

E-BOOK

**VICTREX™ PEEK
POLYMERS**

A POTENTIAL

PFAS

REPLACEMENT



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WHAT ARE PFAS & WHY ARE PFAS A CONCERN?



PFAS, PER and POLY FLUOROALKYL SUBSTANCES

PFAS, as defined by the Organisation for Economic and Co-operation and Development (OECD), are any chemicals with at least one perfluorinated methyl group (-CF₃) or at least one perfluorinated methylene group (-CF₂-)¹.

Per- and Polyfluoroalkyl compounds span a wide range of chemicals. Since the 1950's, they have been extensively used in millions of everyday items. These substances, which are renowned for their resistance to heat, oil, stains, and water, are ubiquitous in a variety of products such as technical clothing, non-stick cookware, food packaging, and many more.

SAFETY CONCERNS

Safety concerns around PFAS has sparked global action. Regulators across the UK, European Union, and the U.S. are proposing to ban or restrict PFAS substances to only a few critical uses.

Considered “forever chemicals” their persistence in the environment poses a significant risk. PFAS, including compounds like PFOA (perfluorooctanoic acid) and PFOS (perfluorooctanesulfonic), do not break down and risk contaminating our food and water, which may lead to health hazards such as liver damage, thyroid disease, obesity, fertility issues and cancer .²

¹ [OECD About PFAS](#)

² European Environment Agency, What are PFAS and how are they dangerous for my health? www.eea.europa.eu

PACE OF CHANGE



It's difficult to predict the pace of change. However, similar historic changes in the chemical sector have typically involved a short period of rapid change prior to regulation.

	Unregulated Use	Understanding of Concern	Compelling Evidence	Regulated Use	Outright Ban
PCB's	1890 - 46 years - 1936	1936 - 30 years - 1966	1966 - 12 years - 1978	1978 - 8 years - 1986	1986 ←→ Today
CFC's	1930 - 44 years - 1974	1974 - 11 years - 1985	1985 - 2 years - 1987	1987 - 17 years - 2010	2010 ←→ Today
Asbestos	1880 - 38 years - 1918	1918 - 49 years - 1967	1967 - 11 years - 1978	1978 ←→	Usage highly controlled
BPA	1950 - 38 years - 1988	1988 - 20 years - 2008	2008 - 2 years - 2010	2010 ←→	Used highly controlled
PFOS/A	1940 - 20 years - 1960	1960 - 20 years - 1980	1980 - 22 years - 2002	2002 ←→ 2015	2015 ←→ Today
Fluoropolymers*	1940 - 60 years - 2000	2000 - 15 years - 2015	2015	Very limited country / sector regulation	→

The "compelling" evidence phase provides a window of opportunity for substitution

Note: *Fluoropolymers is an accelerated path to regulation due to close proximity well studied long-chain PFAS chemicals e.g. PFOS and PFOA. Source EPA: NOAA, Mesothelioma Hub.

REGULATORY DRIVERS

Fluoropolymers: PFOS and PFOA have been under increasing regulation in both the US and Europe with scope starting to expand to the PFAS group



Regulation on individual PFAS chemicals
PFOA/PFOS under increasing monitoring and restriction. Manufacturers switch to other less well understood PFAS chemicals

<u>2002</u> EPA initiated phase out of PFOS and PFOA with domestic manufacturers	<u>2006</u> EPA launched PFO Stewardship program phased out PFOA & PFOS with 8 manufacturers - successful by 2015	<u>2009</u> Global treaty the Stockholm Convention listed PFOS under Annex B, restricting its use	<u>2019</u> PFOA was added in Stockholm convention Annex A prohibiting its manufacture GenX, a PFOA replacement, listed by ECHA as a Substance of Very High Concern (SHVC)	<u>2022</u> Proposed to add PFOA and PFOS to CERCLA as a hazardous substance	<u>2023</u> EU sets limits on 4 PFAS chemicals, to determine how much food is allowed to contain.
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EU Regulations of universal PFAS group chemicals
With greater understanding of PFAS chemicals on humans and health, regulations target applications with direct human contact

<u>2020</u> EU chemicals Strategy for Sustainability recommends phasing out PFAS unless essential Denmark ban PFAS in paper and board food packaging	<u>2022</u> Public consultation by ECHA	<u>2023</u> 5 countries have submitted a proposal to the ECHA about restricting sales of entire group of PFAS	<u>2024 2025</u> ECHA scientific committees present their options
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USA Regulations of universal PFAS group chemicals
With greater understanding of PFAS chemicals on humans and health, regulations target applications with direct human contact

<u>2021</u> California joins Connecticut, Main, Minnesota, New York, Vermont and Washington in banning PFAS from food packaging	<u>2022</u> California signed laws that will ban sales of cosmetics, personal care, clothing and textiles with PFAS - coming into effect in 2025	<u>2023</u> EPA publish final rule requiring all manufacturers & importers to report PFAS uses to the EPA.	<u>2024</u> EPA finalise a rule preventing companies starting or resuming manufacture of 329 PFAS without EPA review	<u>2024</u> EPA propose National Drinking Water Regulation (NPDWR) for six PFAS
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Source ECHA, EPA, Chemical & Engineering News, Chemsec: PFAS free project, EPA (Environmental Protection Agency)

INNOVATORS OUTPACING REGULATORY REQUIREMENTS

Many organisations are already preparing for a PFAS-free future, whether in anticipation of mandatory regulations, in response to consumer demand, or to ensure staff well-being. Here are examples of companies leading the change.

[Click each headline to read more.](#)

2016
IKEA COMPLETES PHASE-OUT OF PFAS IN TEXTILES

2013
BENETTON SET GOAL TO PHASE OUT PFC'S IN ITS MANUFACTURING PROCESSES & PRODUCTS & SUPPLIERS

2022
3M announces to exit PFAS manufacturing by end 2025

2022
APPLE COMMITS TO PHASING OUT PFAS SUBSTANCES

2023
SAINT-GOBAIN ANNOUNCES CLOSURE OF PFAS FACILITY

2023
Milliken announces successful elimination of all PFAS from its Textile Fibers & Finishes Portfolio

COMPANIES THAT DECLARE PRODUCTS HAVE NO ADDED PFAS

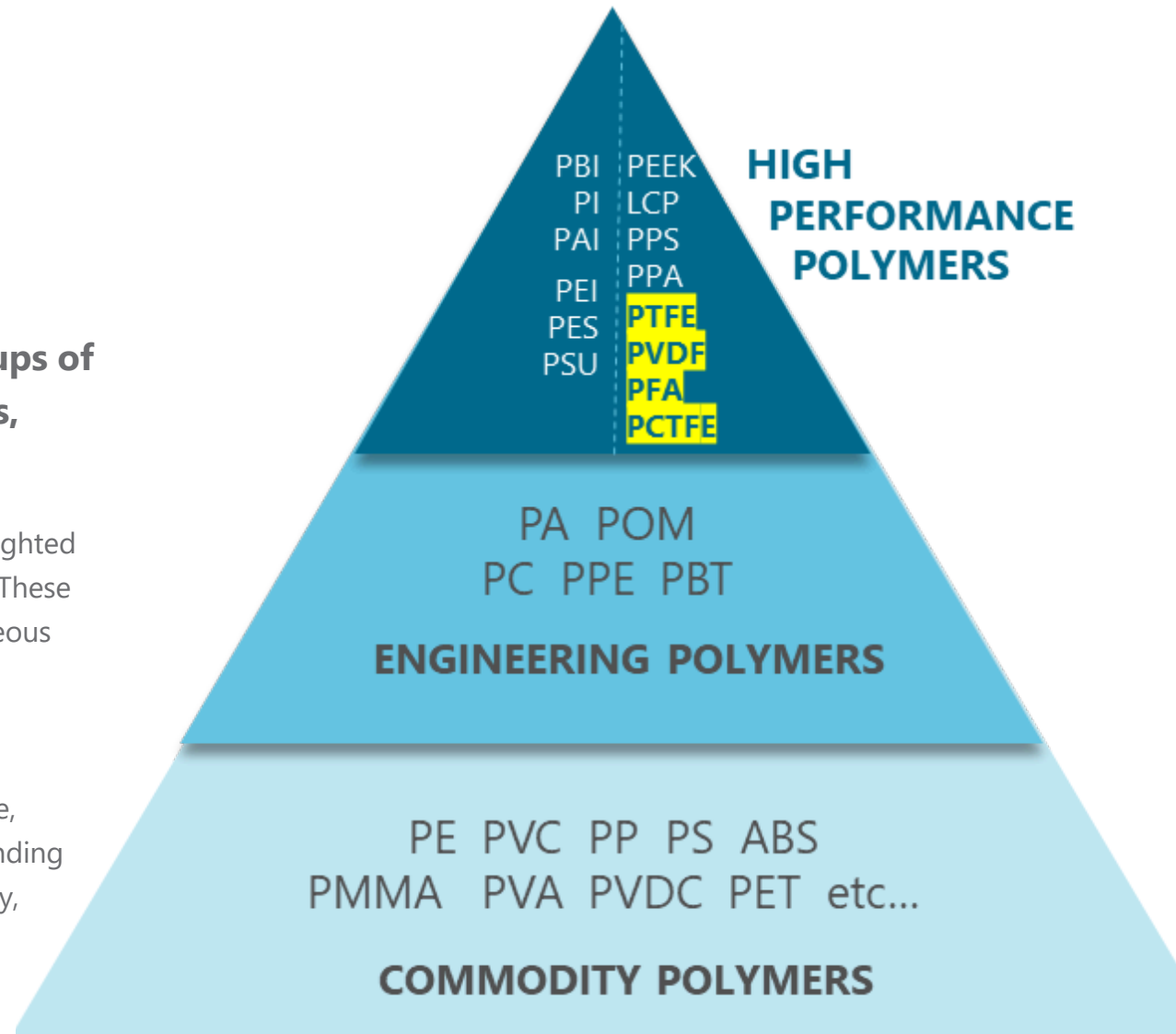
[VIEW MORE](#)

POLYMER PYRAMID

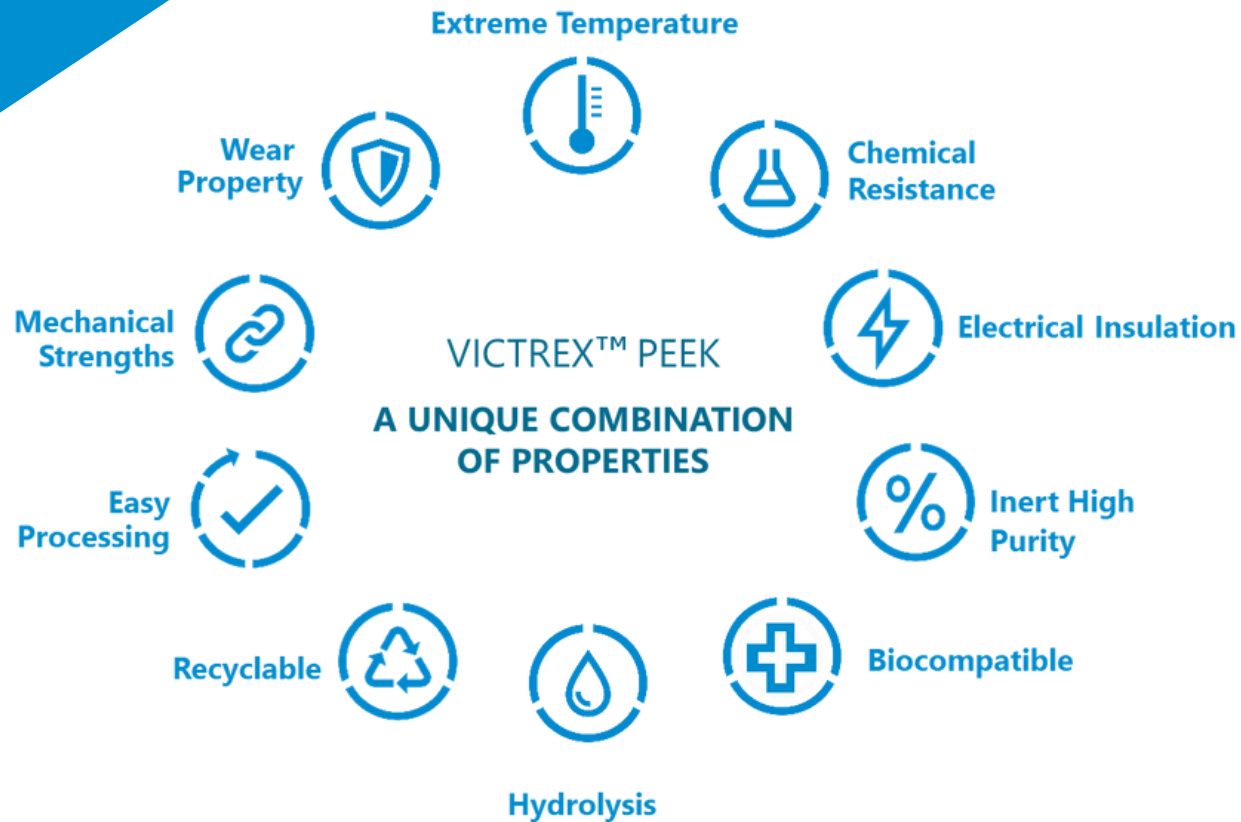
Polymers are divided into three distinct groups of categories, based on performance properties, operating temperatures and cost.

High performance polymers, including several PFAS highlighted in yellow, are located at the top of the polymer pyramid. These polymers are popular because of their range of advantageous properties which meet multiple engineering requirements simultaneously.

Thermal stability at high temperatures, chemical resistance, strength and durability makes them ideal for many demanding applications. These include aerospace, automotive, energy, electronics, industrial and medical applications.



VICTREX™ PEEK POLYMERS



Like PTFE, PVDF, PFA and PCTFE, VICTREX PEEK is also in the category of high performance polymers.

PEEK is being used as alternative in cases where properties offered by e.g. PTFE are required such as bio-compatibility, chemical, temperature and electrical resistance, self-lubricating wear resistance.

PEEK is additionally stronger and stiffer which means it can perform additional structural roles. Although PEEK can replace PTFE in many scenarios, sometimes the increased strength and stiffness may not be required.

PEEK is not classified as a PFAS, nor are PFOAs or PFAS used in the polymerisation process.

VICTREX PEEK POLYMER PROPERTIES VS. PTFE

	VICTREX™ PEEK	PTFE
PHYSICAL PROPERTIES		
Halogen free	Yes	No
Colour	Beige	White
Chemical resistance	Excellent	Excellent
Specific Gravity	1.3	2.16
Biocompatibility	Yes	Yes
Smoke Toxicity	Low	High
Flammability	Excellent	Excellent
MECHANICAL & THERMAL PERFORMANCE		
Tensile strength	High	Low
Tensile modulus	High	Low
Melting temperature	343°C	335°C
PROCESSABILITY	Excellent	Poor to Fair

FOR COMPARISONS TO OTHER PFAS MATERIALS
OR SPECIFIC PROPERTY MEASURES OR REQUIREMENTS

[CONTACT US](#)

POTENTIAL APPLICATION AREAS FOR PEEK AS A PFAS REPLACEMENT

FOOD & WATER CONTACT

VICTREX FG™ grades are compliant with major food regulations and support multiple requirements for safety, quality and regulatory compliance of the industry.

Applications: Conveyor systems, aseptic processing, Clean-in-place (CIP) equipment, beverage dispensers, cookware,

▶ [LEARN MORE](#)



Non-stick cookware



Tribological Components

TRIBOLOGICAL

VICTREX WG™ 101 Polymers, provide premium wear properties to meet the requirements for wear at high speeds and load application performance. PFAS-free and does not contain other halogenated additives or talc.

Applications: Seals, bearings, gears, gaskets, piston rings.

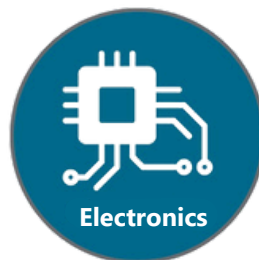
▶ [DOWNLOAD BROCHURE](#)

ELECTRONICS

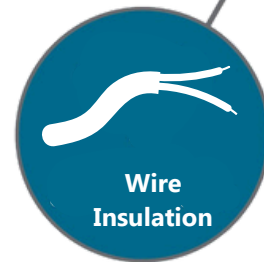
Victrex PEEK polymers and APTIV™ PEEK film are chosen for electronic applications due to superior dielectric properties, high-temperature stability, and exceptional chemical resistance, ensuring reliable performance and longevity in demanding environments.

Applications: Consumer electronics mobile devices, 5G/ 6G base stations, phone hardware, semicon manufacture

▶ [LEARN MORE](#)



Electronics



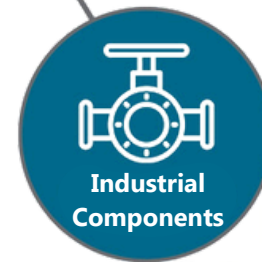
Wire Insulation

WIRE INSULATION

VICTREX PEEK Polymers and APTIV™ PEEK film are ideal for tough transport and oil and gas applications. Offering extreme temperature endurance from -60 to 260 degrees C, flame retardant, low smoke toxicity, and with different colors for identification.

Applications: Power cables, electric heating cables, electric coaxial cables, hook-up wires

▶ [LEARN MORE](#)



Industrial Components

INDUSTRIAL COMPONENTS

VICTREX PEEK is used in chemical and fluid handling environments and is replacing PTFE, PCTFE, PVDF, etc. due to its chemical and temperature resistance and ease of processing. Available in various forms e.g. granules, tubes, fibres and coatings. For cryogenic applications VICTREX CT 100 is a viable alternative to PCTFE.

Applications: Seals, connectors, tubing, filtration, composite pipe.

▶ [LEARN MORE](#)



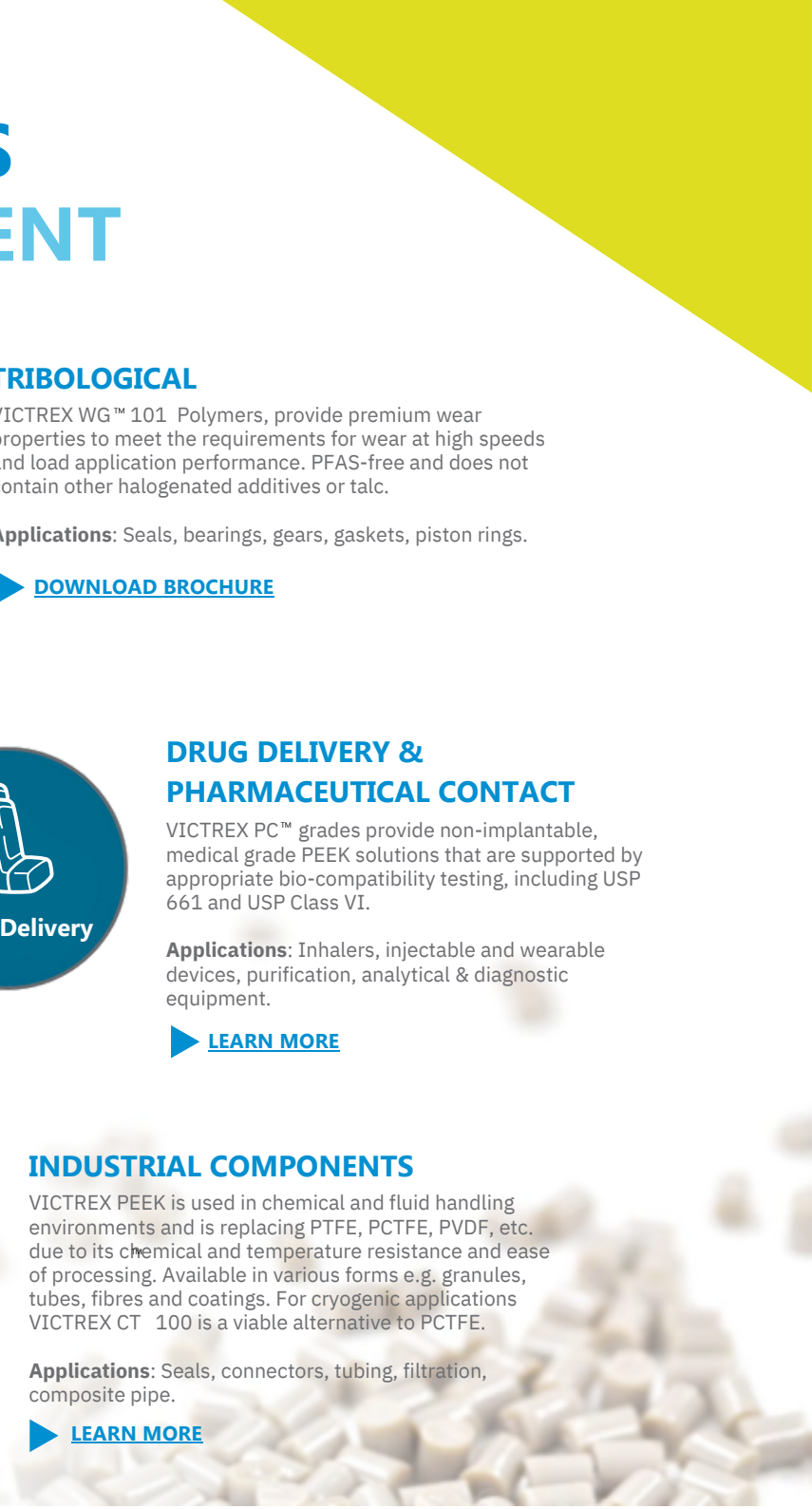
Drug Delivery

DRUG DELIVERY & PHARMACEUTICAL CONTACT

VICTREX PC™ grades provide non-implantable, medical grade PEEK solutions that are supported by appropriate bio-compatibility testing, including USP 661 and USP Class VI.

Applications: Inhalers, injectable and wearable devices, purification, analytical & diagnostic equipment.

▶ [LEARN MORE](#)



DO VICTREX PEEK PRODUCTS CONTAIN PFAS?

PFAS (Per- and polyfluoroalkyl substances) have not been intentionally added, used, or generated as by-products in the manufacturing process of unfilled Victrex PEEK and PAEK polymers. In addition, independent third-party laboratory analysis on representative product samples has confirmed that Perfluoroalkyl substances (including PFOA, PFHxS, PFCA's C9-C14) are not detectable in Victrex products down to test detection limits.

A small number of Victrex products contain PTFE (a fluoropolymer, part of the PFAS family of substances) as an additive – these are manufactured by third party companies which comply with the PFOA restrictions of the POPs regulation (EU 2019/1021). These include VICTREX PEEK grades: 150FC, 150FW, 450FC, 450FE, J301; VICTREX CTTM 200 MIC.

[LEARN MORE ABOUT VICTREX PEEK GRADES THAT ARE PFAS-FREE](#)

[LEARN MORE](#)

VICTREX PEEK PRODUCT PORTFOLIO

Performance by design

Victrex was the first company to commercialise PEEK and has focused on developing high-performance polymeric solutions for over 40 years. This dedication provides us with unmatched expertise and experience. By working together, we can help turn the toughest challenges into opportunities.



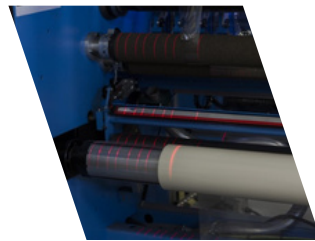
▲ VICTREX PEEK

VICTREX PEEK is THE metal replacement material that can enable optimum performance. Optimise the designs of your next-generation components to achieve significant weight savings with our vast portfolio of polymers.

70% lighter vs. steel
55% lighter vs. titanium
40% lighter vs. aluminum

Injection molding unfilled, carbon-fiber reinforced, and glass-filled grades.

Proprietary grades available to achieve thinner wall sections, higher modulus, and minimal wear.



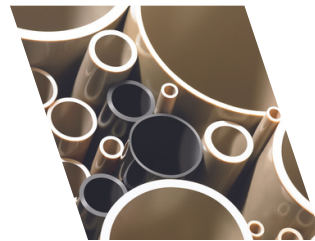
▲ APTIV FILM

Takes advantage of the properties of VICTREX PEEK in a thin film format. By offering unmatched processing opportunities, APTIV film allows for the design of durable, light-weight solutions.

Up to 60% lighter vs polyvinyl fluoride (PVF) film.

Laminate, seal, weld, metalize, and many more.

Available in thicknesses from 5 to 750 microns.



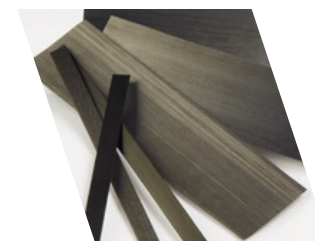
▲ VICTREX PIPES

Lightweight tubing manufactured from VICTREX PEEK polymer can be used for protective sheathing, cable conduits and low pressure fluid transport systems. Benefit from the ability to customer design tubing systems to fit your spacing requirements.

60% lighter vs. stainless steel
45% lighter vs. titanium
33% lighter vs. aluminum

Bend, form, fit, flare and clamp

Excellent corrosion resistance and fire, smoke and toxicity properties.



▲ POLYMERS FOR COMPOSITES

Combine strength and light weight by specifying VICTREX PEEK as a composite matrix material. This innovative technology allows engineers to design for the most demanding environments.

Up to 70% lighter than metal alloys

5x higher specific strength
4x higher fatigue strength
4x higher specific stiffness vs. aluminum

Available in braid, fabric, flake, long fiber pellets, tow and unidirectional tape and sheet



▲ VICOTE COATINGS

Durable VICTREX PEEK coatings enhance the lifetime of metal substrates while being friendly to the environment. Enhance the performance of your components with Victrex liquid and powder dispersions.

Use a one-coat system for a smooth, uniform surface

Excellent resistance to wear, abrasion, high heat, creep and chemicals.

Halogen-free with no additives

NEED HELP SELECTING PRODUCTS?

[CONTACT US](#)



WHY VICTREX?

From the commercialisation of PEEK over 40 years ago, Victrex has continually pioneered new PAEK-based polymer solutions that have transformed markets, delivering global impact in the toughest environments. Our commitment to innovation, quality and customer satisfaction are among the reasons we're trusted and are chosen by customers and have been for decades.

- ▶ Accelerating customer innovation and speed to market
- ▶ Supporting customers from concept through to commercialisation
- ▶ Security of supply with PEEK and PAEK dedicated R&D and manufacturing facilities
- ▶ Global network of Technical Support experts
- ▶ Strong ESG credentials with SBTi approved decarbonisation targets



“Partnering for success”, hear from Michael Koch, Victrex Sustainable Solutions Managing Director (2 mins)

[CLICK TO WATCH](#)

#1 PEEK EXPERT

40+ YEARS OF EXPERIENCE

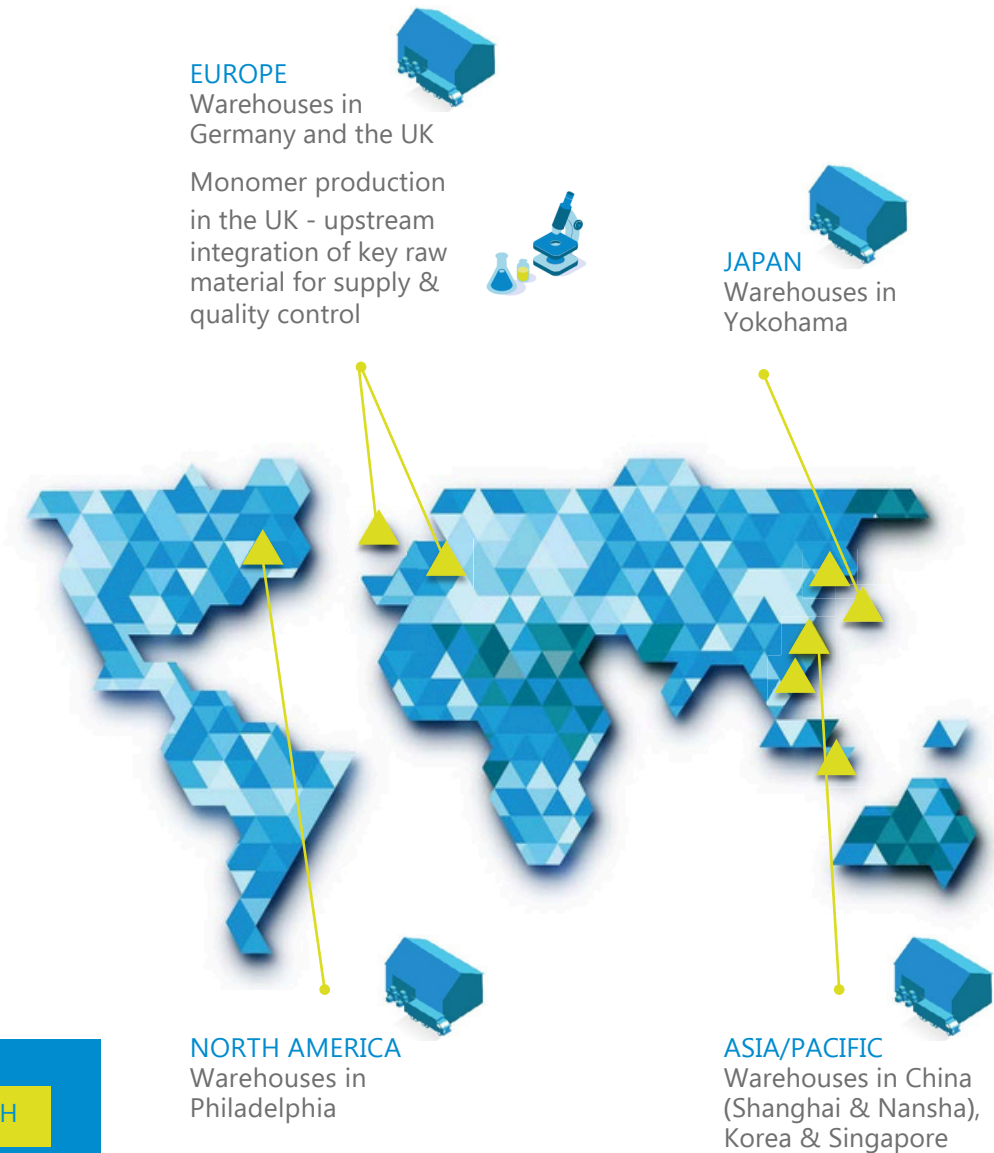
ENABLING SECURITY OF SUPPLY

- ▶ Upstream integration enabling control of formulating flexibility & supply
- ▶ Global facilities offering short lead times and strengthening overall logistics
- ▶ Strategic commitment to supply chain security supported through Class A certified Integrated Business Planning
- ▶ #1 global PEEK production capacity with invested and ready for growth now



'Ensuring Security of Supply' - a 2 minute video

[CLICK TO WATCH](#)



**In the face of the PFAS concerns,
we take pride in offering a range
of proven high-performance PEEK
polymers as potential safer and
more sustainable alternatives.**

Contact us to discuss whether PEEK could
be a suitable PFAS alternative for your
application.

[CONTACT OUR PEEK EXPERTS](#)





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