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Mechanics of nematic elastomers: modeling, analysis, and numerical simulation.

The deep understanding coming from the study of martensitic transformations in metals has often provided the tools for the accurate prediction of the mechanical response of other materials. Liquid crystal polymers and, in particular, nematic elastomers provide an example in this direction. Similarities in physical behavior e.g., soft elasticity, which is the analogue of superelasticity or stripe-domain instability, which is the analogue of mechanical twinning) have inspired the use of similar thermodynamic models and mathematical techniques based on the minimization of multi-well free-energies.

In this talk, we will review the recent progress on the modelling of martensitic-like microstructures in nematic elastomers, which has led to accurate coarse-grained models for the effective mechanical response. Highlights on current research will also be presented, with the aim of showing that nematic elastomers provide an extremely valuable model system to sharpen our understanding of material response governed by evolving microstructures.