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Comparison of Ryton® PPS Types

There are three distinct types of Ryton® PPS polymers: cured, linear and branched. Each type offers a unique set of properties that enable compounded products with varying combinations of physical, electrical, thermal, and chemical-resistant properties to meet a broad range of application-specific requirements. Performance characteristics inherent to a variety of Ryton® PPS polymer systems are outlined in this bulletin.

Regular PPS

Regular PPS is an off-white, linear polymeric material of modest molecular weight and mechanical strength. The polymer exhibits a glass transition temperature (T_g) of approximately 85 °C and an approximate melting temperature (T_m) of 285 °C. When heated above T_g, the material crystallizes rapidly. Regular PPS is primarily used in coatings.

Cured PPS

Cured PPS results from heating of PPS in the presence of oxygen (curing). Generally, the property changes that occur are a result of molecular chain extension and formation of molecular chain branches that increase the molecular weight, resulting in some thermoset-like properties. Examples of these thermoset-like properties, including good thermal stability, dimensional stability, and resistance to harsh chemical environments. However, PPS is a thermoplastic and does not suffer from many of the shortcomings of thermosets. Cured PPS performs well in coatings and injection molding compounds.

HMW Linear PPS

HMW linear PPS has a higher molecular weight than regular PPS. The molecular weight of this polymer is nearly double that of regular PPS. This characteristic is achieved directly by polymerization. Curing is not necessary. The increased molecular chain length results in higher tenacity, elongation, and impact strength. These characteristics make HMW linear PPS ideal for fibers and tougher injection molding compounds.

HMW Branched PPS

HMW branched PPS also has higher molecular weight than regular PPS. However, the “backbone” of the extended molecule has additional polymer chains branched from it. This attribute improves some mechanical properties, as well as tenacity and ductility. HMW branched PPS is suitable for films and injection molding compounds.

Glass Reinforced PPS Compounds

On the accompanying page is data comparing the mechanical and thermal properties of 40 % glass reinforced injection molding compounds made from cured PPS and HMW linear PPS. The data given in Table 1 shows that compounds utilizing cured PPS, such as Ryton® R-4-200NA, can provide mechanical properties comparable to any compounds utilizing exclusively uncured HMW linear PPS. Figure 1 and Figure 2 show that even when HMW linear PPS may provide greater tensile or flexural strength than cured PPS at room temperature, there is little difference in mechanical strength at elevated temperatures. Figure 3 illustrates that there is little difference in flexural modulus (stiffness) between cured PPS and HMW linear PPS, even at elevated temperatures. Figure 4 and Figure 5 exemplify the superior elevated temperature creep resistance of Cured PPS compared to HMW linear PPS.

Bibliography

J. F. Geibel and J. E. Leland, Encyclopedia of Chemical Technology, Vol. 19, p. 904 (1996).

Table 1: Properties of 40 % glass filled PPS

Property	Unit	HMW Linear PPS	Ryton® R-4-200NA	Method
Tensile Strength	MPa	195	195	ISO 527
Elongation	%	1.9	1.7	ISO 527
Flexural Strength	MPa	285	280	ISO 178
Flexural Modulus	GPa	14	14	ISO 178
Notched Izod	kJ/m²	10.0	9.0	ISO 180
Unnotched Izod	kJ/m²	35	35	ISO 180

Figure 3: Flexural modulus vs. temperature

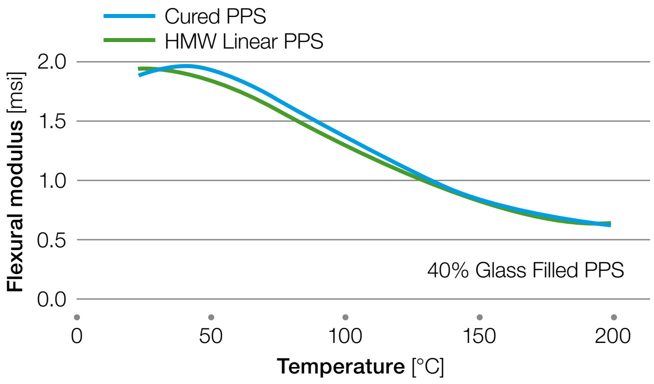


Figure 1: Tensile strength vs. temperature

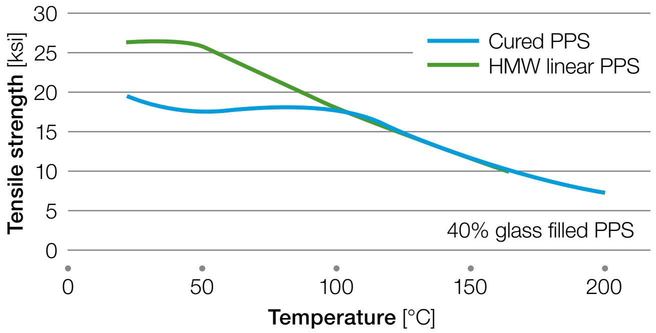


Figure 4: Tensile creep at 250 °F and 5,000 psi

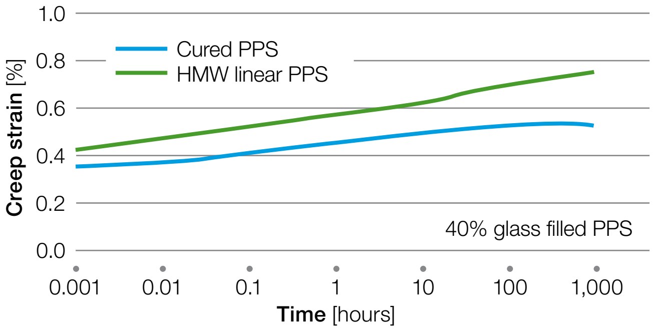


Figure 2: Flexural strength vs. temperature

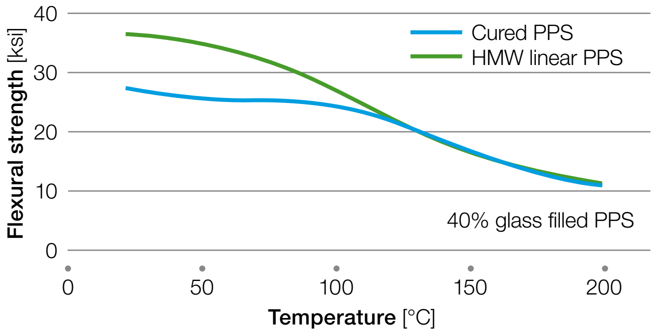
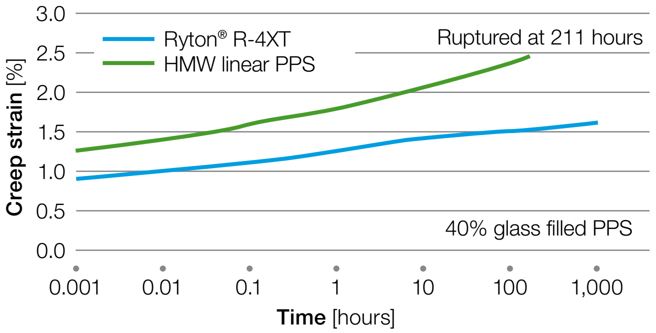


Figure 5: Tensile creep at 250 °F and 10,000 psi



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