Theory and Modeling 8: 3:10 - 3:30 p.m.

Chiral Ribbons Formed by Nematic Elastomer Films

Fangfu Ye,[1] Vianney Gimenez, Badel Mbanga, Robin L. B. Selinger, and Jonathan V. Selinger[2]

Liquid Crystal Institute, Kent State University, Kent, OH 44242, USA

One of the most attractive properties of liquid crystal elastomers is that their shape can change easily when subjected to external stimuli. In this project, we investigate the shape change of heated nematic elastomer films. We focus on samples in which the nematic order direction changes smoothly from the bottom surface to the top surface with the director of the middle surface parallel to the long axis of the film. The difference between the order directions on the top and bottom surfaces causes these two surfaces to respond differently to heating, and the film is thus expected to change shape. Our calculation shows that a thick film which is initially flat will twist around its central line upon temperature increase, forming a straight helicoid. However, when the ratio between the thickness and the width of a nematic elastomer film gets smaller than a certain critical number, the central line of the film will curve into a spiral line and the film itself will form a spiral ribbon. We also show explicitly how the wavelength of these two types of chiral ribbons changes with various physical parameters.

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[1] Present address: Department of Physics, University of Illinois at Urbana-Champaign, Urbana, IL 61801, USA. E-mail: fye@illinois.edu

[2] E-mail: jvs@lci.kent.edu