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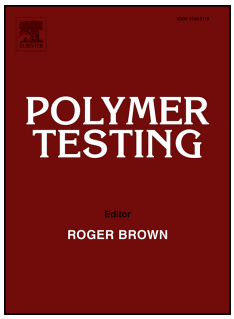

Identification of the viscoelastic properties of the tBA/PEGDMA polymer from multi-loading modes conducted over a wide frequency–temperature scale range

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Material Properties

Identification of the viscoelastic properties of the tBA/PEGDMA polymer from multi-loading modes conducted over a wide frequency–temperature scale range

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Abstract

The viscoelastic properties of tBA/PEGDMA, which is a Shape Memory Polymer (SMP), were characterized over wide bands of frequency and temperature. The continuity of the viscoelastic properties identified according to the frequency, the temperature, the loading mode and the test scale was assessed. Seven experimental methods were used, from quasi-static to high frequencies, in tensile, shear and compression, from the nanoscopic scale to the macroscopic scale. The storage modulus and the loss factor of the SMP were evaluated and compared from one method to the other. The comparison between the various tests was done based on measurements obtained with a Dynamic Mechanical Analysis and extrapolated through the Time-Temperature Superposition principle. All the data gathers on a unique master curve. For the various experimental methods, it appears that all the viscoelastic properties are consistent even if different scales and loading modes are involved. This wide band characterization makes it possible to determine the mechanical viscoelastic properties of the tBA/PEGDMA in order to use it in structural applications. The experimental methods used in this paper combine commercial methods and in-house high-tech methods. It should be emphasized that the set of experiments covers effective measurements from 10^{-4} to 10^{6} Hz, 0 to 90°C, strain levels from 10^{-4}% to 5%, at nano, micro and macro scales on the same material.