



HIGH PERFORMANCE PEEK POLYMERS



Food and Beverage

Material of choice...

VICTREX® PEEK polymer is considered to be the highest performance, melt processable polymer on the market today. It conforms to FDA and EU requirements and is safe for repeated use in food contact applications. Because of its unique properties, VICTREX PEEK polymer has replaced stainless steel, acetal and nylon in many food processing applications due to its ability to eliminate the following problems:

- Frequent maintenance of components
- Metal contamination and flaking
- Deterioration due to steam and harsh chemicals
- Lubrication contamination
- Staining and visual inspection aesthetics

From highly wear-resistant bearings, bushings, seals and valves, to precision cutting blades and energy-efficient pumps, components made with VICTREX PEEK polymer keep machinery running at peak productivity levels.

VICTREX PEEK polymer can improve performance across a full range of food and beverage processing activities from milling, emulsifying, granulating, liquefying and pureeing to mixing, baking, frying, freezing, filling and packaging.

New in the Victrex Portfolio

In 2013 a glass fibre-reinforced thermoplastic “VICTREX PEEK 90GL30BLK EU” was introduced to meet the current requirements of both American and European regulatory authorities, including the EU Commission Regulation 10/2011 (Plastics Implementation Measure, PIM) which will be fully implemented by end 2015. VICTREX PEEK 90GL30BLK EU is a safe and durable alternative to materials such as metals or other plastics for direct food contact applications.

...for performance

VICTREX® PEEK Polymer Advantages

Available in filled, unfilled and fiber reinforced grades, FDA and EU-compliant VICTREX PEEK polymer is ideal for components that have repeated contact with food during processing. The polymer offers a unique combination of properties that can be tailored to specific application needs:

▲ Temperature Performance

VICTREX PEEK polymer exhibits outstanding property performance across a broad range of temperatures from -195°C (-319°F) to greater than 300°C (572°F). Ideal for the wide ranging temperatures found in food and beverage processing.

▲ Chemical and Steam Resistance

Insoluble in all common solvents, VICTREX PEEK polymer has excellent resistance to dilute acids, bases, salts and steam. It has substantially lower moisture absorption than nylons and other polymers.

▲ Wear Resistance Without Lubrication

VICTREX PEEK polymer offers excellent wear resistance coupled with a low coefficient of friction. Can outperform metals in many aggressive environments. In addition, its non-galling nature allows the polymer to be used in aggressive wear applications.

Widely recognized as having the best property profile of any semi-crystalline thermoplastic, VICTREX PEEK polymer is a unique solution for improved part performance and reduced system cost.



Pump Components

Food and beverage processing machinery parts featuring VICTREX® PEEK polymer, VICTREX® HT™, APTIV® film, and VICOTE® Coatings deliver superior performance, reliability, and increased productivity.

Typical Applications

VICTREX PEEK polymers offer a significant benefit to original equipment manufacturers who supply the food and beverage processing industry, by enabling the construction and reproducible mass production of complex, injection molded components that do not require further processing or machining.

In addition, VICTREX PEEK polymer has exceptional chemical and hydrolysis resistance, which allows the repeated use of various rinsing and cleaning agents, sterilization and steam cleaning, as well as the use of water softener, without affecting its mechanical properties.

Typical uses include:

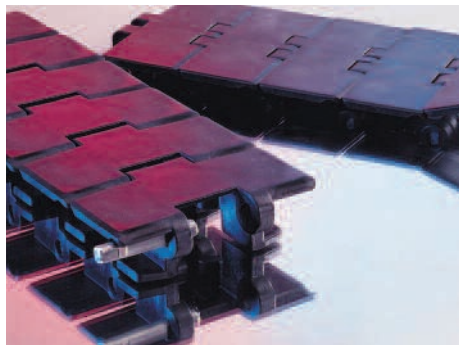
- ▲ Components for machines and equipment for food and beverage processing, e.g., ovens, freezers, fryers, mixers, ultrafiltration membranes, filling machines, etc.
- ▲ Production of food containers for heating or cooking in an oven, microwave or combi-oven.
- ▲ Injection molded parts such as bearings, seats and seals that are used in appliances and food processing equipment.
- ▲ Components for aseptic processing and packaging equipment.
- ▲ As a fiber or fabric, in filters, conveyor belts and as a replacement for metal bristles in food brushes.
- ▲ As a coating, predominantly for the coating of metal components in food-processing equipment, consumer and industrial cookware and bakeware.

Typical Applications



Cleaning Equipment

When Toftejorg A/A of Denmark, a leading manufacturer of industrial cleaning equipment, wanted a material for the helical gear wheels in their equipment's spray heads, they chose VICTREX PEEK polymer because of its superior chemical resistance and high mechanical strength. The cleaning equipment is used in a variety of demanding food and beverage environments due to the polymer's compliance with FDA and EU regulations for repeated food contact.



Conveyor Belt Chains

When Tokyo-based Yamakyu Chain Company was designing conveyor belt chains for high-speed beverage and food processing lines, they chose VICTREX PEEK polymer for its high temperature and superior chemical resistance properties. Traditionally, the industry has used intermesh, low friction transfer plates made from acetal. But acetal's operating temperature limit of 80°C (176°F) prohibits its use in high temperature environments.



Fabrics

Swiss-based Sefar Inc. produces VICTREX PEEK polymer-based fabrics to meet new food and beverage industry requirements for high operating temperatures. Current polyester fabrics often exhibit failure due to a combination of steam and temperature after six months. A major manufacturer of flour-based products increased its processing temperatures to speed production and improve efficiencies by using VICTREX PEEK and has gained longer service life as an added bonus.



Espresso Machines

VICTREX PEEK polymer replaced metal in both the boiler pin and steam faucet of a line of new super-automatic SAECO (Bologna, Italy) espresso coffee machines. Key material requirements included high-temperature performance, outstanding chemical resistance and very high mechanical properties. The superior performance of VICTREX PEEK polymer with steam, together with its chemical resistance at elevated temperatures, makes it ideal for food processing and catering applications.



Bushings

A custom food manufacturer was having trouble with acetal bushing in one of its extruders. The bushings were staining, wearing out too fast and deforming under the chemical and PV loads of the extruder shaft. The manufacturer replaced the bushings with VICTREX PEEK polymer-based Accrolon® 9000 bushings from Accro-Seal (Vicksburg, Michigan). Even though the cost of the new bushings was higher, the cost savings were substantial due to the longer operational life provided, resulting in a reduction of downtime spent replacing bushings.



Aseptic Packaging

Components for aseptic processing and packaging equipment must withstand the high operating temperatures that are required to kill bacteria. The high continuous operating temperature of VICTREX PEEK polymer, 260°C (500°F), and the excellent mechanical properties at this temperature, provide a tailor-made cost-effective material solution for this demanding application use.

Chemical Resistance

Table 1: Common Chemicals* Found in Food and Beverage Processing

CHEMICAL	23°C (73°F)	100°C (212°F)	200°C (392°F)	MISCELLANEOUS	23°C (73°F)	100°C (212°F)
Acetic Acid, 10% Conc.	A	A		Apple Juice	A	
Acetic Acid, Conc.	A	A	A	Beer	A	A
Acetic Acid, Glacial	A	A		Fatty Acids	A	A
Ammonium Chloride, 10% Conc.	A	A		Fruit Juice	A	A
Chlorine	C	C	C	Ketchup	A	
Citric Acid	A	A		Milk	A	A
Diethyl Phthalate	A			Mineral Oil	A	
Hydrochloric Acid, 10% Conc.	A	A		Molasses	A	A
Hydrochloric Acid, Conc.	A	B		Peanut Oil	A	A
Hydrocyanic Acid	A	A		Vinegar	A	A
Iodine	B			Wines and Spirits	A	
Lactic Acid	A	A		Yeast	A	A
Magnesium Chloride	A	A				
Magnesium Hydroxide	A					
Nitric Acid, 10% Conc.	A	A				
Nitric Acid, 30% Conc.	B					
Nitric Acid, 50% Conc.	C	C	C			
Nitric Acid, Conc.	C	C	C			
Phosphoric Acid, 10% Conc.	A	A	A			
Phosphoric Acid, 50% Conc.	A	A	A			
Phosphoric Acid, 80% Conc.	A	A				
Potassium Carbonate	A					
Potassium Hydroxide, 10% Conc.	A					
Potassium Hydroxide, 70% Conc.	A					
Sodium Hydroxide, 10% Conc.	A	A	A			
Sodium Hydroxide, 50% Conc.	A	A	A			
Sodium Hydroxide, Conc.	A					

Key

A —No attack. Little or no absorption.

B —Slight attack. Satisfactory use of VICTREX PEEK will depend on the application.

C —Severe attack. VICTREX PEEK should not be used for any application where these chemicals are present.

*For the complete list of all chemicals, contact Victrex and request the Chemical Resistance brochure.

Steam Resistance

VICTREX PEEK polymer and compounds are not chemically attacked by water or pressurized steam. These materials retain a high level of mechanical properties at elevated temperatures and high pressures in steam or water. The table below demonstrates the ability of components made from VICTREX PEEK polymer to continuously operate in, or be frequently sterilized by, steam. The initial increase in the mechanical properties is due to increases in the degree of crystallinity.

Table 2: A Comparison of the Mechanical Properties of VICTREX PEEK Materials After Conditioning in Steam at 200°C (392°F) and 1.4 MPa (200 psi)

Property	Standard	Control	Time/hours				
			75	350	1000	2000	2500
Tensile Strength/MPa (psi)	ISO 527						
VICTREX 450G		103 (14,900)	111 (16,100)	109 (15,800)	109 (15,800)	109 (15,800)	109 (15,800)
VICTREX 450GL30		182 (26,400)	133 (19,300)	126 (18,300)	122 (17,700)	125 (18,100)	121 (17,500)
Flexural Strength/MPa (psi)	ISO 178						
VICTREX 450G		165 (23,900)	188 (27,300)	192 (27,800)	185 (26,800)	196 (28,400)	181 (26,300)
VICTREX 450GL30		277 (40,200)	227 (32,900)	210 (30,500)	214 (31,000)	214 (31,000)	213 (30,900)
Flexural Modulus/GPa (psi)	ISO 178						
VICTREX 450G		4.1 (590,000)	4.4 (640,000)	4.4 (640,000)	4.2 (610,000)	4.4 (640,000)	4.0 (580,000)
VICTREX 450GL30		11.3 (1,640,000)	10.5 (1,520,000)	9.6 (1,390,000)	10.4 (1,510,000)	10.3 (1,490,000)	10.0 (1,450,000)

APTIV® Film

Victrax APTIV films offer a unique combination of properties, providing an unrivaled material solution for engineers and designers for use in high performance applications. It is among the most versatile and high performance thermoplastic film available. Produced from VICTREX PEEK polymer, APTIV film has all of the properties of VICTREX PEEK polymer in a flexible film format.

APTIV film is available in thicknesses from 5 to 750 microns and widths up to more than 1.4 meters. It can be subjected to a broad range of secondary process operations that include surface treating, metallization, coating, laminating and thermoforming, making it an extremely versatile substrate.



Key Features

- ▲ High heat resistance
- ▲ Excellent wear properties
- ▲ Low moisture absorption
- ▲ Broad chemical resistance
- ▲ High strength and toughness
- ▲ Excellent barrier properties
- ▲ FDA food contact and dairy 3A certified

VICTREX® HT™

VICTREX HT polymer is the unique high performance material developed for applications that demand higher temperature resistance than standard VICTREX PEEK polymer. With a glass transition temperature of 157°C (315°F) and a melting temperature of 374°C (705°F), VICTREX HT delivers extended high temperature performance, while offering all the key characteristics of VICTREX PEEK polymer, including toughness, strength and chemical resistance.

VICTREX HT offers manufacturers a premium material that can be a more cost-effective, lightweight alternative to metals. This advanced engineering material enables exceptional design freedom, high precision reproducibility and long-term product reliability.

Applications based on VICTREX HT not only pass the stringent high-temperature testing prevalent in the food industry, but also have the essential FDA food contact compliance.

For more demanding applications, VICTREX HT offers a number of advantages:

Key Features

- ▲ Superior high temperature performance
 - Retention of mechanical and physical properties to temperatures 30°C (54°F) higher than standard VICTREX PEEK polymer
 - Up to 3 times the wear resistance of standard VICTREX PEEK polymer at high temperatures
 - Excellent long-term creep and fatigue resistance over a wide temperature range
 - Substantially higher tensile strength and flexural modulus at 250°C (482°F)
- ▲ Improved compressive strength
- ▲ Exceptional resistance to chemicals, solvents and fuels
- ▲ Inherent low flammability, low smoke emission
- ▲ Good electrical properties
- ▲ Outstanding hydrolysis resistance
- ▲ Consistent ease of processing

Table 3: Approvals for Food and Beverage Applications

21 CFR 177.2415	All grades of unfilled VICTREX PEEK and some glass-filled grades, and APTIV film have been manufactured and tested to be compliant with the requirements of FDA regulation 21 CFR 177.2415 for use in food contact applications. Victrax plc accepts no responsibility for the compliance of the final material if other substances have been added during subsequent processing stages. End users and processors should note that it is the responsibility of the manufacturer of the food contact article to assure compliance of the extractive limitations of 21 CFR 177.2415.
21 CFR 175.300	VICOTE Coatings grades 701 through 709, and grades 804 through 810 including 804Blk, 807Blk and 810Blk comply with the compositional requirements of FDA regulation 21 CFR 175.300 for resinous and polymeric coatings. VICTREX® HT™ polymer is compliant with the compositional requirements of FDA regulation 21 CFR 175.300 for resinous and polymeric coatings. Regulation 21 CFR 175.300 specifies that the finished coated part, which is in contact with food, is subject to extractive limitations. Compliance with any applicable extractive limit can only be demonstrated by testing carried out on the final article.
Sanitary Standard 3-A	All unfilled grades of VICTREX PEEK and APTIV film comply with Sanitary Standard as multiple-use plastic materials for use as product contact surfaces for dairy equipment.
1935-2004-EC / 10-2011-EC	VICTREX150P, 380P, 450P, 151G, 381G, 450 G and 90GL30BLK EU comply with an EC directive for plastic in contact with foodstuffs.
WRCA BS 6920	VICTREX 450G, 450GL30, 450CA30, and 450FC30 meet the Water Research Council Approval BS 6920 Report M100216/(A-D) for non-metallics in contact with water for human consumption.

VICOTE® Coatings

VICOTE Coatings, based on VICTREX PEEK polymer, are the next generation of coatings featuring high temperature performance, scratch-resistance, and durability for long life.

VICOTE Coatings were developed to fill the performance gap found in many existing coating technologies today. Whether the coatings are applied to cookware, food processing, industrial, or automotive parts, they are a great choice for engineers looking to improve the overall wear and life of their application.

There are two types of VICOTE Coatings — the 700 Series powder grades and the 800 Series aqueous dispersion grades. Powder is used for electrostatic coating while aqueous dispersions are generally used for thinner coatings or where difficult geometries must be coated.

Key Features

- ▲ **Exceptional Abrasion Resistance**
Very hard and scratch-resistant — up to four times more than common fluoropolymers.
- ▲ **Excellent Wear Surface**
Require no lubrication to prevent galling or seizing.
- ▲ **FDA Compliance**
Majority of grades can be used in environments involving food contact.
- ▲ **High Load Bearing Surface**
Strength at 260°C (500°F) is greater than PTFE at room temperature.
- ▲ **Outstanding Chemical Resistance**
Insoluble in all common solvents. Superior resistance versus stainless steel and titanium.
- ▲ **Exceptional Hydrolysis Resistance**
Chemically inert to water and pressurized steam.
- ▲ **Requires No Primer**
- ▲ **Halogen Free, Low Smoke and Toxicity**
- ▲ **Ease of Processing**



Rice Cookers

Cuckoo Industrial chose VICOTE Coatings as a major ingredient for a new coating formulation for its latest range of high-pressure rice cookers.

Traditionally, the inner pot of an electric rice cooker was made of aluminum, and was, therefore, susceptible to corrosion due to the alkaline solution resulting from the mixing of rice with water. Cuckoo was one of the first rice cooker manufacturers to identify this problem and start research into coating agents that could offer the necessary level of corrosion protection. At the same time, Cuckoo wanted to improve durability, as many food-standard coatings can be scratched by the frequent use of rice scoops and scrubbers.

The vulnerability to fast corrosion was the motivation behind developing a new coating material with high abrasion protection characteristics. Cuckoo found that PTFE, PFA, and FEP are all fairly vulnerable to scratches and/or abrasion, and therefore simply don't last long in these very demanding applications.

Cuckoo selected VICOTE Coatings because of its remarkable mechanical performance at high temperatures, superb heat and abrasion resistance, and corrosion resistance.



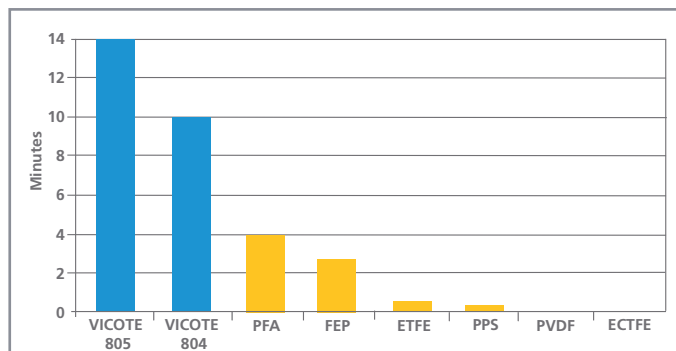
Food Processing Belts

Taconic International uses VICOTE Coatings in its new Tacmaster range of food processing belts that are produced in master rolls and converted to required conveyor belt dimensions.

These specially coated conveyor belts are used in aggressive food cooking environments where excellent wear, release and mechanical properties, and excellent temperature performance are required, such as in the pre-cooking of bacon, chicken, burgers, tortilla, pizza crusts and eggs.

Using VICOTE Coatings for the food conveyor belts enables Taconic to provide its customers with increased wear and abrasion resistance, improved cut-through resistance, increased puncture and impact resistance as well as non-stick properties. When these properties are combined with improved dimensional stability, resistance to oils and grease, and continuous temperature resistance up to 260°C (500°F) the belt's life can be increased by up to 40%, reducing both downtime and maintenance costs.

Time to Wear Through 25 Microns at 250N Load



VICOTE 805 did not wear through to the substrate over the time of the test

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 polymer, 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.

World Headquarters

Victrex plc
Hillhouse International
Thornton Cleveleys
Lancashire FY5 4QD
United Kingdom
Tel: + (44) 1253 897700
Fax: + (44) 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
Langgasse 16
65719 Hofheim/Ts.
Germany
Tel: + (49) 6192 96490
Fax: + (49) 6192 964948
Email: eurosales@victrex.com

Asia Pacific

Victrex Japan Inc.
Mita Kokusai Building Annex
4-28, Mita 1-chome
Minato-ku
Tokyo 108-0073
Japan
Tel: +81 (0)3 5427 4650
Fax: +81 (0)3 5427 4651
Email: japansales@victrex.com

Asia Pacific

Victrex High Performance
Materials (Shanghai) Co Ltd
Part B Building G
No. 1688 Zhuanxing Road
Xinzhuan Industry Park
Shanghai 201108
China
Tel: + (86) 21-6113 6900
Fax: + (86) 21-6113 6901
Email: scsales@victrex.com

VICTREX PLC BELIEVES THAT THE INFORMATION CONTAINED IN THIS BROCHURE IS AN ACCURATE DESCRIPTION OF THE TYPICAL CHARACTERISTICS AND/OR USES OF THE PRODUCT OR PRODUCTS, BUT IT IS THE CUSTOMER'S RESPONSIBILITY TO THOROUGHLY TEST THE PRODUCT IN EACH SPECIFIC APPLICATION TO DETERMINE ITS PERFORMANCE, EFFICACY AND SAFETY FOR EACH END-USE PRODUCT, DEVICE OR OTHER APPLICATION. SUGGESTIONS OF USES SHOULD NOT BE TAKEN AS INDUCEMENTS TO INFRINGE ANY PARTICULAR PATENT. THE INFORMATION AND DATA CONTAINED HEREIN ARE BASED ON INFORMATION WE BELIEVE RELIABLE. MENTION OF A PRODUCT IN THIS DOCUMENTATION IS NOT A GUARANTEE OF AVAILABILITY. VICTREX PLC RESERVES THE RIGHT TO MODIFY PRODUCTS, SPECIFICATIONS AND/OR PACKAGING AS PART OF A CONTINUOUS PROGRAM OF PRODUCT DEVELOPMENT. VICTREX® IS A REGISTERED TRADEMARK OF VICTREX MANUFACTURING LIMITED. VICTREX PIPES™ IS A TRADEMARK OF VICTREX MANUFACTURING LIMITED. PEEK-ESD™, HT™, ST™ AND WG™ ARE TRADEMARKS OF VICTREX PLC. VICOTE® AND APTIV® ARE REGISTERED TRADEMARKS OF VICTREX PLC.

VICTREX PLC MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, A WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE OR OF INTELLECTUAL PROPERTY NON-INFRINGEMENT, INCLUDING, BUT NOT LIMITED TO PATENT NON-INFRINGEMENT, WHICH ARE EXPRESSLY DISCLAIMED, WHETHER EXPRESS OR IMPLIED, IN FACT OR BY LAW. FURTHER, VICTREX PLC MAKES NO WARRANTY TO YOUR CUSTOMERS OR AGENTS, AND HAS NOT AUTHORIZED ANYONE TO MAKE ANY REPRESENTATION OR WARRANTY OTHER THAN AS PROVIDED ABOVE. VICTREX PLC SHALL IN NO EVENT BE LIABLE FOR ANY GENERAL, INDIRECT, SPECIAL, CONSEQUENTIAL, PUNITIVE, INCIDENTAL OR SIMILAR DAMAGES, INCLUDING WITHOUT LIMITATION, DAMAGES FOR HARM TO BUSINESS, LOST PROFITS OR LOST SAVINGS, EVEN IF VICTREX HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, REGARDLESS OF THE FORM OF ACTION.

