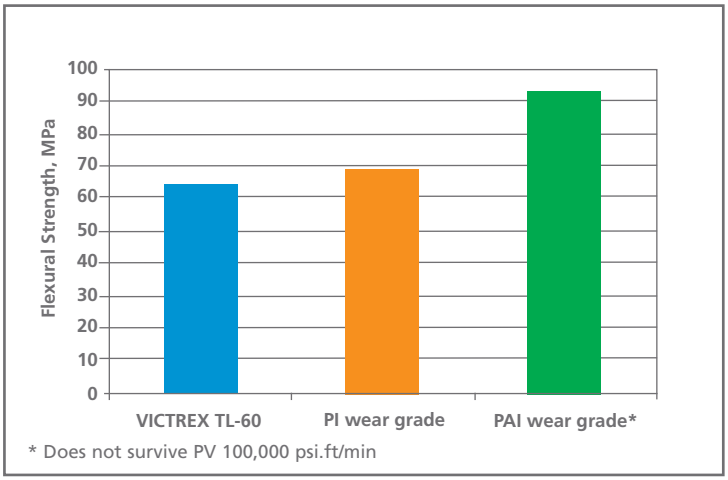
VICTREX TL-60 Flexural Strength at 225°C (437°F)



* Does not survive PV 100,000 psi.ft/min

VICTREX T-Series Advantages

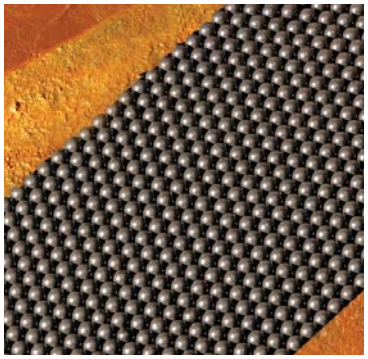
- Excellent molded mechanical properties at high temperature
- Melt processable thermoplastic (not a thermoset)
- No post treatment necessary
- System cost advantages
- Regrind utilization
- Use as molded
- Excellent tribological performance

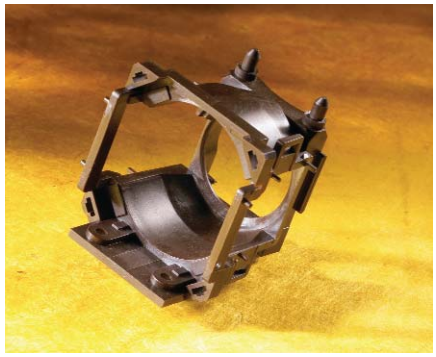
PROPERTIES OF VICTREX T-SERIES POLYMERS

PROPERTIES	TEST METHOD	TEST CONDITION	VICTREX TU-60	VICTREX TF-60V	VICTREX TL-60	VICTREX TF-60C
Tensile Modulus	ISO 527	23°C (73°F)	4.9 MPa (710 ksi)	14 GPa (2000 ksi)	16 GPa (2300 ksi)	24 GPa (3500 ksi)
Tensile Strength	ISO 527	23°C (73°F)	100 MPa (14 ksi)	180 MPa (26 ksi)	110 MPa (16 ksi)	240 MPa (35 ksi)
Tensile Elongation	ISO 527	23°C (73°F)	2.2%	1.6%	1.1%	1.5%
Notched Izod Impact Strength	ISO 180	23°C (73°F)	4.0 kJ/m² (1.9 ft-lb/in²)	5.0 kJ/m² (2.4 ft-lb/in²)	3.5 kJ/m² (1.7 ft-lb/in²)	5.0 kJ/m² (2.4 ft-lb/in²)
Unnotched Izod Impact Strength	ISO 180	23°C (73°F)	25 kJ/m² (12 ft-lb/in²)	25 kJ/m² (12 ft-lb/in²)	14 kJ/m² (7 ft-lb/in²)	25 kJ/m² (12 ft-lb/in²)
Flexural Modulus	ISO 178	23°C (73°F)	4.9 MPa (710 ksi)	14 GPa (2000 ksi)	14 GPa (2000 ksi)	22 GPa (3200 ksi)
Flexural Strength	ISO 178	23°C (73°F)	180 MPa (26 ksi)	270 MPa (40 ksi)	160 MPa (23 ksi)	350 MPa (50 ksi)
Specific Gravity	ISO 1183	23°C (73°F)	1.30	1.51	1.43	1.41
Water Absorption at Saturation	ISO 62	23°C (73°F)	6.5%	4.6%	3.8%	3.8%

VICTREX T-Series Polymers — Typical Applications





The vast range of properties found in VICTREX T-Series polymers provide design flexibility, optimum processability, longer part life, lower operating costs, and exceptional mechanical and chemical performance at high temperatures. The material is a great fit for a variety of market applications.

- Plasmas torches
- Conveyor belting, tilt pad bearings
- Glass handling
- Pumps
- Turbines
- Compressors
- Seals
- Seats
- Thrust washers
- Bushings
- Bearing cages
- Balls
- Electrical insulators
- Soldering tools
- Wafer transportation and chamber parts in spin coating, etching, PVD
- Lifting pins, screws, bushings
- Cassettes
- End-Effector pads
- Lamp holders

VICTREX T-Series Polymers for Composites

In addition to the standard VICTREX T-Series grades for injection molding or extrusion, VICTREX T-Series polymers can be used as a matrix for thermoplastic composite prepegs made of carbon, glass or aramid continuous fibers. Its outstanding high temperature properties and chemical resistance make it a great replacement for metals and thermoset applications.


VICTREX T-Series Polymers — Processing

VICTREX T-Series Injection Molding Recommendations

Set-up	Recommendation			
Equipment Requirement				
Machine Temperature Capability	450°C (840°F)			
Cylinder & Screw	Abrasion Resistant; HRC hardness 56-60			
Injection Pressure	200-250 MPa (29 – 36 kpsi)			
Injection Speed	High speed; up to 400 cm/sec			
Temperature Control	Cartridge heater for molds			
Temperature Profile	**TU-60**	**TF-60C**	**TF-60V**	**TL-60**
Cylinder Nozzle	435°C (815°F)	450°C (840°F)	450°C (840°F)	450°C (840°F)
Cylinder Front	430°C (805°F)	445°C (835°F)	445°C (835°F)	445°C (835°F)
Cylinder Middle	425°C (795°F)	440°C (825°F)	440°C (825°F)	440°C (825°F)
Cylinder End	420°C (790°F)	435°C (815°F)	435°C (815°F)	435°C (815°F)
Mold	200°C (390°F)	210°C (410°F)	210°C (410°F)	210°C (410°F)
Injection Speed				
Typical	200 cm^3/sec or less			
Thin parts (0.4-0.5 mm)	400 cm^3/sec			
Mold Requirements				
Mold Surface	Cr Steel; HRC hardness 50-60			
Sprue	Taper 2-5 degrees; mirrored face			
Pellet Storage/ Drying				
Storage	Keep dry; use soon after opening			
Dry before use	6hr @ 210°C (410°F); -40°C dew point			

VICTREX T-Series Machining Guidelines

Recommended Feed and Speed Rates

Grinding	
Function	**Rough**
Table Surface Speed	80 ft/min (24 m/min)
Traverse Feed	.060" (1.5 mm)
Down Feed	.100" to .015" (2.5 to 0.38 mm)
Wheel Surface Speed	3000 to 4000 ft/min (910 to 1,200 m/min)
Function	**Finish**
Table Surface Speed	30 ft/min. (9.1 m/min)
Traverse Feed	.005" to .050" (0.13 to 1.27 mm)
Down Feed	.001" to .0002" (0.025 to 0.005 mm)
Wheel Surface Speed	3000 to 4000 ft./min. (910 to 1,200 m/min)

Milling		
Operation Feed	**(in/min)**	**(mm/min)**
Roughing	12 to 18	300 to 450
Finishing	5 to 10	130 to 255
Depth of Cut		
Roughing	up to .250 in. (6.4 mm)	
Finishing	.005 in. to .030 in. (0.13 mm to 0.76 mm)	

Turning		
Operation	**Crossfeed**	
	(in/rev)	**(mm/rev)**
Rough Turning	.006-.012	0.15-0.31
	.001-.005	0.03-0.13
Rough Boring	.006-.012	0.15-0.31
Finish Boring	.001-.005	0.03-0.13
Rough Facing	.006-.012	0.15-0.31
Finish Facing	.001-.005	0.03-0.13
Parting	.003-.006	0.08-0.15
Depth of Cut		
	(in/rev)	**(mm/rev)**
Rough	.050-.150	1.3-3.8
Finish	0.10-0.30	0.25-0.76
Surface Speed		
700 to 1000 ft/min		
215 to 305 m/min		

Recommended Tooling: Carbide or Diamond.

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X World Headquarters
● Subsidiaries
■ Distributors
▲ Representatives

World Headquarters
Victrex plc
Hillhouse International
Thornton Cleveleys
Lancashire FY5 4QD
United Kingdom
Tel: +44 (0) 1253 897700
Fax: +44 (0) 1253 897701
Email: victrexplc@victrex.com

Americas
Victrex USA, Inc.
300 Conshohocken State Road
Suite 120
West Conshohocken, PA 19428
USA
Tel: + (1) 800 VICTREX
Tel: + (1) 484-342-6001
Fax: + (1) 484-342-6002
Email: americas@victrex.com

Europe
Victrex Europa GmbH
Hauptstr. 11
65719 Hofheim/Ts.
Germany
Tel: + (49) 6192 96490
Fax: + (49) 6192 964948
Email: eurosales@victrex.com

Asia Pacific
Victrex Japan Inc.
Hanai Building 6F
1-2-9 Shiba-Kouen
Minato-ku
Tokyo 105-0011
Japan
Tel: +(81) 35777 8737
Fax: +(81) 35777 8738
Email: japansales@victrex.com