Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Viscosity-Based Constitutive Model for the Nonlinear Deformations of Shape Memory Network Polymers KRISTOFER WESTBROOK, FRANCISCO CASTRO, H. JERRY QI, Mechanical Engineering Department, University of Colorado, Boulder — Shape memory polymers (SMP) are materials that can recover a large pre-deformed shape in response to environmental stimuli. This capability makes SMPs suitable materials for applications such as smart fabrics, biomedical devices and deployable structures. For a thermally induced amorphous SMP, the pre-deformation and recovery of the shape require the SMP to traverse its glass transition temperature (Tg) to complete the shape memory (SM) cycle. The dramatic change in viscosity (molecular chain mobility) as the temperature traverses the Tg is the underlying mechanism of the SM effect. As the temperature decreases from above to below the Tg, the material exhibits a transition from a low to high viscosity and the material relaxation increases substantially. Here, the mechanical response of an acrylate-based polymer network is characterized under various thermomechanical histories. A constitutive model is developed to capture the material behavior and implemented to predict responses of the material in specific biomedical applications.

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Date submitted: 20 Nov 2009 Electronic form version 1.4