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VICTREX® WG™ Polymers – Premium Wear Grades

A NEW RANGE OF THERMOPLASTIC COMPOUNDS WITH LOWER COEFFICIENT OF FRICTION AND LOWER WEAR RATE FOR DEMANDING APPLICATIONS

Victrex Polymer Solutions, a division of Victrex plc, has developed a range of new grades over the past few years in response to requests from design engineers and OEMs for increased durability to meet the requirements of more demanding applications in the automotive and industrial equipment industries.

Continuing this tradition, Victrex is introducing VICTREX® WG™ polymers. These premium wear grades offer excellent wear rates and a reduced and very stable coefficient of friction to meet customer requirements for wear at higher speed and load application performance.

The aim of Victrex Polymer Solutions when developing VICTREX WG polymers was to obtain improved wear resistance and reduced coefficient of friction compared to metals, polyimide (PI) and polyamide-imide (PAI). Ease of processing to facilitate the use of standard thermoplastic processing technologies was also considered to improve efficiency of production and reduce overall manufacturing costs. These new tribological compounds, VICTREX WG101 and WG102, meet the requirements of mechanical load



Thrust washer



Sealing element

and tribological performance in challenging thermal and chemical environments combined with the ability to meet the need for economical processing and low density. While VICTREX® PEEK 450FC30 will remain the standard product for the majority of wear application developments, VICTREX WG polymers provide a solution for more demanding wear applications and environments. VICTREX WG101 and WG102 extend the fit of VICTREX PEEK polymer to new application areas, ranging from full plastic wear bushings to composite bushings and vane tips in vacuum pumps formerly reserved for metals and other polymers such as PI and PAI.

KEY PROPERTIES

- ▲ High temperature performance, good dimensional and thermal stability up to and beyond 300°C (572°F)
- ▲ High compressive strength, mechanical properties maintained at high temperature
- ▲ Wear resistance, lowest coefficient of friction in the Victrex product portfolio
- ▲ Similar density to other Victrex wear grades offers low moment of inertia
- ▲ Comparable melt flow to other Victrex wear grades
- ▲ Good chemical and hydrolysis resistance

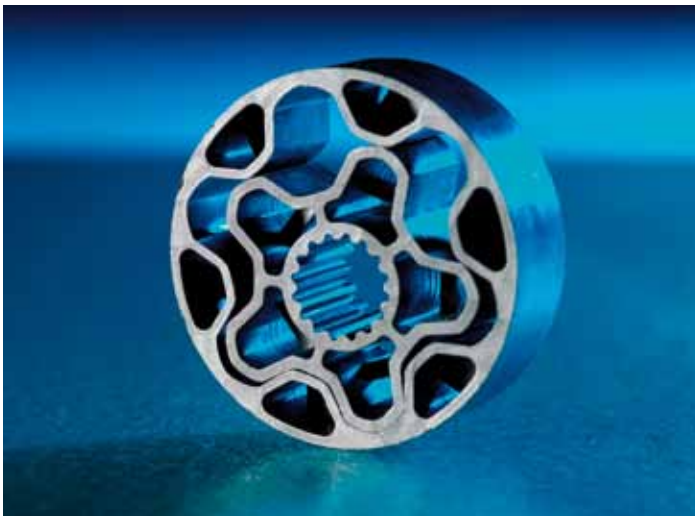
For Extended Service Life, Lower Component Weight and Lower Costs

BENEFITS FOR WEAR APPLICATIONS

- ▲ Extended service life, improved reliability, reduced failure rate
 - 25-75% lower wear rate
- ▲ Parts run cooler and last longer, lower abrasion to mating surfaces, less wear debris
 - 50% lower coefficient of friction, less drag and frictional heating
 - 50°C (122°F) lower temperature
- ▲ Potential for redesign to reduce weight, improved energy efficiency
 - Higher stiffness at elevated temperatures allows same performance at lower thickness
 - Metal replacement
 - Lower density, lower weight per component
- ▲ Significantly lower manufacturing costs and shorter manufacturing times in comparison with PI and PAI wear grades and PEEK/PBI blend
 - Melt processable with industry standard injection moulding and finishing techniques
- ▲ Fully recyclable
 - PTFE-free
- ▲ Superior performance under hot/wet conditions
- ▲ Materials are compatible with a wide range of service environments
 - Good compatibility with service fluids and other critical lubricants
- ▲ RoHS and GADSL compliant
- ▲ WG101 is FDA compliant

TYPICAL APPLICATIONS

- ▲ Bushings
- ▲ Thrust washers
- ▲ Bearing cages
- ▲ Seals and gaskets
- ▲ Bearing retainers
- ▲ Brake elements
- ▲ Vane tips in vacuum pumps
- ▲ Seal rings
- ▲ Gerotors
- ▲ Gears
- ▲ Transmission components
- ▲ Clutch components



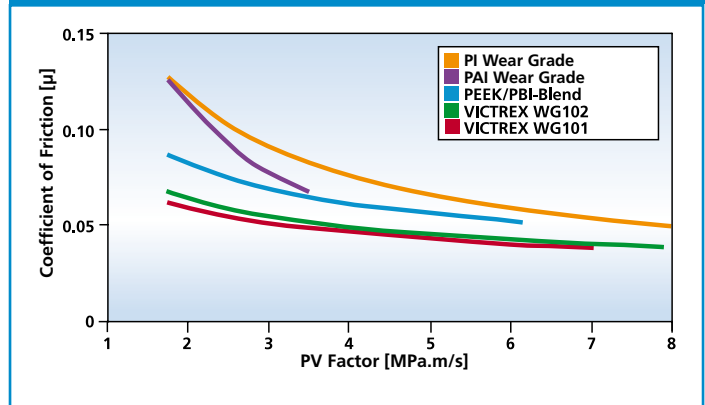
Gerotor pump wheel

One advantage of Victrex polymer-based thrust washers, wear bushings and seal rings is the excellent melt flow allowing thin walled intricate component design. This allows manufacture of smaller components and therefore more efficient heat transfer through the plastic component into the metal counterface or to the lubricant.

In common with other Victrex products, VICTREX WG polymer does not require the mandatory post annealing necessary for PAI; except for conditions where a heat setting operation is desired for calibration purposes, thereby saving time and lowering cost of production.

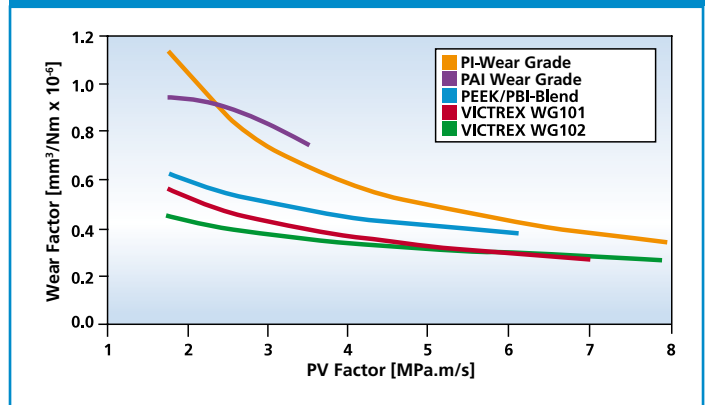
The new VICTREX WG101 and WG102 grades run with lower coefficient of friction over a range of pressure and velocity conditions, than PEEK/PBI blend, PI and PAI wear grades (Figure 1).

FIGURE 1: Coefficient of Friction D3702 Thrust Washer Testing, 1m/s Test Speed



Within tribological systems the coefficient of friction varies depending on the choice of counterface material and its surface roughness, as well as with the specific conditions of speed and pressure.

FIGURE 2: Wear Factor D3702 Thrust Washer Testing, 1m/s Test Speed



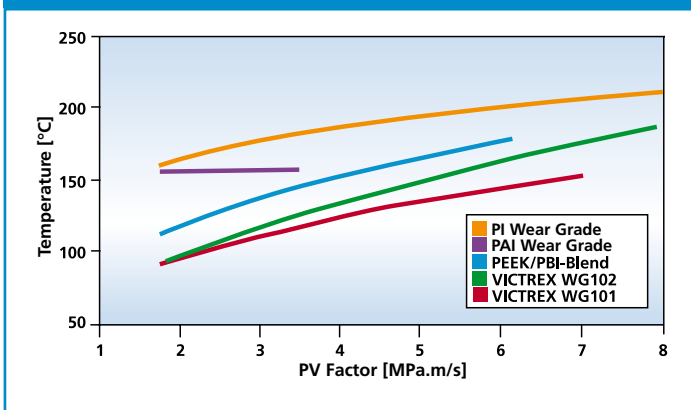


Friction rings

The wear factor shown in Figure 2 is another important consideration in design; it determines the lifetime of a tribological system.

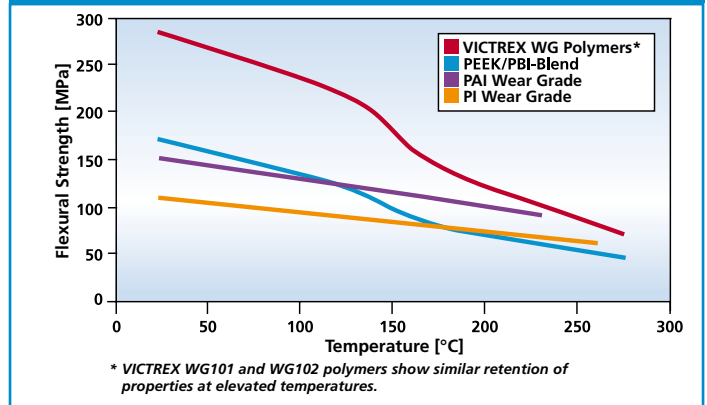
As illustrated in the thrust washer testing, VICTREX WG101 and WG102 generate significantly less heat in wear testing than PEEK/PBI blend, PI and PAI wear grades. Lower counterface temperatures will reduce the wear rate and improve mechanical performance of components made from VICTREX WG polymers (Figure 3).

FIGURE 3: Counterface Temperature D3702 Thrust Washer Testing, 1m/s Test Speed



Next to coefficient of friction and specific wear rate there are further properties that impact durability of a product. Especially an excessive load, which would typically be a compressive load in wear applications, can lead to polymer creep (Figure 5) resulting in dimensional changes. As shown in Figure 4, when compared to PEEK/PBI blend, PI and PAI wear grades, VICTREX WG polymers have higher retention of mechanical properties at elevated temperatures. A component in VICTREX WG101 or WG102 may therefore be designed for significantly higher loads compared to the same component in the other materials.

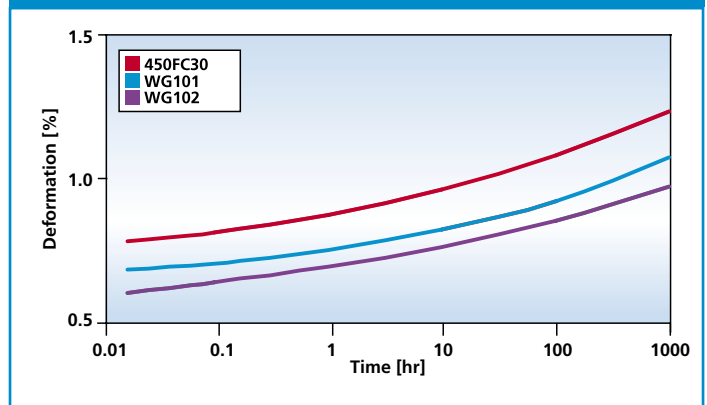
FIGURE 4: Flexural Strength at Elevated Temperatures



* VICTREX WG101 and WG102 polymers show similar retention of properties at elevated temperatures.

VICTREX WG polymers provide higher reliability, longer life and reduced risk of failures for components operating in extreme environments. This increases the operating range of machines at higher speeds and pressures.

FIGURE 5: Compressive Creep at 120°C/50MPa



SUMMARY

Victrex Polymer Solutions offers the new VICTREX WG wear grades to increase the lifetime and performance of customer applications. These new tribological compounds offer improved performance combined with low density and are processable with standard injection moulding. The improved performance at higher temperatures, speeds, pressures and wear conditions extends the range for Victrex polymers to applications formerly limited to metals and other products like PI and PAI. All VICTREX WG polymers are RoHS compliant and meet GADSL requirements. For use in the food industry WG101 is conform with the FDA regulations. VICTREX WG polymers meet customer requirements of the future while offering the ability to be processed with the same processing technologies and temperatures as other Victrex polymers. Apart from injection moulding there are options for stock shape extrusion applications.

For more detailed information please contact your local Victrex Polymer Solutions representative or download data sheets from www.victrex.com.

www.victrex.com



Victrex Polymer Solutions, a division of Victrex plc, is the world's leading manufacturer of Polyaryletherketones, high performance polymers, which are sold under the brand names VICTREX® PEEK polymers, VICOTE® coatings, APTIV® films, and VICTREX Pipes™. With production facilities in the UK backed by sales and distribution centres serving more than 30 countries worldwide, our global market development, sales, and technical support services work hand-in-hand with OEMs, designers and processors offering assistance in the areas of processing, design and application development to help them achieve new levels of cost savings, quality, and performance.

PROPERTIES

Property	Conditions	Test Method	Units	VICTREX® 450FC30	VICTREX® WG101	VICTREX® WG102
General						
Density	Crystalline	ISO 1183	gcm ⁻³	1.45	1.44	1.44
Water Absorption (3.2 mm thick tensile bar)	24h, 23°C	ISO 62-1	%	0.04	0.04	0.05
Mechanical						
Tensile Strength	Break, 23°C	ISO 527	MPa	140	180	190
	Break, 125°C			95	125	130
Compression Strength	23°C	ISO 604	MPa	170	225	245
	120°C			110	160	175
Tensile Elongation	Break, 23°C	ISO 527	%	2.2	1.9	2.0
Flexural Strength	23°C	ISO 178	MPa	230	280	380
Flexural Modulus	23°C	ISO 178	GPa	11.5	17	17
Izod Impact Strength	0.25 mm notch, 23°C	ISO 180/A	kJm ⁻²	6.0	5.5	6.0
	Unnotched, 23°C	ISO 180/U		35	35	35
Thermal						
Melting Point		ISO 11357	°C	343	343	373
Glass Transition (Tg)		ISO 11357	°C	143	143	152
Specific Heat Capacity	23°C	DSC	kJkg ⁻¹ °C	1.8		
Coefficient of Thermal Expansion	Along flow below Tg	ISO 11359	ppm °C	15	9	9
	Average below Tg			45	35	35
	Along flow above Tg			20	10	10
	Average above Tg			115	90	90
Heat Deflection Temperature	1.8 MPa	ISO 75A-f	°C	315	343	367
Thermal Conductivity	23°C	ISO/CD 22007-4	Wm ⁻¹ °C ⁻¹	0.87	1.30	1.30

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