

Replacing Metals with PEEK (Polyetheretherketone): An Interview with John Walling at Victrex plc.

Interview conducted by Kal Kaur

insights from industry

John WALLING

Strategic Marketing Manager,
Victrex Polymer Solutions



John Walling, Strategic Marketing Manager for [Victrex Polymer Solutions](#), talks to AZoM about metal replacement with PEEK (polyetheretherketone).

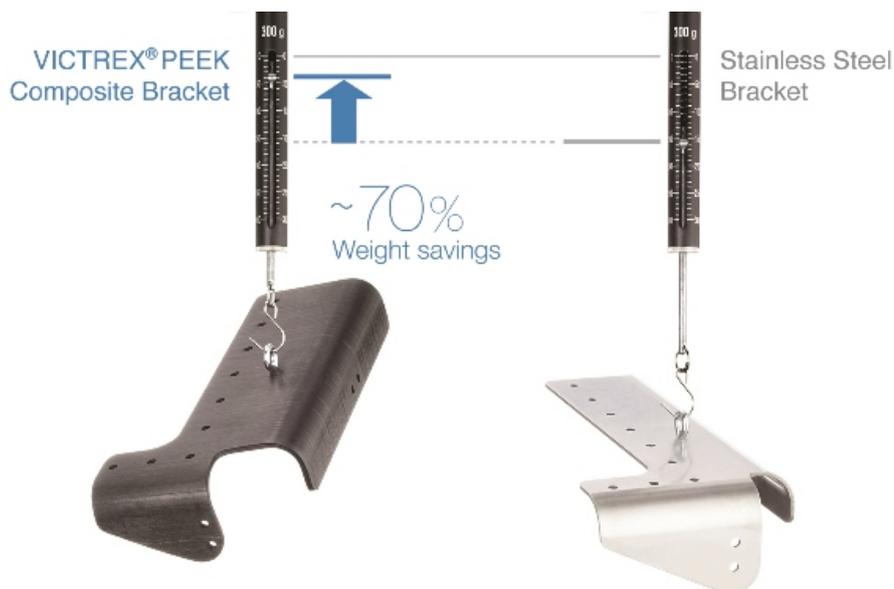
KK - PEEK is one of the highest performing materials being used in the world. Can you describe this polymer and the benefits it offers?

JW - Simply put, PEEK is “best all around” when it comes to high performance and processing versatility. PEEK (polyetheretherketone) is a semi-crystalline thermoplastic with a linear aromatic polymer structure. The fully recyclable material melts at 343°C and possesses exceptional mechanical properties with resistance to chemicals, wear, fatigue and creep even at high operating temperatures where it is commonly used in service.

PEEK also has low moisture absorption, stable dielectric (insulating) properties and inherently low flammability. The amazing thing about PEEK is the wide range of processing options from injection molding, compression molding, and extrusion into shapes, film or fibers, to thermoforming, spray coating, or stock shape machining – it is truly one of the most versatile structural materials available.

KK - How is VICTREX® PEEK delivering high performance at reduced weight?

JW - The inherent low specific gravity of VICTREX PEEK (1.3 g/cm³) is less than half that of aluminium and one sixth that of steel. Carbon or glass fibers are added as structural reinforcements in PEEK compounds that have high strength and modulus properties similar to aluminium, but still much lower in density. This results in a superior strength-to-weight ratio so VICTREX PEEK-based compounds can offer equivalent strength and stiffness with up to 70% weight reduction.



VICTREX PEEK composite bracket.

KK - What metals are being replaced with VICTREX PEEK?

JW - Carbon Steel, Stainless Steel, Titanium, Aluminum, Magnesium, Brass and Bronze have all been replaced with VICTREX PEEK over the years.

"While heavier metals were first replaced with aluminium, titanium and magnesium, we now see engineers looking to further optimize their designs by replacing these "light metals" with VICTREX® PEEK. We now have over 35 years of experience in working with customers on metal replacement and a growing list of applications across all industries."

KK - What are the main benefits of replacing metals with PEEK for the engineers?

JW - Besides weight reduction, we see three more major benefits: enhanced performance, greater design freedom, and lower total system cost. Enhanced performance benefits include everything from extending lifetime by eliminating corrosion, increasing fuel efficiency with lower friction, and handling higher loads/speeds to operating in more extreme chemical environments.

Greater design freedom comes from PEEK's amazing processing versatility which allows complex geometries to be molded-in without labor intensive post-machining steps. This, in turn, helps engineers improve on performance while reducing total system cost.

KK - What are the key applications for this material?

JW - Some of the first VICTREX PEEK applications were wear components for industrial equipment such as seal rings, bushings, bearings and valves, especially in extreme environments. Hydraulic valves in automotive anti-lock brake systems started in Europe and quickly became a global industry standard.

The need for high wear performance combined with heat and chemicals translated into high purity environments such as food, beverage and semiconductor industries where electrostatic dissipative (ESD) PEEK compounds were developed for wafer handling in IC chip fabrication. Over the past two decades the number of applications for VICTREX PEEK has exploded to include aircraft brackets, clamps and insulation, oil drilling tool seals and connectors, transmission gears, and now even more into consumer applications like vacuum impellers, refrigerator compressors, and mobile device speakers.



Balance shaft gears by Victrex.

KK - PEEK is being used increasingly in the automotive industry. How will the use of VICTREX PEEK help car manufacturer deliver better fuel economy, and reduce the global footprint?

JW - VICTREX PEEK can improve fuel economy and reduce emissions in two ways. First, by reducing energy losses due to excess weight, and second, by reducing friction losses in the powertrain. A 68% weight reduction in gears, for example, results in a 78% reduction in the moment of inertia which leads to a 9% increase in efficiency. The reason: low weight – i.e. reduced moving masses – and the lower friction losses typical of plastic, both of which help considerably when optimising response or when accelerating or decelerating masses.

While the automotive industry drives for weight reduction to achieve increased fuel efficiency needed to meet aggressive government mandates, noise reduction and low maintenance are also important design goals. In the gear example, noise, vibration, and harshness was lowered by 3dB – this is equivalent to a 50% noise level reduction for the human ear.



VICTREX PEEK used for powertrain components.

KK - How does the use of PEEK polymers affect manufacturing processes, time and costs?

JW - Not only is PEEK a lightweight solution, it also provides a productivity solution in manufacturing with the opportunity to consolidate and simplify part designs through the injection molding process. Designing with thermoplastics like PEEK allows engineers to take a current metal component, re-visit the design, and simplify it to make it easier on the installation and manufacturing teams at the tier and OEM level.

The beauty of the injection molding process, once mastered, is that it can be optimized for faster processing cycles and easy part-to-part repeatability which means lower overall costs compared to metals.

KK - Are there any development plans for PEEK polymers over the next five years?

JW - Absolutely. Victrex is committed to developing advanced materials that leverage our knowledge and expertise with polyketones. We are led by market needs and look to innovate with our customers who are leaders in their respective industries. With a focus on solving challenging engineering problems, we have identified several unmet needs that can be addressed by new polymers that we are actively working on.

KK - Are there any case studies that demonstrate the benefits of PEEK polymers over metals?

JW - One recent case study highlights the benefits of metal replacement in aircraft system attachment clamps. One of the world's leading suppliers of interconnect products has worked to replace aluminum and stainless steel in their line of wire and tubing clamps. One electrical wire bundle clamp made with VICTREX PEEK is 20% lighter than the aluminum clamp it replaced.

There are approximately 15,000 clamps used to secure the wiring and cables on a given plane which results in substantial weight savings. This translates to \$23,000 per year in fuel savings as well as a CO₂ emission reduction of 80 tons for each plane using this technology. Not only can this application help save airlines money and reduce air travel's effect on the environment, but the clamps are much easier to install.

The switch from metal to plastic injection molding allowed for a re-design that led to the integration of a new locking hinge that helped reduce installation times by 30%. The "lock-open, lock-closed" feature of the clamp provides manufacturers with the opportunity to install the clamps with one hand leaving the other free for other tasks. This really demonstrates how VICTREX PEEK is solving multiple problems to gain acceptance versus metal in one of the world's most conservative industries.

KK - Where can we find further information on your products and services?

JW - You can find a wealth of information and regional contacts at [our website](#) or you can [follow us on LinkedIn](#) to learn about new products and applications. We will also be exhibiting at the K Show in Dusseldorf, Germany from Oct. 16-23, so please come visit us at Hall 5, Booth A23! For a sneak "peek" visit www.Victrex-K2013.com to give you a flavor of our presence at K 2013. This smartphone-friendly page echoes our stand's key themes, shares relevant tradeshow information and allows visitors to schedule a meeting with our PEEK experts.

About John Walling

John Walling is the Americas Strategic Marketing Manager for Victrex Polymer Solutions. He holds a Bachelor of Mechanical Engineering Degree from the University of Michigan and a Masters in Business Administration from the Anderson School at UCLA.



John has more than 20 years of experience with high performance polymer and composite material suppliers serving in various technical and market development roles with GE Plastics and Owens Corning Composites Systems prior to joining Victrex in 2003.

Date Added: Oct 16, 2013 | Updated: Oct 17, 2013

Victrex plc.



300 Conshohocken State Road, Suite 120
West Conshohocken
PA, 19428
United States
PH: +1 (484) 342-6001
Fax: +1 (484) 342-6002
Visit [Victrex plc.](http://www.victrex.com) Website

Primary Activity

Manufacturer of high performance polyaryletherketone materials.

Company Background

Victrex is a world leader in high performance polymer solutions such as [VICTREX® PEEK™ polymer](#), [APTIV™ film](#), [VICOTE® coatings](#), and [VICTREX Pipes™](#). These materials are used in a variety of markets and offer an exceptional combination of properties to help OEMs, designers and processors reach new levels of cost savings, quality, and performance.

Victrex are committed to providing their customers specialized services and the most comprehensive product portfolio of its kind.

Victrex's broad PAEK-based product portfolio represents their focus on quality, performance and creating value by solving their customers' toughest challenges today and tomorrow.

[VICTREX PEEK polymers](#) deliver performance and efficiency gains with high reliability in extreme environments.

Today's innovative engineers specify lightweight, strong and versatile [VICTREX PEEK](#) polymers to help reduce weight, increase reliability and cut cost with no compromises in the safety performance of their products.

Versatile [APTIV® films](#) offer durability, reliability, and design flexibility.

Lightweight APTIV films provide all of the outstanding material properties of [VICTREX PEEK polymer](#) and are available in thicknesses between 6 and 750 microns. APTIV films are currently being used in over 750 million mobile devices since they deliver exceptional acoustic performance.

Lightweight [VICTREX Pipes™](#) extend service life and reduce maintenance downtime.

Durable, lightweight pipes and tubes extruded from [VICTREX PEEK polymer](#) can operate in some of the most challenging environments where excellent chemical, abrasion, and corrosion resistance at elevated temperatures is required.

[VICOTE® coatings](#) deliver exceptional corrosion protection with scratch and wear resistance.

[VICOTE PEEK-based coatings](#), available in powder and aqueous dispersions, deliver excellent scratch and wear resistance, high strength, and durability leading to a longer lifetime for critical coated components.