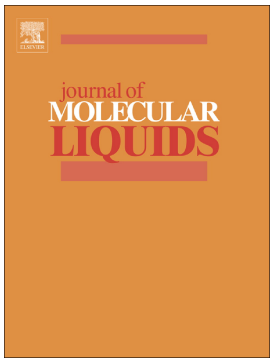

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Nanoparticles-enhanced Photonic Liquid Crystal Fibers

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Abstract

Optical properties of photonic crystal fibers (PCFs) as well as micro-capillaries infiltrated with a 6CHBT liquid crystal (LC) doped with spherical silver (Ag) nanoparticles (NPs) have been studied. Three different concentrations of Ag NPs dopants were taken into consideration and their presence in the 6CHBT LC was found to modify the spectral properties of the infiltrated PCF. A significant improvement of switching times was observed for the NPs-doped LC-infiltrated PCF. Moreover, the Ag NPs-doped 6CHBT LC inside both micro-capillaries and PCFs was found to reduce the nematic-isotropic phase transition temperature.

keywords: photonic crystal fiber, liquid crystal, nanoparticle, photoalignment

1. Introduction

Over the last two decades, an extensive attention has been devoted to the development of a new class of micro-structured optical fibers, named photonic crystal fibers (PCFs) [1]. Their structure consists of a matrix of periodically arranged micro-channels forming a two-dimensional photonic structure being an equivalent of cladding and a defect acting as a fiber core. The defect can be present either as a solid rod or a hole breaking the periodicity of the photonic structure. Two guiding mechanisms can be responsible for light propagation in the core region. The first guiding mechanism is based on a modified total internal reflection (mTIR) principle and occurs when the refractive index of the core region is higher than the effective refractive index of the surrounding cladding region. The second guiding mechanism is caused by a lower refractive index of the core than in the cladding region. As a result, only selected wavelengths are guided inside the fiber, thus this mechanism is called photonic bandgap (PBG) effect.