Tensile Creep

Radel® R-5000 PPSU

When a plastic component is subjected to a load, there will be a predictable deformation. If the load is sustained, the deformation will continue to increase without any increase in load. This deformation is commonly referred to as creep. When designing for sustained load, it is important to include creep in the deformation calculations. The use of the creep modulus instead of the elastic modulus in the design calculations will account for the deformation due to creep. Creep modulus, however, is not a constant. Rather, it is defined as the ratio of stress to strain at a specified time interval and temperature.

The method used to determine the creep characteristics of Radel® R-5000 polyphenylsulfone (PPSU) was ASTM D2990, which is quite similar to ISO 899. The test specimen used was an ASTM D638 Type I tensile bar. Five stress levels were used: 3 MPa (430 psi), 7 MPa (1,010 psi), 10 MPa (1,450 psi), 20 MPa (2,900 psi), and 30 MPa (4,350 psi). The gauge length used was 25 mm (0.1 inch). Tests were conducted at three temperatures: 23 °C (73 °F), 95 °C (203 °F) and 160 °C (320 °F). The elongation was monitored at time intervals up to 2,000 hours. Strain was calculated by dividing the elongation by the initial length and multiplying by 100. At 160 °C (320 °F) and 30 MPa (4,350 psi), rupture occurs in less than 10 hours. Creep modulus versus time curves are shown in Figures 1 through 3; isochronous stress/strain curves are shown in Figures 4 through 6.

Figure 1: Creep modulus at 23 °C (73 °F)

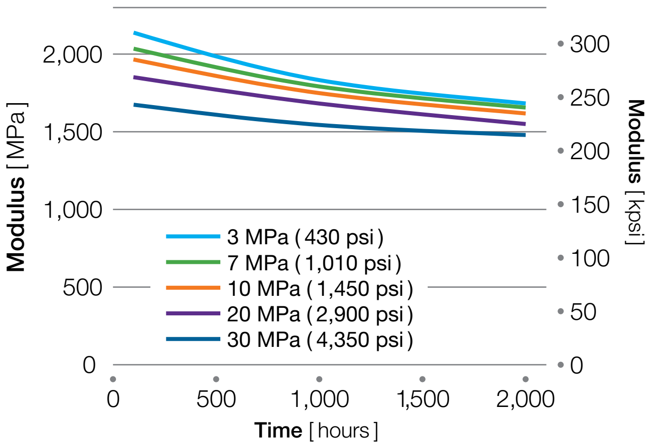


Figure 2: Creep modulus at 95 °C (203 °F)

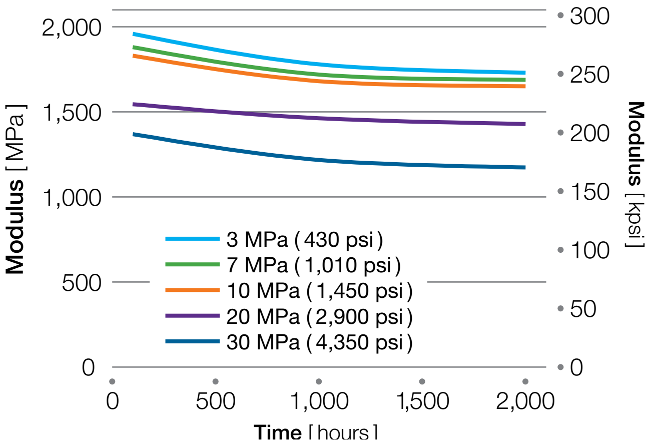


Figure 3: Creep modulus at 160 °C (320 °F)

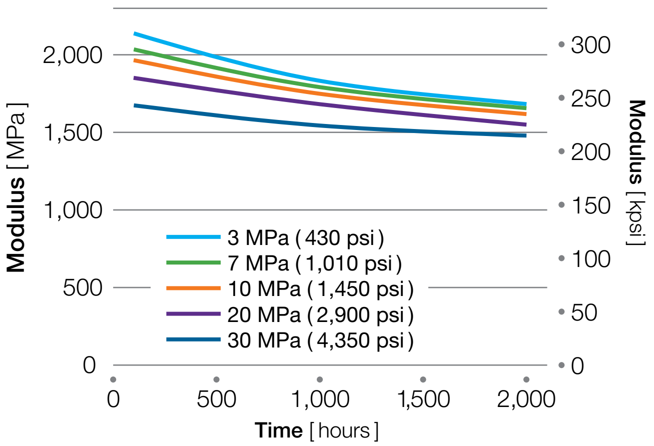


Figure 4: Isochronous stress/strain curves at 23 °C (73 °F)

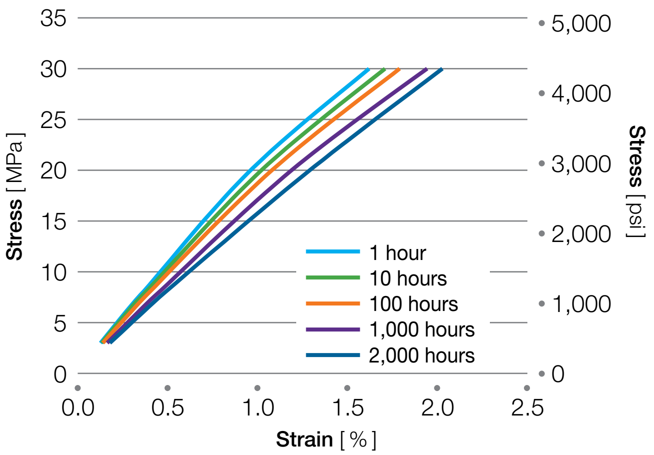


Figure 5: Isochronous stress/strain curves at 95 °C (203 °F)

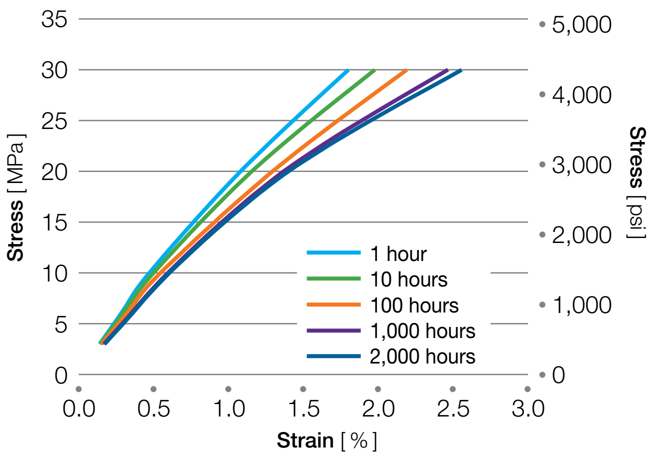
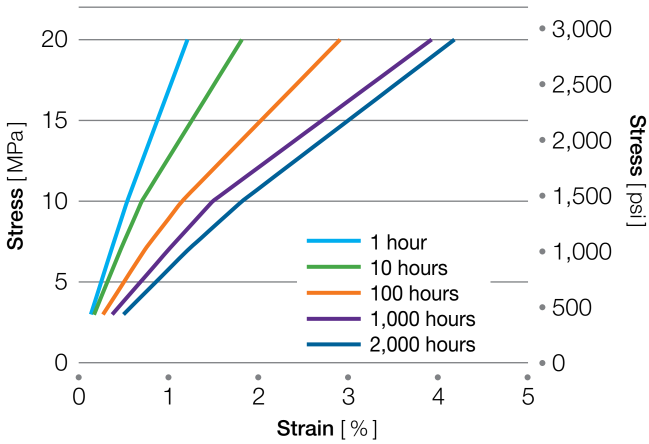


Figure 6: Isochronous stress/strain curves at 160 °C (320 °F)



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