Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Photo-Crosslinkable Shape-Memory Elastomers Containing Hydrogen-Bonding Side-Groups

JIAHUI LI, CHRISTOPHER LEWIS, MITCHELL ANTHAMATTEN, University of Rochester — Lightly crosslinked poly(butyl acrylate) networks containing self-complementary hydrogen bonding side-groups (e.g. ureidopyrimidinones) can exhibit unique shape-memory effects. Conventional free-radical solution polymerization of monomer mixtures offers a simple approach to achieving these networks, but presents the following limitations: (i) the H-bonding side- group content is limited by its solubility; (ii) prepared networks can only be studied in their crosslinked form; and (iii) upon solvent removal, intrinsic stress is generated making shape-memory responses difficult to interpret. Here, photo-polymerization of linear prepolymers is reported as an approach to overcome these limitations. A series of linear poly (butyl acrylate)s containing light-sensitive benzophenone side- groups and H-bonding side-groups were prepared using free radical polymerization. These pre-polymers can be fully characterized in solution (NMR, GPC). Moreover, following solvent removal, they can be molded into any desired shape and subsequently photo-crosslinked to form shape-memory elastomers. The impact of H-bonding side-group content and the benzophenone side-group content on the mechanical properties of the photo-crosslinked polymer will be discussed. A constitutive model is also developed to interpret the mechanical response of these shape-memory elastomers.

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Date submitted: 20 Nov 2009 Electronic form version 1.4