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Mechanical Measurement of Gels: Pre-stress and Failure SAMI FAKHOURI, SHELBY HUTCHENS, ALFRED CROSBY, University of Massachusetts Polymer Science and Engineering — A recently developed technique, Cavitation Rheology (CR), provides a means of measuring the mechanical properties of soft materials on length scales from ~ 0.1 μm to mm at a specific location. CR involves inflation of a small bubble at the tip of a syringe needle which has been inserted into a material. After insertion, the pressure in the syringe is raised until a critical point where the material fails, resulting in rapid inflation of a cavity at the syringe tip. The critical pressure for failure can provide information about the materials properties of the system such as the elastic modulus, E, the critical strain energy release rate, G_c, and the surface energy, γ. Modulus measurements by CR have been made in many synthetic gels and biological tissues with similar accuracy to shear rheology. However, as CR requires insertion of a needle into the subject material, measurements are inherently made in a pre-stressed state. In this work, we have examined the pre-stress associated with needle insertion and the influence of this stress on failure in a synthetic gel of PMMA-PnBA-PMMA triblock copolymer in 2-ethylhexanol.

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