An investigation on disclination defect and nematic order coupled nonlinear behavior of liquid crystal glassy polymer using quasi-soft energy

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Photo-responsive polymer (PRP) broadly refers the polymer that shows strong, macroscopic displacement due to light and temperature as an external stimuli. For azobenzene-doped liquid crystal polymer, light induced response is driven by nematic-isotropic order change stimulated by photoisomerization of the mesogens. In this study, anisotropic, stimuli-responsible material is modeled via linearized quasi-soft energy that mediates between light and stress-strain relation. Corotational formula is used for finite element formulation to explain geometric nonlinear shape change such as bending with large rotation. The contribution of light, temperature and director of liquid crystal mesogens to the bending, twisting, and instabilities such a wrinkling behavior observed in PRP is investigated throughout present study. The latter offers a rich possibility to use of liquid crystal's disclination defect into a measure to design nontrivial topology of thin flat sheets.

Keywords: Photo-responsive polymer (PRP), Geometric nonlinearity, Quasi-soft free energy, Disclination defect

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