Spectral and Photoelectric Properties of Ionic Liquid Crystals Tuned by Nanoparticles

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Abstract

Glass materials with nanoparticles (NPs) represent a new class of electro-optical structures with unique properties. The photoelectric and physical characteristics of these structures can be precisely adjusted using nanoparticles of definite size and composition. These nanocomposite materials attract increasing attention of researchers because of promising possible applications in optoelectronics, photonics, sensing, electrochemistry, catalysis, biomedicine, etc.

In this work, we studied the cadmium octanoate $Cd^{+2}(C_7H_{15}COO^-)_2$ (abbreviation CdC_8) ionic liquid crystals with several types of NPs. A distinctive property of the CdC_8 matrix acting as a nanoreactor is the possibility to control the size and uniformity of NPs during the synthesis. Nanocomposite materials including semiconductor, metallic and hybrid NPs in the CdC_8 matrix are investigated. The shape and size of NPs are measured using scanning electron microscopy (SEM) and transmission electron microscopy (TEM). These methods allowed us to obtain high-resolution images and precisely study the distribution and characteristic sizes of the NPs in the CdC_8 matrix. The SEM and TEM results show that the CdC_8 matrix represents a suitable environment for positioning NPs since it assists in the formation of nanocomposite materials with uniformly distributed NPs in the material with minimal size dispersion and without aggregation. Obtained data are used to analyze the correlation between the structural characteristics of NPs and their optical properties. The photoelectric properties of these materials are studied using ultraviolet and visible range light sources of different intensities. The results demonstrate that synthesized nanomaterials have great potential for the design of photoelectric elements and optical sensors.

D. Zhulai greatly appreciates a research grant from the German National Academy of Sciences Leopoldina.