Hybrid VCSEL and DFB Organic Microlasers

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Microlasers based on organic small molecules have shown great potential as coherent light sources [1,2]. Two important types of resonators being under investigation are the vertical-cavity surface-emitting laser (VCSEL) and the distributed-feedback laser (DFB). The gain medium in all structures produced is a blend of the red laser dye DCM doped by 2 wt% into the host material Alq3. Although based on entirely different concepts and symmetries, the two resonators exhibit comparable lasing thresholds and confinement factors (see Fig. 1).

In this work, we design a hybrid device combining both resonators in one compound structure, where second-order Bragg diffraction couples vertical modes of the VCSEL and lateral modes of the DFB. Using optical spectroscopy techniques, we observe coherent interaction of the two regimes. We analyse the emission properties and lasing characteristics to control the balance between the different mechanisms on positive optical feedback inside the composite system. Based on the results obtained, novel structures are modelled and designed to optimise the performance of the hybridised microlaser device.

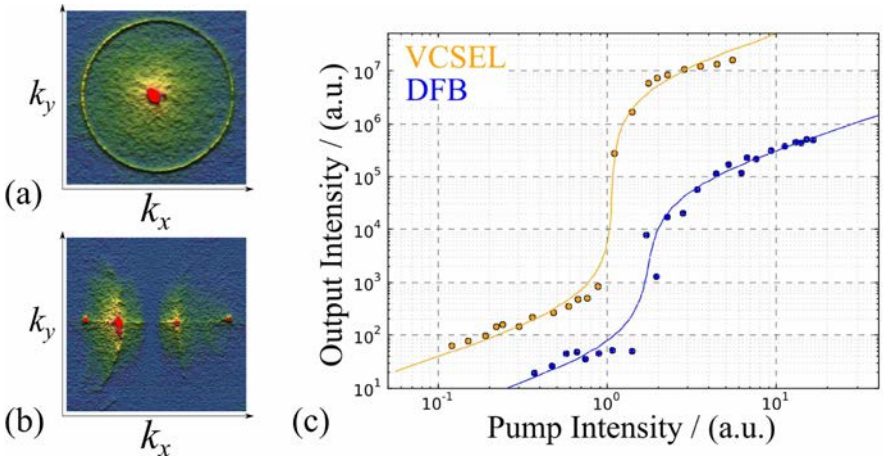

Figure 1 – Far field emission patterns of a VCSEL (a) and a DFB (b) structure above the lasing threshold. Input-Output characteristics of a VCSEL and a DFB device produced with the same set of materials (c).

[1] S. Chénais and S. Forget *Polymer International* **61**, 390 (2012)
[2] A. Mischok et al. *Advanced Optical Materials* **2**, 802 (2014)