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Prediction of Creep Behavior in PMMA JAMES CARUTHERS, REBECCA MARTIN, GRIGORI MEDVEDEV, Purdue University — Recently proposed thermoviscoelatic constitutive model (TVEM) of Caruthers et al. [1] has shown promise in being able to describe within a single set of material parameters a wide range of experiments including yield, stress and enthalpy relaxation, and nonlinear stress-strain behavior under complex loading histories. The TVEM program consists in performing a number of linear relaxation experiments (i.e. for small deviations from equilibrium in relaxing quantity) in order to determine the shear, bulk, and enthalpy relaxation spectra which serve as input to the TVEM constitutive equations. Once these memory functions have been set, TVEM must be able to predict results of a non-linear experiment under an arbitrary thermal and loading history without any further adjustment of model parameters. Following this program we carried out an extensive study of relaxation behavior of lightly cross-linked PMMA using TMA, DMA, and DSC techniques. The nonlinear experiments chosen for validation of TVEM were the creep experiments below Tg where we studied the dependencies on load, temperature, and aging time. We also performed multi-step loading-unloading experiments in both linear and non-linear regimes. In this report the predictive capabilities of TVEM are presented and critically analyzed. 1. J.M. Caruthers, D.B. Adolf, R.S. Chambers, P. Shrikhande - Polymer, 45, 4577 (2004)

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