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Effect of ZnO nanoparticles on the morphology, dielectric, electro-optic and photoluminescence properties of a confined ferroelectric liquid crystal material

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Abstract

The influence of spherical zinc oxide nanoparticles (ZnO-NPs) incorporated in low concentrations (0.45, 0.7, 1.0 wt./ wt. %) into a polymer confined ferroelectric liquid crystal (FLC) has been investigated. Varying the concentration of ZnO- NPs is found to have a profound impact on the morphology of the polymer dispersed ferroelectric liquid crystal (PDFLC) composites. With increasing ZnO- NP content, the real and imaginary parts of the permittivity and the dielectric strength of a relevant relaxation mode depict an increase. However, the associated relaxation frequency shifts to lower values; a concomitant increase in spontaneous polarization is also observed. The response time of the composites slightly improved on doping with the ZnO-NPs. The changes in electro-optic and dielectric parameters are explained in terms of change in elastic energy as well as surface morphology of the composites. Interestingly, the polymer/liquid crystal environment is also seen to enhance the photoluminescence response of confined FLC.

Keywords: polymer dispersed ferroelectric liquid crystal, ZnO-NPs, morphology, dielectric relaxation, spontaneous polarization, photoluminescence spectroscopy.

Introduction

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