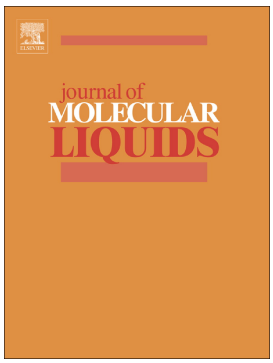

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Giant Enhancement of Photoluminescence and Tertiary Emission in a Chiral Nematic by Matching Photonic Band Gap and Excitation Wavelength

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Abstract

We demonstrate that chiral nematic liquid crystal compositions incorporating fluorophores, wherein the photonic band gap (PBG) of the liquid crystal is matched with the excitation wavelength of the fluorophore results in (a) significant enhancement in the overall photoluminescence of the system and (b) eliciting secondary and tertiary emission such that a single low wavelength illumination can give emissions at multiple and highly desirable Red, Green and Blue wavelengths. The light-trapping strategy of matching the PBG with the excitation wavelength instead of the previously attempted protocol of matching with the emission wavelength is shown to be superior in terms of the magnitude of emission and consequently, the quantum yield of the device. Further, we show that by using an applied electric field, three different emission levels can be achieved, two of them stable even when the field is switched off; the magnitude of the field provides a powerful handle to control the emission level with an overall change of a factor of 2.The observed PL features are explained using radiative energy transfer mechanism and the short range ordering of the fluorophores, as obtained from X-ray diffraction experiments.

Keywords: Photonic band bap structures; Enhancement of photoluminescence; Wavelength matching; Electrically switchable fluorescence

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