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Modeling dynamic mechanical response in polydomain nematic elastomers[1] BADEL MBANGA, Liquid Crystal Institute, Kent State Univ., FANGFU YE, Dept. of Physics, Univ. of Illinois, Urbana, JONATHAN SELINGER, ROBIN SELINGER, Liquid Crystal Institute, Kent State Univ. —

When a polydomain nematic elastomer is subject to a uniaxial strain, it may undergo a transition to a monodomain texture. We model the resulting microstructural evolution and dynamic mechanical response using a 3-d finite element elastodynamics approach. We show that the nature of the transition is governed by the thermomechanical history of the sample. In particular, polydomain samples crosslinked in the nematic phase (N-PNE) show a pronounced "crosslink memory" effect, in which the local preferred nematic director orientation is imprinted in the polymer network upon crosslinking. By contrast, the cross-link memory effect is at least an order of magnitude smaller in samples crosslinked in the isotropic phase (I-PNE). Our simulation results are in good qualitative agreement with observed differences in the stress-strain behaviors of N-PNE and I-PNE materials, as seen in recent experiments [K. Urayama, Macromolecules 2009].

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