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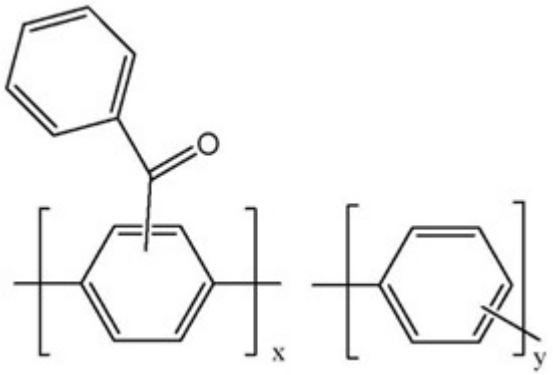
Self Reinforcing Polyphenylene (SRP)

Self reinforcing polyphenylene is a revolutionary new family of ultra-performance engineering polymers whose main polymer backbone structure is comprised entirely of directly linked phenylene units. This class of polymers had been known for a long time, but it was only in the last few years that these polymers have been possible to produce on production scale in a form that is amenable to conventional thermoplastic melt processing and fabrication techniques. This was achieved by the careful tailoring of backbone substituent groups and other aspects of molecular architecture of the polymers. The main backbone repeating unit constituents of SRP polymers are shown in the generic combination of two structures represented below:



This wholly aryl-aryl bonded backbone chemical make-up confers some very unique physical and mechanical attributes to these polymers including tensile strength and Young's modulus values that are higher than those of any other unreinforced commercially available thermoplastic. Indeed, the strength and stiffness properties of SRP in their natural unreinforced state are comparable to those of short fiber-reinforced plastics but without the known downsides of fiber reinforced plastics. For example, short fiber reinforced plastics exhibit anisotropic behavior where the mechanical properties are highly dependent on part geometry and processing/fabrication steps, SRP exhibits more or less uniform properties in all directions with little dependence on part geometry or fabrication steps used to produce the finished part. Also, unlike fiber reinforced plastics, which typically exhibit tensile brittle breaks with elongations of less than 3%, SRP offers ductile mechanical deformation behavior with tensile elongations of 8% or higher.

SRP polymers are completely amorphous and have glass transition temperatures (Tg) that are generally in the range from 150 to 180°C depending on specific composition and grade. Because of their amorphous nature these polymers are transparent in their natural state although they can be dark in color depending on how they are melt processed.

This polymer has a tensile yield strength of 21,500 psi (148 MPa) and a tensile modulus of 800 kpsi (5.3 GPa). These strength and modulus (stiffness) of SRP are thus about 50% higher than those of unreinforced PEEK. These superior mechanical properties are also achieved with a relatively low specific gravity of only 1.19 compared to 1.30 for PEEK. On a strength-to-specific gravity ratio basis, SRP offers strength that is on par with or higher than those of many metal alloys. For example the specific strength of SRP is comparable to that of the magnesium AE42-F alloy.