Pre-Stressed Double Network Elastomers And Hydrogels
NAVEEN SINGH, ALAN LESSER, Polymer Science and Engineering Dept., University of Massachusetts at Amherst — A new approach to prepare and characterize pre-stressed double network elastomers and hydrogel systems is investigated. In one example, a styrene-butadiene-styrene (SBS) tri-block copolymer system containing physical cross-links is used to achieve a pre-stressed double network by additional chemical crosslinking in a strained state using ultra-violet (UV) light. Unusual physical and mechanical properties that result from the interactions between each network are presented. These double network elastomers show a transition between competitive and collaborative behavior in their mechanical properties, as well as lower permanent set in both low and high strain regimes along with lower hysteresis. These networks exhibit lower modulus, along with lower coefficient of thermal expansion, still showing lower swelling ratios, which results from a competition of the networks. In another example, a new two-step curing schedule is utilized for Polyacrylamide based hydrogels, where a strain is induced in the middle of curing reaction. The final mechanical properties of these double network hydrogels are studied and compared to both first network and the single network formed without any step strain.

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