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PlanOS

Fluorescent rare-earth complex doped acrylate based host-guest system for optical applications fabricated by microstructure technologies

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Concept / Challenges

Monomer preparation

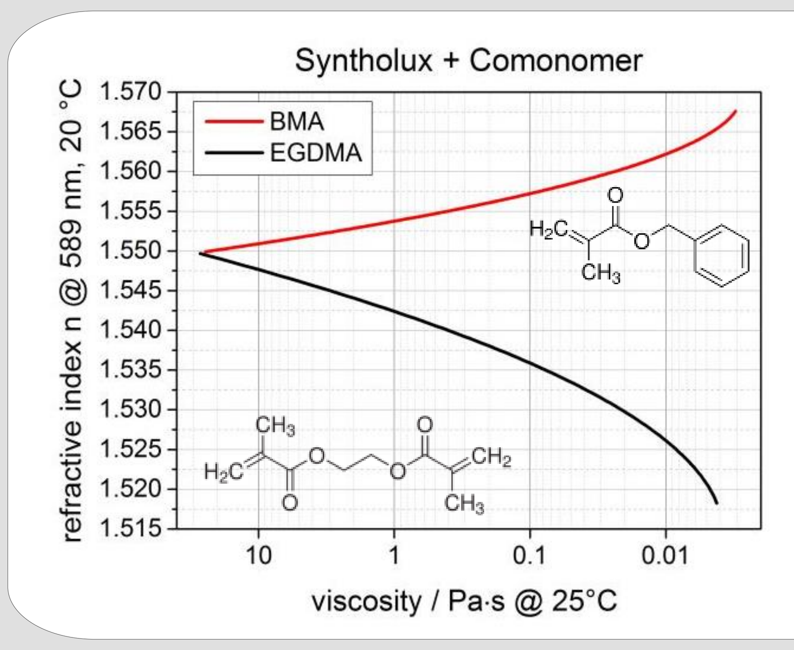
- Adjustment of refractive index
- Viscosity adjustment
- "Cold" polymerization by UV-light
- Addition of **active fluorescent** material

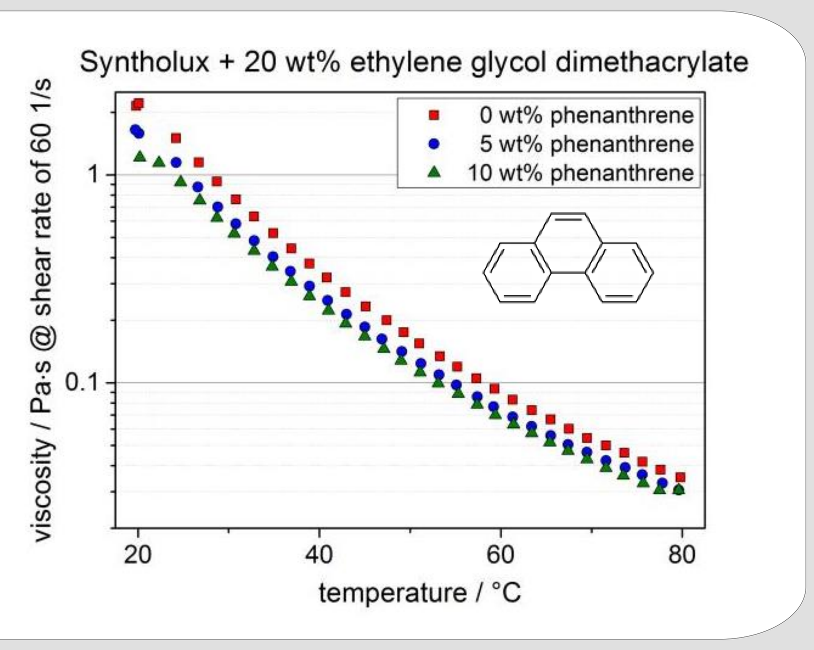
Polymer challenges

- Low optical damping
- Fully cured surface (oxygen inhibition)

Results I – Viscosity adjustment

- Adjustment: co-monomer content
  - ➢ Ethylene glycol dimethacrylate (EGDMA)
  - ➢ Benzyl methacrylate (BMA)
- Dopant: e.g. phenanthrene, no strong influence on viscosity

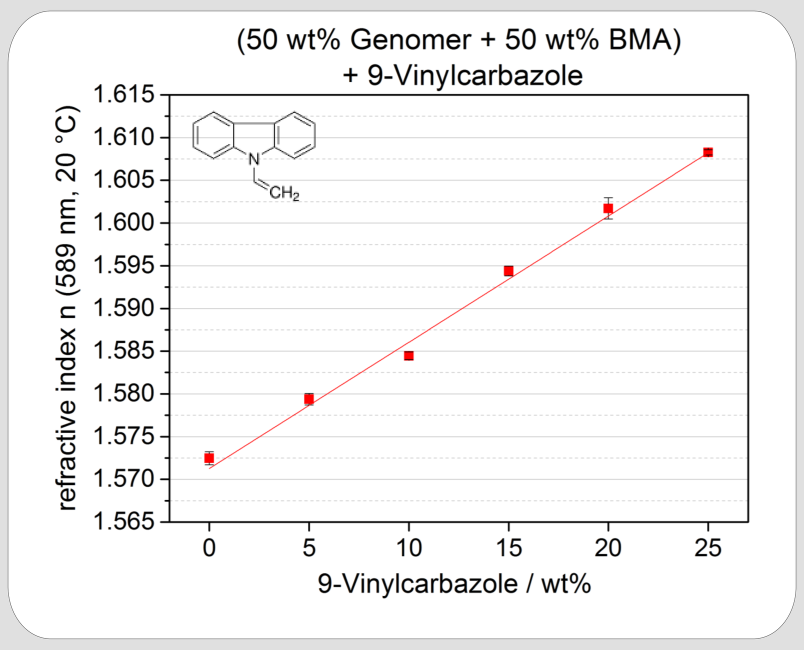


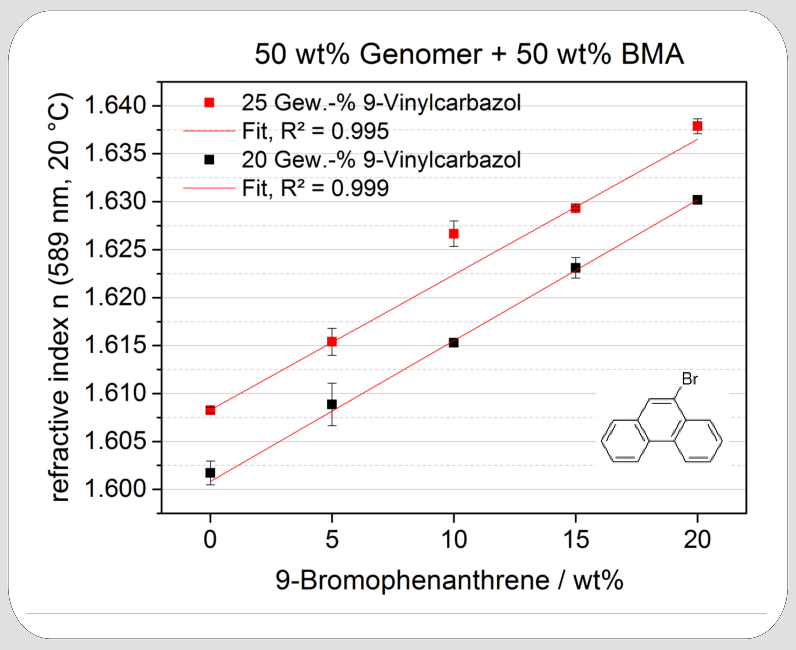


Results II – Passive material

New approach for increase

- Mixture of monomers: Genomer2263 / BMA
- Increase via 2 dopants at the same time:
  - 9-vinylcarbazole / 9-bromophenanthrene

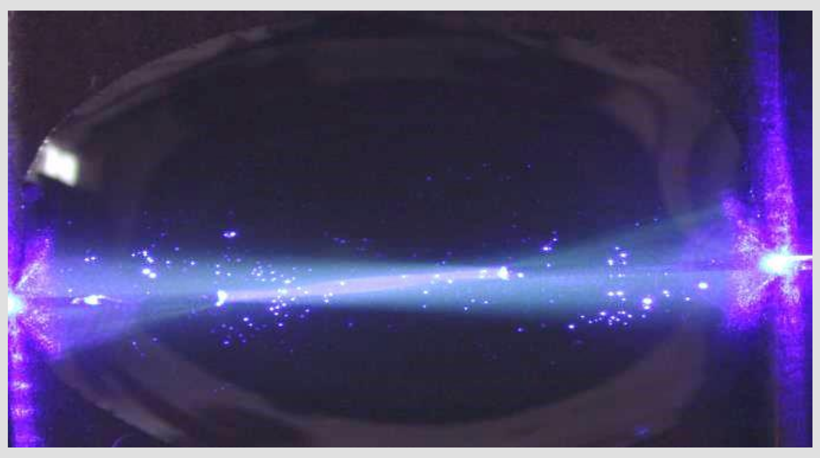




➢ Maximum refractive index of $n_{D,20}$ = **1.638**

Self-writing waveguide (A. Günther, Opt. Lett., 40 (8), 2015)

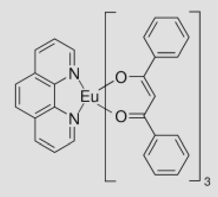
- Two separated waveguides with several mm gap
- New photo curable liquid material in gap deposited
- UV-polymerization closes gap by self-writing

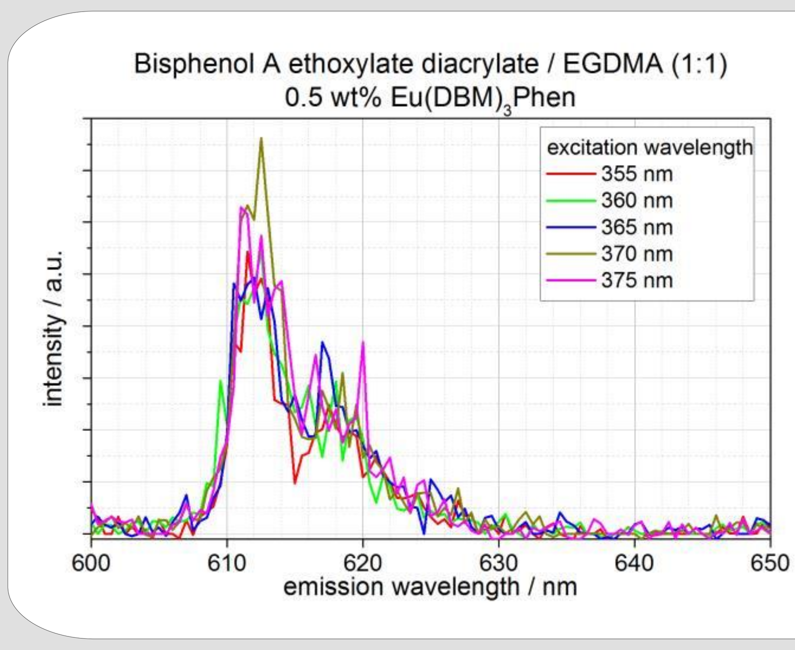


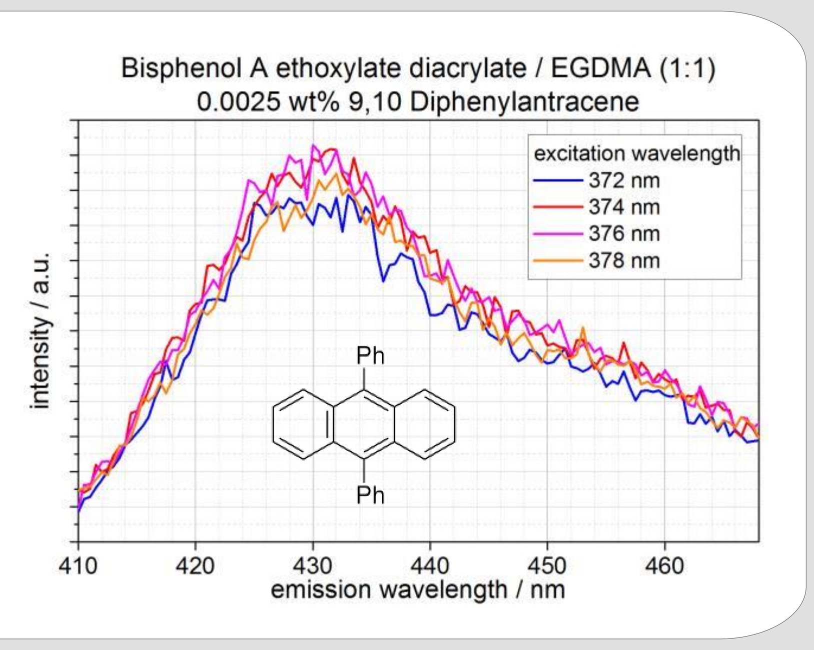
Self writing waveguide

Results III – Active material

- Materials: luminescent, organic chromophores
  - ➢ Rare earth complex: $Eu(DBM)_3Phen$
  - ➢ 9,10 Diphenylanthracene
- Mixed into monomer matrix

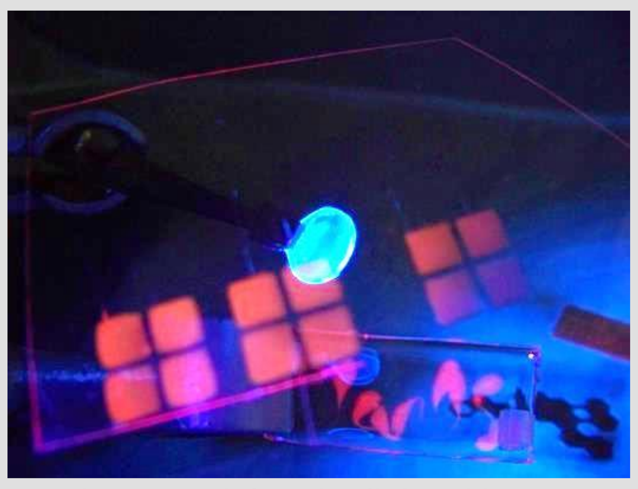






Proof of concept

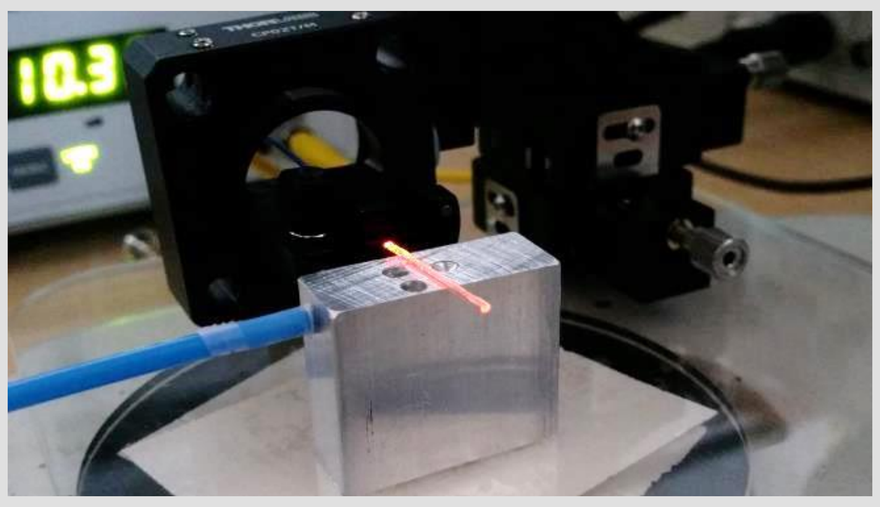
- 2.5 wt% $Eu(DBM)_3Phen$
- Inkjet printed on PMMA substrate
- Substrate temperature: 60 ˚C
- Printing temperature: 40 ˚C
- UV-Polymerization



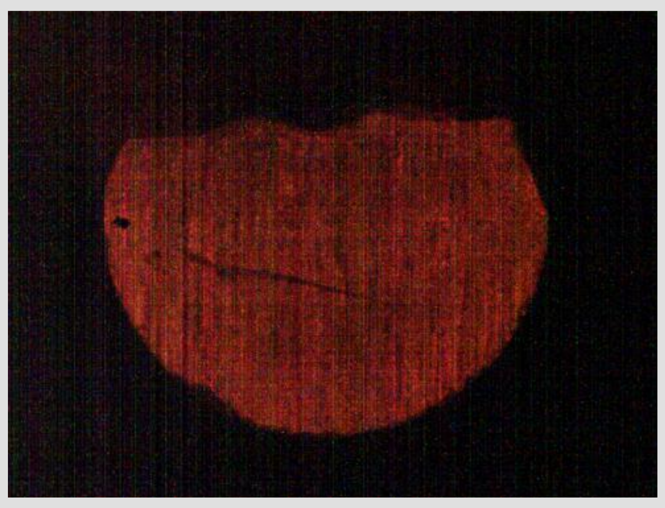
Active material under light with 405 nm

Applications: Active optical fiber

- Active material optical fiber, excited by 405 nm laser light
- Material: EGDMA + 2.5 wt% $Eu(dbm)_3Phen$
- Conversion to red light
- Inkjet-printed waveguides: **P. Bollgrün, Poster P46**



Characterization setup of active optical fiber



End facet of active optical fiber

Summary

✓ Refractive index tunable: 1.44 < n < 1.63
✓ "Cold" polymerization by UV-light possible
✓ Viscosity adjustment for: inkjet- and flexoprinting, spin coating, hot embossing
✓ Conversion of light with active fluorescent material

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