Temperature tunable lasing from dye doped chiral microdroplets encapsulated in a thin polymeric film

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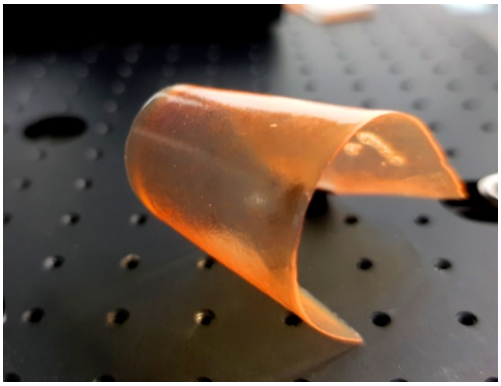
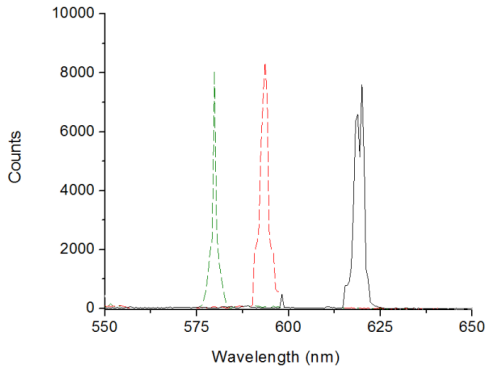
Cholesteric liquid crystals (CLC) are one of the most promising materials in the field of soft-matter photonics, that may be the key elements for the development of compact laser sources. From a practical point of view, as opposite to semiconductor lasers, using CLC any wavelength can be obtained, from ultraviolet to near infrared simply by adjusting the position of the photonic band gap and properly selecting the luminescent dopant for the desired wavelength range.

3D laser emission from dye doped cholesteric liquid crystals confined inside micro-droplets paves the way for many applications in the field of sensors or tunable photonics [1]. Several techniques can be used to obtain small micro-resonators, as an example, dispersing a liquid crystal inside an immiscible isotropic fluid to create an emulsion [2]. Here, we report on the possibility to obtain a thin free standing film starting from an emulsion having a mixture of water and poly vinyl alcohol as isotropic matrix. Following water evaporation, a free-standing polymeric film in which the micro droplets are encapsulated is obtained (Figure 1a). Bragg type stimulated laser emission can be obtained from the emulsion as well as from the thin film. Using a chiral dopant, with temperature dependent solubility, the emitted laser wavelength can be tuned in a range of 40nm in a temperature of 17°C (Figure 1b). The proposed device can have applications in the field of sensors and for the development of anti-counterfeiting labels.



a)



b)

Figure 1: a) free standing polymeric film containing DD-CLCs micro-droplets; b) blue shift of the laser emitted wavelength, measurements acquired at 28°C (black solid line), at 40°C (red dashed line) and at 46°C (green dotted line), respectively.

References

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