Odjel za fiziku Sveučilišta Josipa Jurja Strossmayera u Osijeku predstavlja

miniSIMPOZIJ

Tekući kristali

(od kristala raspršenih na polimerima do
elektro-optičkih naprava sa
svjetlosnom modulacijom – i natrag)

prof. dr. sc. Ridvan Karapinar
Burdur Mehmet Akif Ersoy University, Turska

Dejan Bošnjaković
Sveučilište Josipa Jurja Strossmayera u Osijeku
Sveučilište u Ljubljani

Petak, 06.05.2022., 11-13h
Prostorija 60, Odjel za fiziku
Trg Ljudevita Gaja 6, Osijek

POLYMER-DISPERSED LIQUID CRYSTAL FILMS

Ridvan Karapinar

Burdur M. Akif Ersoy University, Faculty of Arts and Sciences,
Department of Nanoscience, Burdur, Turkiye

Polymer dispersed liquid crystal (PDLC) films are promising materials for the electro-optical devices which require light modulation. The PDLC film is a polymer film with embedded LC droplets. Each droplet is characterized by the director which determines the direction of the optical axis of the droplet. When PDLC material is sandwiched between transparent conductive electrodes, it can be switched from an opaque state to a transparent state by application of an electric field. At zero electric field, the LC molecules inside droplets take random orientations. Because of the mismatch between refractive index of the LC and the refractive index of the polymer matrix, light is scattered by the droplets. However, if the electric field is applied the PDLC film, the LC molecules align along the field and the optical axis of a droplet is rotated. Thus, the electro-optical properties of a PDLC film are controlled by the application of the electric field. Optical performance of the films depends on several factors such as the shape and the droplet size of LC droplets. The PDLC films are used in many applications such as switchable windows. In this talk, the fabrication of these films and their electro-optical characteristics are presented. Some applications of these materials are discussed.

Tuneable optical diffractive structures based on a polymeric scaffold and liquid crystalline materials

Dejan Bošnjaković

Faculty of Electrical Engineering, Computer Science and Information Technology, Josip Juraj Strossmayer University of Osijek,
Faculty of Mathematics and Physics, University of Ljubljana, Slovenia

Diffractive optical elements (DOEs) are thin micro-patterned films that are used in various optical devices to manipulate optical beams, and the simplest DOEs are optical diffraction gratings. My work is focused on theoretical modelling of electric and magnetic tuning of optical diffractive properties of optical grating structures made from periodic configurations of a polymer (SU-8) and liquid crystalline (LC) material, where a ferromagnetic liquid crystal (LC) is used for magnetic tuning and a conventional nematic LC (E7) for electric tuning. The research was based on the anchoring and its influence as a boundary condition on the polymer–LC interface and its influence on the diffractive properties of optical diffraction gratings. The associated field-induced distortion profile of a director field induced by an external magnetic or electric field is determined numerically and analytically by minimization of the Landau–de Gennes free energy. To describe optical properties of LC-based diffraction gratings we solved Maxwell's equations numerically, in the medium with periodic spatial modulation of optical dielectric tensor, by using the rigorous coupled-wave analysis (RCWA). Since the theoretical description of electrically or magnetically tuneable gratings agreed very well with experimental results, the presented methodology provides an effective tool for designing various LC-based diffractive optical elements (DOEs) and simulations of their operation controlled by an external electric or magnetic field.