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Investigation of electrical and nonlinear optical properties of colloidal composite nematic liquid crystal

Z. Dehghani^{a,*}, N. Dalir^b, M. Nadafan^{c,d}, M. H. Majles Ara^e, E. Saievar Iranizad^c

^aDepartment of Physics, University of Neyshabur, Neyshabur, P. O. Box 9319774400, I.R. Iran

^bDepartment of physical chemistry, Tarbiat Modares University, Tehran, P. O. Box 14115-175, I.R. Iran

^cDepartment of physics, Tarbiat Modares University, Tehran, P. O. Box 14115-175, I.R. Iran

^dDepartment of Physics, Shahid Rajaei Teacher Training University, Tehran, Lavizan, P. O. Box 16788-15811, I.R. Iran

^eDepartment of Physics, Kharazmi University, Tehran, P. O. Box 15719-14911, I.R. Iran

Abstract:

The synthesized TiO₂ nanoparticles (NPs) doped to nematic liquid crystals (NLCs) with 1% wt. for both alignments (homeotropic and homogeneous). Dielectric permittivity of samples was measured by LCR meter at different temperatures. TiO₂ NPs doped into NLCs show higher permittivity than pure NLCs. According to the obtained results, the permittivity of ϵ_{\perp} increases more than ϵ_{\parallel} in samples. The magnitude and temperature dependence of the refractive indices of TiO₂ NPs doped into NLCs are reported. Investigated electrical behavior of the sample was studied over a wide range of frequency using a complex impedance spectroscopy (CIS) technique. The third-order nonlinear optical properties of TiO₂ NPs doped into NLCs which tested by a Z-scan method with continuous wave (CW) He: Ne laser beam, are reported. The Z-scan results revealed that the TiO₂ NPs in NLCs exhibit self-focusing nonlinearity and saturable absorption effect for both alignments. The results showed that NLCs doped with a small amount of TiO₂ NPs can have significantly improved electro-optic properties.

Keywords: TiO₂ nanoparticles, Sol-gel method, Nematic liquid crystals, Optical properties, Impedance spectroscopy, Permittivity

Correspondence Author

Z. Dehghani, PhD

Assistant Professor of Physics

Dept. of Physics, University of Neyshabur, Neyshabur, I.R. Iran

Tel: +985143305237 Fax: +985143305201

Email: zahra.dehghani@neyshabur.ac.ir

z_dehghani2004@yahoo.com

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