Electro-optical properties of nematic liquid crystals doped with carbon quantum dots

Pamela S. Terceiro, Italo N. de Oliveira, and Maria Socorro S. Pereira

Instituto de Física, Universidade Federal de Alagoas, 57072-970 Maceió-Alagoas, Brazil

The characterization of phase transitions and critical phenomena involving liquid crystals constitutes a challenging topic in soft-matter physics, being a subject of theoretical and experimental investigations for several decades. In particular, it is well known that the introduction of guest particles may induce dramatical changes in the phase transitions of liquid-crystal hosts. A prominent example is the pronounced shift in nematic-isotropic a transition temperatures due to the addition of ferroelectric nanoparticles. In particular, it was observed that the local electric field or local disorder of guest particles tend to modify the nematic order parameter, leading to changes in the transition temperatures of liquid crystal compounds. Recently, the synthesis and characterization of metal-free nanomaterials have attracted a remarkable amount of interest, being motivated by the ongoing need of developing fluorescent probes with reduced-toxicity for biological applications. In this context, carbon quantum dots (CDs) have emerged as a promising alternative to inorganic quantum dots and nanoparticles, being characterized by a rich phenomenology of their physicochemical properties. The present work is devoted to the study of the electro-optical properties of liquid crystals doped with traces of carbon quantum dots at the vicinity of the nematic-isotropic phase transition. By using the an experimental optical setup to probe the electro-optical response of planar cells under an AC electric field, we measure the characteristic switch times and Freedericksz threshold of doped nematic liquid crystals.