Organic Semiconductor Lasers for Sensing Applications

Sönke Klinkhammer[ab], Christoph Vannahme[ba], Thomas Woggon[ba], Timo Mappes[b], Uli Lemmer[a]

[a]Lichttechnisches Institut (LTI) and Center for Functional Nanostructures (CFN), Karlsruhe Institute of Technology, 76128 Karlsruhe, Germany;
[b]Institut für Mikrostrukturtechnik (IMT), Karlsruhe Institute of Technology, 76128 Karlsruhe, Germany

Organic semiconductors are of increasing interest in the field of optoelectronics. Their spectrally broad emission range in the visible along with high energy conversion efficiencies and ease of thin film fabrication make them ideal candidates as gain material in broadband laser sources [1]. As resonators, distributed feedback (DFB) structures consisting of a surface-corrugated substrate are well established as they come along with high efficiencies, a high modal selectivity and small linewidths [2]. A thin film of the organic gain material on top of the grating structure forms a slab waveguide in which the guided mode experiences diffraction according to the Bragg formula $\lambda_{las} = 2\Lambda n_{eff}/m$. The lasing wavelength is controlled by the grating period as well as the effective refractive index of the guided mode.
Due to the flexibility of thin film fabrication and imprinting techniques, these optically pumped lasers can either be used as tunable free space light sources or be integrated into photonic lab-on-chip devices (LOCs).
Here, we present schemes to continuously tune organic lasers [3]. By employing a simple optical setup, we are able to probe samples with spectroscopic features within the emission range of our DFB laser and demonstrate the feasibility of such a tunable device for spectroscopic analysis applications [4].
Furthermore, we outline possibilities to implement tunable laser sources into integrated photonic sensing systems to fully take advantage of mass production technologies and simple processes with only few different materials for low-cost all-organic LOC-systems.

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