# Large-strain Deformation Behavior of Swollen Polymer Gels

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Swollen polymer gels are used in a wide variety of applications ranging from bioimplants to food materials to drug delivery to tissue engineering. In many of these applications gels are subjected to large-strain deformation, however, very little is known how the swollen gels with different molecular architecture behave at large-strain. In this presentation, I will present our recent results on the non-linear mechanical responses, elastic instability, and failure behavior of two different gels: a physically crosslinked gel (triblock gel) and an ionically crosslinked gel (alginate gel). The physical gel consists of a triblock copolymer poly(methylmethacrylate)-poly(n-butylacrylate)-poly(methylmethacrylate) [PMMA-PnBA-PMMA] in a mid-block selective solvent. Both small and large amplitude oscillatory shear experiments were used to understand the gelation behavior, and rheological properties of these gels. Failure behavior of these gels initiated from a defect was investigated using cavitation rheology, a new characterization technique. It involves growing a cavity at the tip of a syringe needle (~10 -1000 μm) located at any arbitrary location within a gel and monitoring the pressure at the onset of instability and fracture. The onset or critical pressure is directly related to the local mechanical properties of the material. Cavitation and shear-rheology results capture distinctly different non-linear behavior and failure responses for the triblock and alginate gels. The effect of graphene nanoplatelets on the self-assembly and mechanical properties of the triblock gel will also be presented. Our results provide a fundamental understanding gel failure mechanism at large-strain.

**Bio:**

Dr. Santanu Kundu is an Assistant Professor in the Dave C. Swalm School of Chemical Engineering of Mississippi State University since January 2012. Before joining Mississippi State Dr. Kundu performed postdoctoral research in the Sustainable Polymers Group (Polymers Division) of the National Institute of Standards and Technology (NIST) and with Prof. Alfred Crosby at the Polymer Science and Engineering Department of the University of Massachusetts-Amherst. Dr. Kundu has received his PhD in Chemical Engineering from Clemson University in 2006. His PhD work, which linked flow, microstructure, and the processing of liquid crystalline carbonaceous materials, has been awarded the best dissertation in Carbon Science (2004-2006) by the Elsevier-Carbon journal. Dr. Kundu's research interest is investigating the processing-structure-property relationships for various soft materials towards applications ranging from bioimplants to energy storage to water purification to structural composites. He is the recipient of the 2014 NSF Early Career Award.