p i o n e e r s   i n   p o l y m e r s

Polymer dye lasers
you choose the wavelength

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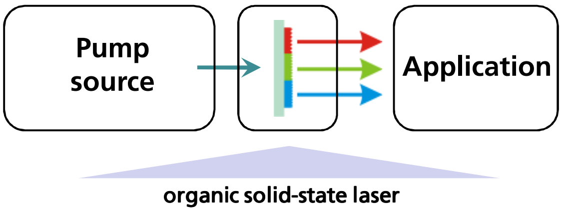
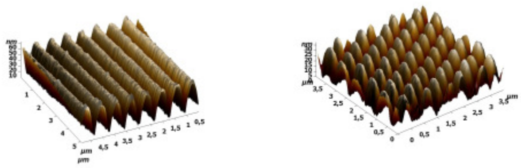
Methods and materials



- holographic interferometry: UV/VIS, volume/surface
- photo-/thermo-polymerization
- photo-/thermo-embossing
- multilayer surface deposition
- easy processible polymers
- spin coating
- variable polymers/polymer composites
- variable gain materials
- compact & economic

Holographic structured Surface relief gratings (SRG)

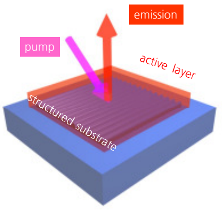


Options:

- large square structuring
- defect-free
- adjustment of DFB period
- adjustment of DFB geometry
- real-time monitoring of efficiency
- sinusoidal shape
- 1D or 2D grating structures
- complex 2D structures with the help of re-recordable material

Organic DFB-lasers

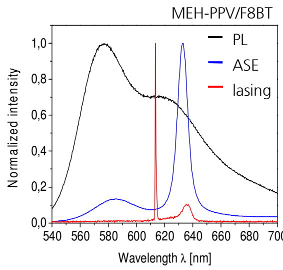
2nd order DFB-laser

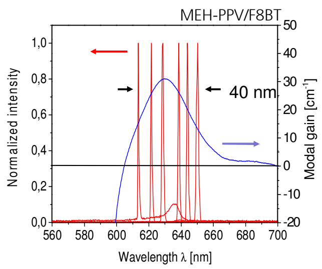


Bragg condition:

$$\Lambda = \frac{\lambda}{2\sin\theta}$$

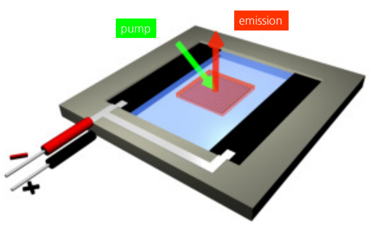
- very sharp laser line, low threshold
- arbitrary wavelength due dye selection
- fine-tuning of lasing wavelength and cavity modes

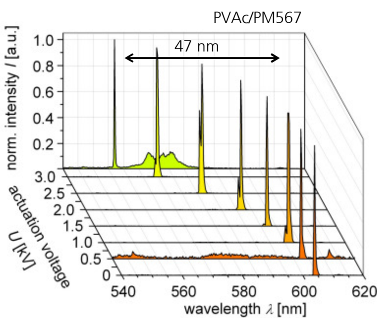




- active material: MEH-PPV in F8BT
- spectral narrowing compared to PL due to ASE ($\Delta\lambda_{FWHM}$ < 10 nm) and lasing ($\Delta\lambda_{FWHM}$ < 1 nm)
- laser line shift ($\Delta\lambda_{FWHM} \cong$ 40 nm) using the whole gain spectrum of the material

Voltage tunable elastic, organic DFB-laser

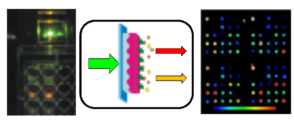




- voltage tuning of diffractive optical elements and elastic, organic DFB-Lasers
- continuous voltage induced wavelength shift by change of grating period due an electro active substrate

Applications:

- *In-vitro diagnostics*
- *Sensors*
- *Lab-on-chip*
- *Laser induced fluorescence*



Conclusion:

With the help of azobenzene containing films one-dimensional SRGs of up to 130 nm corrugation depth at grating pitches of 400 nm were produced holographical in a one-step fabrication process.
Replicated gratings were used as DFB structures for the investigation of thin film lasers using polyfluorene derivative F8BT and phenylenevinylene polymer MEH-PPV forming an active layer emitting in the red wavelength region. Narrow laser emission was shifted via change of refractive index and layer thickness using the whole gain spectrum offered by the medium.

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