Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Auto-origami with defects: modeling blueprinted liquid crystal polymer networks[1] ROBIN SELINGER, ANDREW KONYA, VIANNEY GIMENEZ-PINTO, Kent State Univ. — Coupling between topological defects and curvature plays an important role in morphology and microstructural evolution of soft matter with orientational order. We explore this coupling in photoresponsive liquid crystal polymer networks (LCN), which deform under illumination by shrinking along the nematic director and expanding in orthogonal directions. If a non-uniform director field is imposed when a sample is cross-linked, known as "blueprinting," illumination induces non-uniform strain, causing the sample to change shape. The 3-D director field thus encodes a complex deformation, a form of programmed auto-origami. Topological defects in the director field induce an initially flat sample to deform out-of-plane, forming structures with Gaussian curvature. Using 3-D finite element elastodynamics simulation studies, we model the actuation of a photoresponsive LCN containing high order topological defects (from +10 to -10) and defect arrays, and compare to recent experiments by McConney et al [1]. We also model blueprinted structures with a striped pattern of twisted domains which form tear-drop shaped accordion folds, and compare to experiments by de Haan et al [2]. Finally, we compare the physics of defect-curvature coupling in LCN with that in other materials such as lipid membranes.

[1] DOI: 10.1002/adma.201301891
[2] DOI: 10.1002/adfm.201302568

[1]Supported by NSF DMR-1106014.

Robin Selinger
Kent State Univ.

Date submitted: 15 Nov 2013 Electronic form version 1.4