As the properties of polymer gels can be tuned, polymer gels consisting of both synthetic and biopolymers are found in many applications ranging from bioimplants to food materials to tissue scaffold to oil recovery to drug delivery. In many of these applications swollen gels are subjected to large-strain deformation, which result in elastic instabilities (cavitation, creasing) and failure (fracture). Here, we present large-strain deformation behavior of a physically associating thermoreversible gel and an ionicically bonded alginate gel. The physically associating gel, consisting of a triblock copolymer, poly(methyl methacrylate)–poly(n-butyl acrylate)–poly(methylmethacrylate) in 2-ethyl-1-hexanol, displays strain-stiffening behavior as investigated by small- and large-amplitude oscillatory (LAOS) shear experiments. In contrast, the alginate gel strain-softens at large shear-strain. Gel deformation behavior is also investigated using newly developed cavitation rheology technique. This technique involves pressurization of a defect introduced by inserting a needle at an arbitrary location within a gel and monitoring the pressure as a function of time. At a critical pressure the gel either cavitates or fracture and the critical pressure scales with the local elastic modulus of the gel. The transition from cavitation to fracture has been studied as a function of gel network structure.

Friday, January 17th, 2014
11:00AM – 12:00 PM
Lindy Boggs Room 104

Light refreshments provided