

# VICTREX WG™ Polymers

## Premium Wear Grades



### A range of PFAS-free thermoplastic compounds with lower coefficient of friction and lower wear rate for demanding applications

VICTREX WG™ polymers were developed for design engineers and OEMs seeking greater durability to meet the requirements for more demanding automotive and industrial equipment applications.

These premium wear grades provide excellent wear rates as well as a lower and more consistent coefficient of friction, when compared to metals, polyimide (PI), and polyamide-imide (PAI). This meets customer needs for wear at higher speeds and load application performance.

Ease of processing to allow for the use of conventional thermoplastic processing technologies enables a potential increase in production efficiency and lower overall manufacturing costs.

These tribological compounds, VICTREX WG 101 and VICTREX WG 102, meet the requirements of mechanical load and tribological performance in challenging thermal and chemical environments combined with the ability to meet the need for economical processing and low density.



*Seal ring made with VICTREX WG*

VICTREX WG 101 and WG 102 extend the fit of VICTREX PEEK polymer to new application areas, ranging from full plastic wear brushings to composite brushings and vane tips in vacuum pumps formerly reserved for metals and other polymer 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.

## BENEFITS FOR WEAR APPLICATIONS

- Extended service life, improved reliability, reduced failure rate.
- 25-74% 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 (112°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.
- VICTREX WG 101 is FDA compliant.

## TYPICAL APPLICATIONS



Gerotor pump wheel

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

An advantage of Victrex polymer-based thrust washers, wear brushing and seal rings and other friction components, 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 counter-face or to the lubricant.

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

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

VICTREX WG™101 and WG™102 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

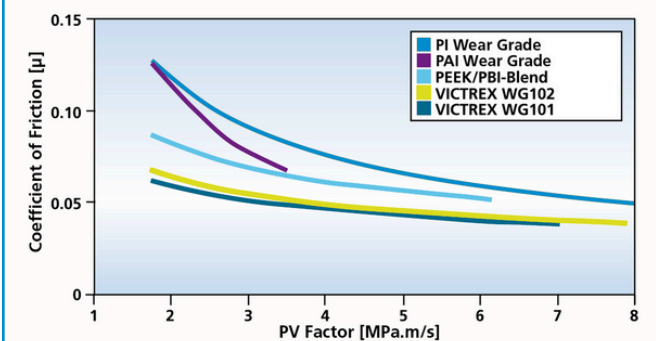
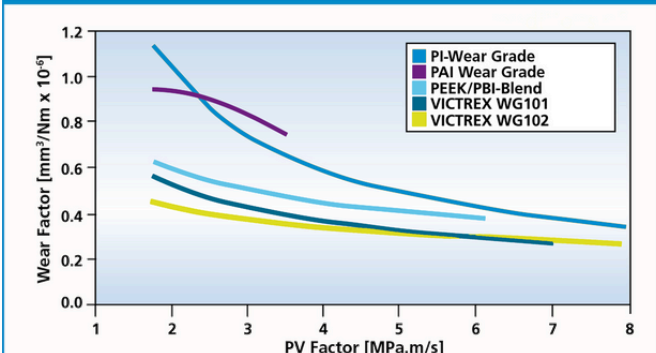


FIGURE 2: Wear Factor D3702 Thrust Washer Testing, 1m/s Test Speed



## THE WEAR FACTOR IN DETERMINING LIFETIME

Another critical design consideration is the wear factor, which is shown in Figure 2 and determines the lifetime of a tribological system.

As illustrated in the thrust washer testing, VICTREX WG 101 and WG 102 generate significantly less heat in wear testing than PEEK/PBI blend, PI and PAI wear grades. Lower counter-face temperatures will reduce the wear rate and improve the mechanical performance of components made from VICTREX WG polymers (Figure 3).

## DURABILITY UNDER EXCESSIVE LOAD

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.

Figure 4 shows that 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 WG 101 or WG 102 may therefore be designed for significantly higher loads compared to the same component in the other materials.

## REDUCED DOWNTIME, INCREASED COMPONENT LIFETIME

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.

## PREMIUM WEAR GRADES ENABLING EXTENDED SERVICE LIFE

VICTREX WG wear grades potentially increase the lifetime and performance of customer applications. These tribological compounds offer improved performance combined with low density. They also provide a high performance alternative to PTFE polymers.

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.

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

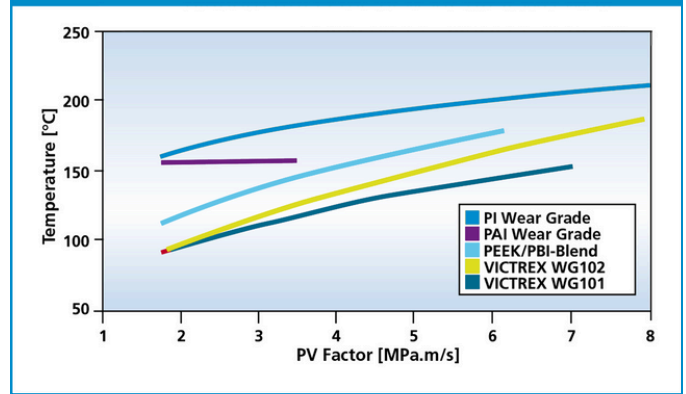


FIGURE 4: Flexural Strength at Elevated Temperatures

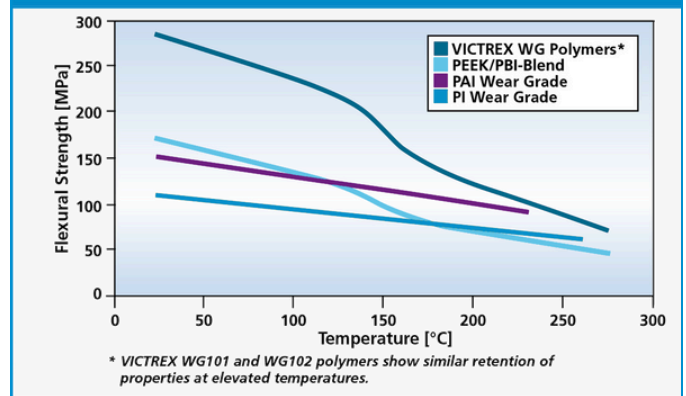
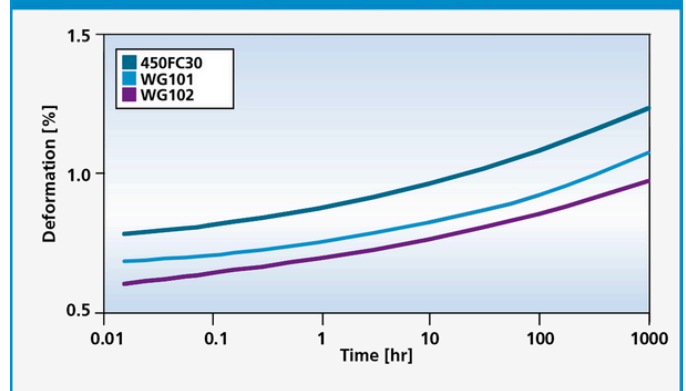


FIGURE 5: Compressive Creep at 120°C/50MPa



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 complex engineering requirements and can be processed with standard injection moulding, with the same processing technologies and temperatures as other Victrex polymers. There are also options for stock shape extrusion applications.

## Properties

	Conditions	Test Method	Units	VICTREX WG™ 101	VICTREX WG™ 102
<b>General</b>					
Density	Crystalline	ISO 1183	gcm <sup>-3</sup>	1.44	1.44
Water Absorption (3.2mm thick tensile bar)	24h, 23°C	ISO 62-1	%	0.04	0.05
<b>Mechanical</b>					
Tensile Strength	Break, 23°C	ISO 527	MPa	180	190
	Break, 125°C			125	130
Compression Strength	23°C	ISO 604	MPa	225	245
	120°C			160	175
Tensile Elongation	Break, 23°C	ISO 527	%	1.9	2.0
Flexural Elongation	23°C	ISO 178	MPa	280	290
Flexural Modulus	23°C	ISO 178	GPa	17	17
Izod Impact Strength	0.25mm notch, 23°C	ISO 180/A	kJm <sup>-2</sup>	5.5	6.0
	Unnotched, 23°C	ISO 180/U		35	35
<b>Thermal</b>					
Melting Point		ISO 11357	°C	343	373
Glass Transition (Tg)		ISO 11357	°C	143	152
Specific Heat Capacity	23°C	DSC	kJkg <sup>-1</sup> °C		
Coefficient of Thermal Expansion	Along flow below Tg	ISO 11359	ppm°C	9	9
	Average below Tg			35	35
	Average flow above Tg			10	10
	Average above Tg			90	90
Heat Deflection Temperature	1.8 MPa	ISO 75A-f	°C	343	367
Thermal Conductivity	23°C	ISO/CD 22007-4	Wm <sup>-1</sup> °C <sup>-1</sup>	1.30	1.30

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