

Abstract Submitted
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Cavitation Rheology and Fracture Behavior of Polyacrylamide Hydrogels SANTANU KUNDU, ALFRED CROSBY, University of Massachusetts-Amherst — Cavitation rheology is a new characterization technique for the measurement of mechanical properties on small length scales, e.g. 10 -1000 μm , at any arbitrary location within a soft material. The technique involves growing a cavity at the tip of a syringe needle and monitoring the pressure of the cavity at the onset of instability. This critical pressure is directly related to the local modulus of the material. We used this technique to characterize the network mechanics of polyacrylamide hydrogel materials, a common material used in many biological applications. Gels with different moduli, which were obtained by varying initial monomer to water ratio, were investigated. As monomer concentration increased, a transition from stable cavity to fracture was observed. Applying scaling theory for gels, we modify the Lake-Thomas Theory for the fracture of crosslinked networks to relate the transition from cavitation to fracture in terms of molecular parameters. We anticipate this fundamental understanding of cavitation and fracture mechanism will be applicable to biological tissues, as well as the development of advanced soft materials

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