Spectral redistribution of fluorescence intensity in all-polymer microcavities and distributed Bragg reflectors

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All-polymer planar photonic crystals such as distributed Bragg reflectors (DBR) and microcavities are a very versatile tools with applications in many fields, such as sensing and lasing.[1] Notwithstanding the relatively low dielectric contrast achievable with polymers, they can be successfully used to obtain large areas and free-standing flexible systems. When photoactive materials (fluorescent, photochromic or plasmonic media) are embedded in these structures, different physical effects are induced by spatial light localization. In this communication we will focus on different cases of spectral redistribution of fluorescence intensity.
For instance, when fluorescent materials such as conjugated polymers and molecules, J-aggregates and quantum dots are inserted into polymer cavities with quality factors ranging from 50 to 300, their fluorescence spectrum undergoes significant directional spectral redistribution. Fluorescence enhancement and modification of the radiative lifetime in these systems will be discussed.
A different fluorescence enhancement effect can be achieved when Bloch surface waves (BSW) are excited in DBR structures. BSW are excitations running on the surface of a structure asymmetrically confined by total internal reflection from one side and by the photonic band gap from the other. In this case, tuning the BSW of the photonic crystal on the pumping beam wavelength can easily and efficiently enhance the fluorescence intensity (about 10 fold) and deeply modify its spectral profile. [2]

References

[1] Organic and Hybrid Photonic Crystals, edited by D. Comoretto, Springer Int. Pub. (2015).
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