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KetaSpire® PEEK Offers Higher Purity and Improved Toughness for Clean Room Environments

Components used in clean room equipment must be constructed of inert materials that can withstand thermal cycling, harsh chemicals and the constant, frictional motion associated with semiconductor fabrication without adversely affecting their environment.

Polyetheretherketone (PEEK) has proven itself as the material of choice for structural components that require superior strength and stiffness while exhibiting chemical resistance that is on par with fluoropolymers. Additionally, the material's well-balanced combination of dimensional stability, low particulation, and dynamic fatigue make it an excellent choice for applications that require indexing and repeated motion.

PEEK must also deliver high purity and toughness to help optimize the performance of device manufacturing equipment. This bulletin presents recent findings that show differences in purity and toughness between Solvay's KeteSpire® PEEK and commercial PEEK traditionally used in clean room equipment.

Testing Reveals Higher Purity

Blind samples of KetaSpire® KT-820 conventional flow PEEK and conventional standard flow PEEK were submitted for evaluation to Fremont, California-based Balazs Labs, an independent lab that offers analytical services for high-technology products. The materials tested did not contain additives, lubricants or processing aides. Five lots of KetaSpire® PEEK and six lots of conventional PEEK were analyzed using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Test results from all lots for each product were averaged and are summarized in Figures 1 and 2.

As shown in Figure 1, the concentrations of total metals and alkali metals are significantly lower for KetaSpire® PEEK. As shown in Figure 2, the concentrations of most elemental metal contaminants present in KetaSpire® PEEK were lower than the concentrations of those present in conventional PEEK. This is especially noticeable for sodium, calcium, and potassium.

Figure 1: ICP-MS Analysis of Total Metals and Alkali Metals

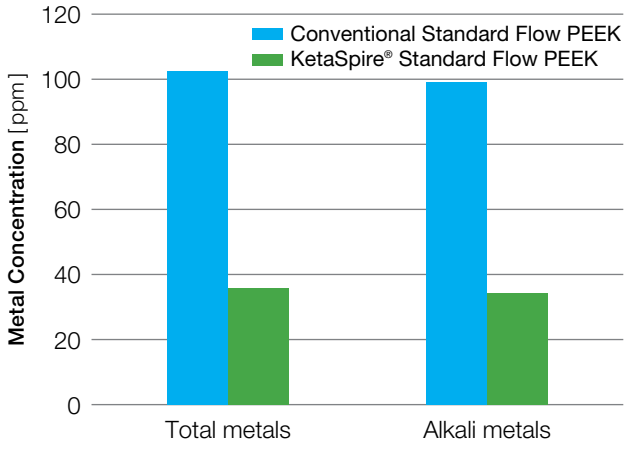
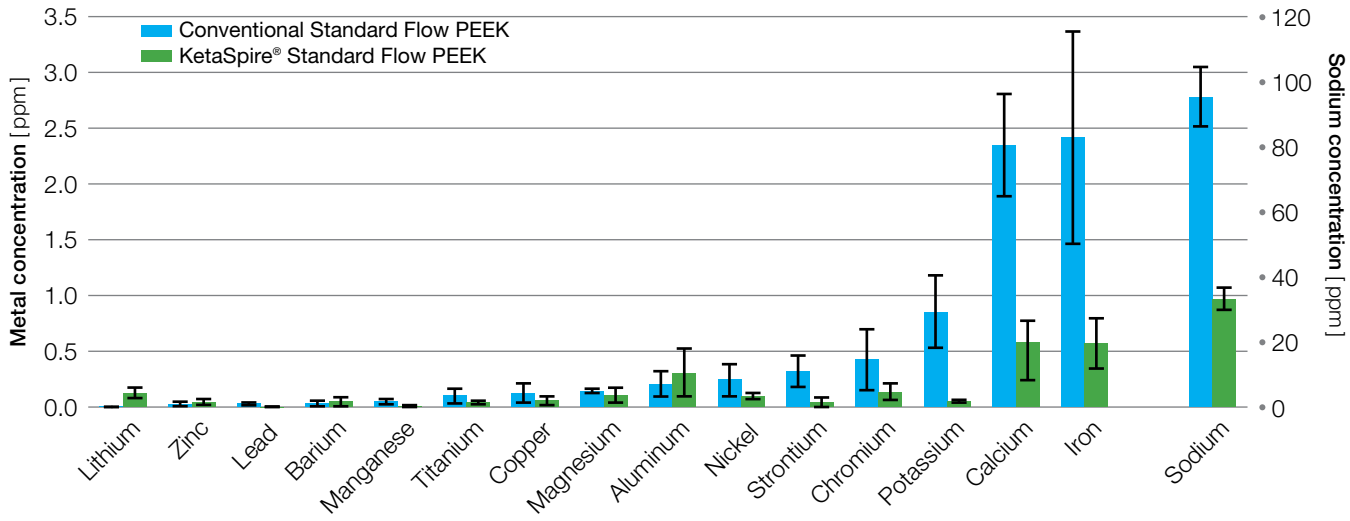


Figure 2: ICP-MS analysis of elemental metals



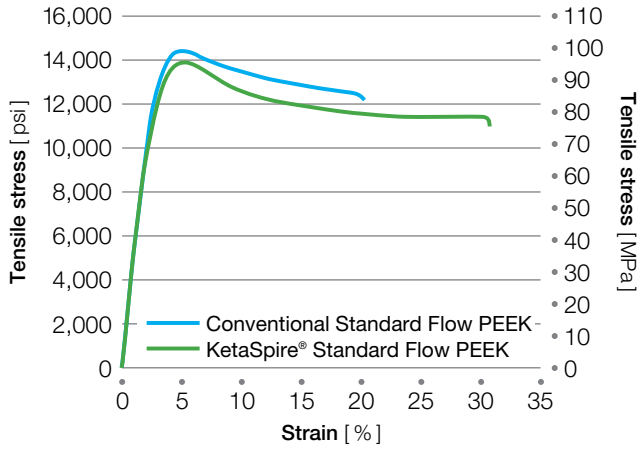
(1)Note that the scale used to report sodium concentration is different than the scale used for the other elements.

Superior Toughness

The area under each tensile stress-strain curve shown in Figure 3 represents the material's practical toughness. The higher value of KetaSpire® PEEK indicates that it has a greater capacity to absorb a higher amount of energy or load before breaking versus conventional PEEK.

The tensile bars used to generate the stress-strain curves are shown in Figure 4. The KetaSpire® PEEK bar has a fully developed, smooth neck region that is characteristic of shear banding; the conventional PEEK bar exhibits less necking and a drawdown that is characteristic of crazing.

Figure 3: Tensile stress-strain curves (ASTM D638)



The superior toughness of KetaSpire® PEEK can also be demonstrated through notch sensitivity testing. As shown in Figure 5, Solvay's PEEK exhibits superior toughness as the notch radius is decreased, which indicates that it will be less likely to crack or chip when machined or impacted in sharp-edge geometries.

Figure 4: Tensile bars used to generate tensile stress-strain curves

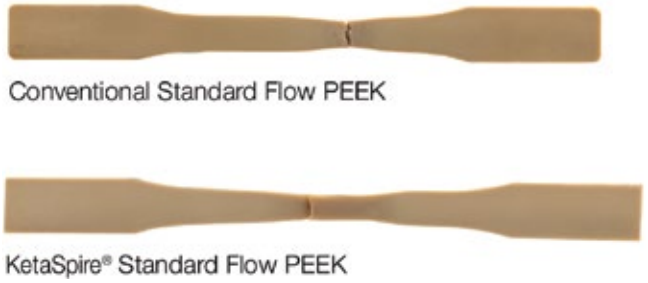
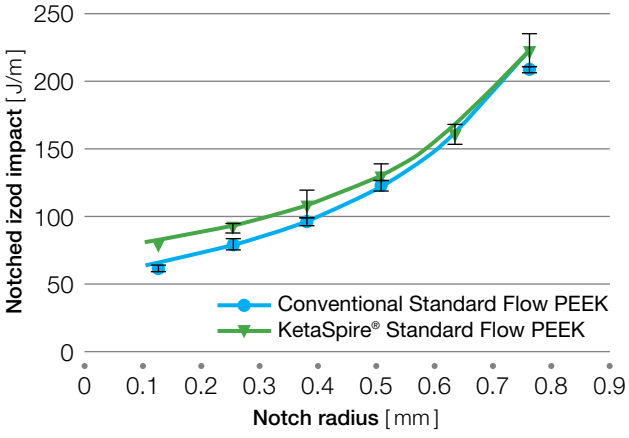


Figure 5: Notched Izod vs. notch radius (ASTM D256)



Not All PEEK is Created Equal

Extensive testing has been conducted to evaluate KetaSpire® PEEK's performance versus other commercial PEEK products. Results show that KetaSpire® PEEK offers distinct performance advantages that can be attributed to Solvay's newer polymer production technology.

KetaSpire® PEEK offers higher purity than the PEEK traditionally used in the semiconductor industry. Solvay's PEEK contains a lower amount of the metals that pose the largest risk in clean room processes. Higher purity enables higher precision, and that can give OEMs a competitive advantage.

KetaSpire® PEEK also offers superior toughness and a greater capacity to absorb a higher amount of energy or load before breaking versus conventional PEEK.

Similar to conventional PEEK, KetaSpire® PEEK meets existing performance requirements for components used in clean room equipment, including end effectors, push pins, in-process transport media, part carriers, IC test equipment, sockets, and other applications that require a well-balanced combination of strength, stiffness, dimensional stability, and excellent resistance to chemicals, wear and fatigue.

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SpecialtyPolymers.EMEA@solvay.com | Europe, Middle East and Africa
SpecialtyPolymers.Americas@solvay.com | Americas
SpecialtyPolymers.Asia@solvay.com | Asia Pacific