Polyketone Is Back

Over 15 years ago, Shell Chemical announced their exit from engineered plastic materials, which included epoxies, elastomers, thermoplastic polyester and one-of-a-kind CARILON™ aliphatic polyketone. The portfolio was sold off, except for CARILON, which was too new and needed too much additional investment. The patent portfolio for CARILON was placed with SRI International for licensing and everything changed when Hyosung of Seoul South Korea came looking for novel polymers for their industrial fibers and yarn business.

Since completing a licensing agreement in 2006, Hyosung has invested heavily in aliphatic polyketone. During this time, they developed a new polymerization catalyst, re-designed the reactor, built a two million pound capacity pilot plant, designed, built and commercialized a 110 million pound capacity production plant including infra-structure to double the output to 220 million pounds and launched a global effort to re-introduce aliphatic polyketone under the POKETONE™ brand.

What is aliphatic polyketone?

It is a terpolymer of ethylene and carbon monoxide and a small percentage of propylene. More succinctly, POK as it is abbreviated, is a semi-crystalline (very) low moisture absorbing resin, with mechanical properties similar to PBT, wear & friction performance better than POM, chemical / thermal resistance comparable to PA6 and resistance to the latest alternative motor fuels by 10x compared to PA11 and PA12.

Unreinforced POKETONE™ has similar mold shrinkage to POM and has been a drop-in, in existing injection molds. Like these other semi-crystalline resins, polyketone is easily enhanced with mineral fillers, reinforcing fibers, flame retardants, PTFE (as well as other lubricants) and custom colors. The base resin meets FDA and NSF requirements for food and potable water contact too.

How does polyketone improve the quality of my part or design?

POK resin has a lower glass transition temperature than POM, PBT and PA (6, 6/6, 6/12, 11 & 12). This lower Tg results in a high tensile elongation and a lower tensile modulus (at room temp.) and as a result POK is replacing polyamides in applications where either impact modifiers are needed or where the parts must be moisture conditioned. In addition, the elongation and modulus contribute to exceptional cyclic fatigue resistance, both tensile and flexural.

POK is solving design and performance problems now, where moisture effects, outgassing, coefficient of friction, heat resistance, chemical resistance and especially fuel resistance are causing these established resins to be less than ideal.

Some examples:

- PBT has been used for years in under the hood electrical connectors, but its Achilles heal is long term degradation due to humidity-induced hydrolysis. In addition, POK is able to fill thinner wall sections and is triple the toughness of PBT without having to add impact modifiers. Hyundai is switching the vast majority of their PBT based connectors to POK.

- A leading beverage equipment OEM is replacing PEI and PSU components with reinforced POK, not only for cost savings (and supply) but for substantial improvements in exposure to hot coffee grounds, to eliminate stress cracking from oils contained in whipped toppings and superior performance / longevity at low temperatures (frozen drink machines).

- A refrigerator latch mechanism is being changed over from POM to POK at Samsung to reduce noise and to improve toughness.

- The rotor of an air conditioner is being changed to POK from PA for improved chemical resistance and durability.

- Laser jet printer gears are being changed to POK from POM and PA to reduce noise and resolve a moisture induced change in dimensions which causes premature failure.

- New plastic conveyor chain designs are being commercialized that manage higher speeds and high contact pressures than POM owing to POK's 50 ^{o}C higher melting point. POK's abrasion resistance is also demonstrating reduced 'dusting' compared to POM.

- The bearings used in the spray tower assembly of Haier dishwashers are being changed to POK from POM to resolve a chemical attack and premature failure caused by the newer soap formulations. Wear performance and durability are also much better.

POK is finding tremendous interest in automotive fuel handling and fuel systems because of its exceptional resistance to bio-fuels, its barrier properties and its resistance to attack from fuels which have the possibility to generate acid. For these reasons, next generation devices are being designed in POK instead of POM, PA11 and PA12. In the case of PA11 and PA12, there is a very large cost savings potential as well when utilizing POK.

If your tried and true 'go to' resins like nylons, POM and PBT are not getting the job done, you need to test POK and see how great this new resin is.

PolySource is a national distributor for POKETONE™ aliphatic polyketone and is staffed to help you get the most from your POK based designs. www.polysource.net