Newsworthy developments in thermoplastic composites research have impact in the aerospace and medical sectors while the US House of Representatives and a five-country European study group look at composites in civil infrastructure.

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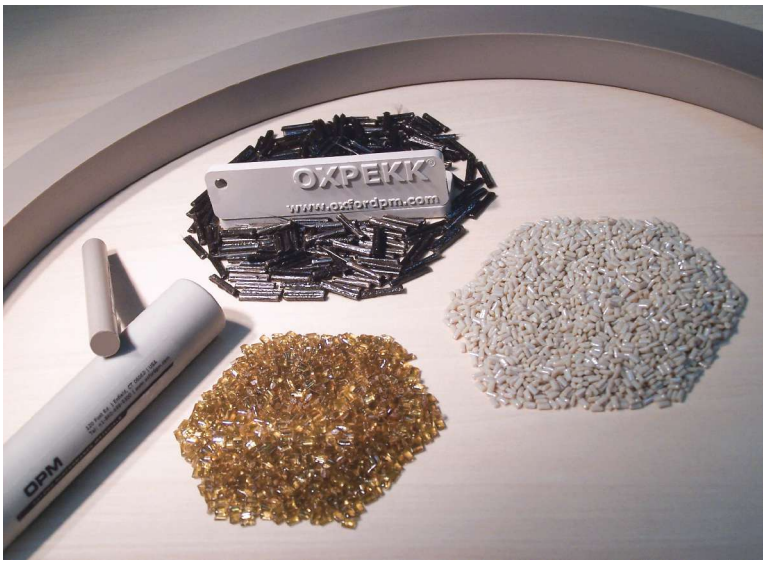
Aerospace TPCs: "Cold-process" PEKK holds promise for prepregs



As The Boeing Co. (Chicago, IL, US) and Airbus (Toulouse, France) debate how thermoplastics will play a part in near-term and future aircraft, both are evaluating the price, processability and performance of two high-performance engineered polymers: PEEK (polyetheretherketone) and PEKK (polyetherketoneketone). Members of the broader polyaryletherketone (PAEK) family, they have similar crystallinity, a characteristic that affects both the polymer's mechanical properties in a finished part and the speed at which it can be processed as composite parts are molded. Although PEEK has been the predominant choice in aerospace for two decades, its processing temperature is higher (385-390°C). Alternatively, PEKK offers a wider, lower-temperature process window (355-375°C). The two are currently cost-competitive, but that could change as the market scrambles to address capacity and quality concerns when suppliers compete for work packages announced by Boeing and future aircraft fuselage and wing development programs in Europe.

Against this backdrop, Oxford Performance Materials (OPM, South Windsor, CT, US) has introduced a new PEKK product, OXPEKK-LTS, which it claims offers some interesting advantages. OPM CEO Scott DeFelice notes all PEKK products on the market today are made using a method originally developed by DuPont (Wilmington, DE, US), which uses high-temperature synthesis (HTS). DeFelice notes that this HTS process runs fairly fast, which keeps cost down, but points out there was another process, developed by Raychem, which was sold to BASF (Wyandotte, MI, US), but the latter abandoned PAEK materials. "Raychem's technology was for *low*-temperature synthesis (LTS)," says DeFelice.

The HTS process produces PEKK polymer *flake* which must then be ground before being mixed with solvent, etc., for prepreg and 3D printing applications. LTS technology, however, enables production of a *powder* with a spherical shape that is possible to control. DeFelice asserts that because LTS is a "cold" process, it is also much more controllable in terms of the finished polymer's molecular weight and molecular structure. Although the LTS process is slower and, thus, a little more costly "it is also possible to go directly to powder with no grinding step," says DeFelice, "which helps to offset the slower processing."

This patented LTS process is the basis for OPM's new OXPEKK-LTS product. DeFelice claims it offers the best of both worlds: a controllable process that produces a product with a spherical polymer powder. "With grinding, you end up with jagged 'rocks' of polymer which are difficult to stack uniformly when coating and impregnating a tape," he explains. "The round shape of OXPEKK-LTS allows more precision during tape making." So now we can improve the tape and enable true out-of-autoclave (OOA) processing via in-situ consolidation, which is hampered by current tape dimensional fidelity." The result is a lighter structure with greater strength-to-weight and fatigue than can be achieved with a PEEK-based part, produced in one step instead of two. (Read more online about in-situ consolidation in *CW*'s two-part series | **short.compositesworld.com/ISC-Part1** | **short.compositesworld.com/ISC-Part2**.)

"The physics of round polymer particles in prepregging is well-established," says DeFelice. "We believe we offer control of these particles which then gives more levers to achieve the balance needed for producing large OOA primary structures that meet cost and performance targets. We have very powerful tools to get this technology where Airbus and others want it to be." OXPEKK LTS will be introduced for developmental purposes by the end of 2018 and commercially available in early 2019.