

Invited Presentation

Thermoreversible networks for moldable photo-responsive elastomers (Presentation Recording)

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ABSTRACT

Soft-solids that retain the responsive optical anisotropy of liquid crystals (LC) can be used as mechano-optical, electro-optical and electro-mechanical elements. We use self-assembly of block copolymers to create reversible LC gels and elastomers that flow at elevated temperatures and physically cross link upon cooling. In the melt, they can be spun, coated or molded. Segregation of the end-blocks forms uniform and uniformly spaced crosslinks. Matched sets of block copolymers are synthesized from a single "prepolymer." Specifically, we begin with polymers having polystyrene (PS) end blocks and a poly(1,2-butadiene) midblock. The pendant vinyl groups along the backbone of the midblock are used to graft mesogens, converting it to a side-group LC polymer (SGLCP). In the present case, cyanobiphenyl groups are used as the nonphotoresponsive mesogens and azobenzene groups are used as photoresponsive mesogens. Here we show that matched pairs of block copolymers, with and without photo-responsive mesogens, provide model systems in which the optical density can be adjusted while holding other properties fixed (cross-link density, modulus, birefringence, isotropic-nematic transition temperature). For example, a triblock in which the SGLCP block has 95% cyanobiphenyl and 5% azo side groups is miscible with one having 100% cyanobiphenyl side groups. Simply blending the two gives a series of LC elastomers that have from 0 to 5% azo, while having all other physical properties matched. Results will be presented that show the outcomes of this approach to systematic and largely independent control of optical density and photo-mechanical sensitivity.

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