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Dynamic Theory for Polydomain Structures in Liquid-Crystal Elastomers[1] AYHAN DUZGUN, JONATHAN SELINGER, Kent State Univ - Kent — Liquid-crystal elastomers are remarkable materials that combine the elastic properties of cross-linked polymer networks with the anisotropy of liquid crystals. Any distortion of the polymer network affects the nematic order of the liquid crystal, and, likewise, any change in the magnitude or direction of the nematic order influences the shape of the elastomer. When elastomers are prepared without any alignment, they develop disordered polydomain structures as they are cooled into the nematic phase. To model these polydomain structures, we develop a dynamic theory for the isotropic-nematic transition in elastomers. In this theory, the local nematic order is coupled to the strain tensor, which satisfies the constraint of elastic compatibility. If the system is rapidly cooled into the nematic phase, a polydomain state with a characteristic length scale can emerge. This polydomain state may eventually become uniform, or it may be locked in by quenched impurities.

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