Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Injection initiated fracture in soft solids. SHELBY HUTCHENS, STEVEN YANG, Univ of Illinois - Urbana — Damage accumulation in soft materials under hydrostatic loading conditions is a primary injury mechanism in blast and blunt force trauma. A recently explored technique known as cavitation rheology (CR) provides a promising avenue for quickly and inexpensively approximating hydrostatic conditions via the reverse loading scenario, void pressurization. Past CR measurements of synthetic, polymeric materials at length scales from mm's to μm's have been found to correlate with both elastic modulus and fracture energy. The technique is performed via pressurization of fluid within a needle that is embedded within a material. This experimental setup allows crack evolution to be monitored, similar to traditional pre-notched failure samples. We observe a systematic evolution of crack morphology as a function of cross-link density in a soft elastomer. Crack shape is quantified using micro-computed tomography and shown to transition from being roughly penny-shaped to multi-lobed (predominately three) to spherical with decreasing crosslinking. Moduli are on the order of kPa. We describe this morphology evolution using a balance between the energetic costs of the strain energy in deforming the surrounding material and the intrinsic fracture energy necessary to form a new surface.

Shelby Hutchens
Univ of Illinois - Urbana

Date submitted: 11 Nov 2016 Electronic form version 1.4