



Investition in Ihre Zukunft!



Optical polymer materials: nanocomposites for waveguides and electrooptic polymer with phototuning

Leonid Goldenberg,^{a,b} Claus Villringer,^a Mathias Köhler,^b Sigurd Schrader,^a and Christian Dreyer^{a,b}

^a*Technical University of Applied Sciences Wildau*

^b*Fraunhofer-Institut for Applied Polymer Research IAP,
Research Division Polymer Materials and Composites PYCO*

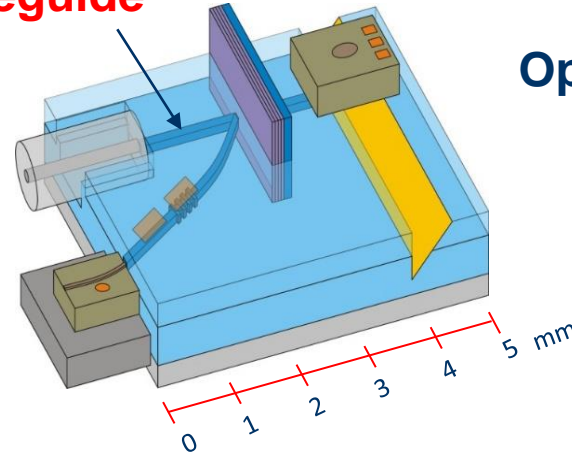
Motivation – Polymer waveguide



Investition in Ihre Zukunft!

EUROPÄISCHE UNION
Europäischer Fonds für
Regionale Entwicklung
www.efre.brandenburg.de

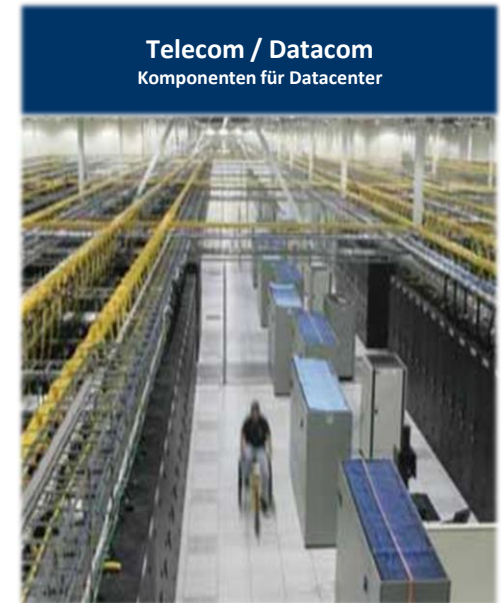
Waveguide



Optical chip



**Mini- Plattform
with polymer
waveguide**



Polymer Waveguide



Investition in Ihre Zukunft!



- * Refractive index / 1550nm - 1,45 (Cladding) and 1,455-1,5 (Core)
- * Propagation losses / 1550nm - $\leq 0,6$ dB/cm
- * Thermo-optic coefficient - $< -1,4 \cdot 10^{-4}/K$



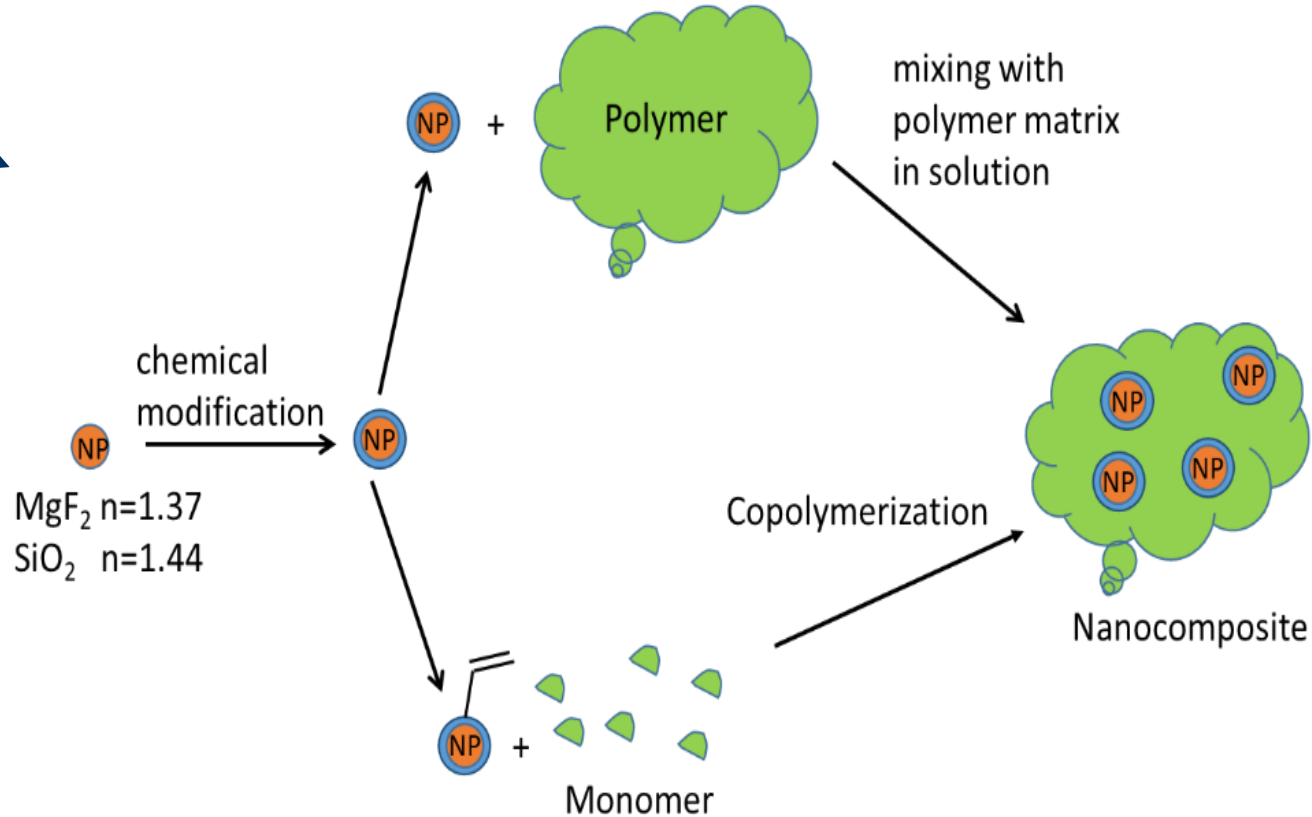
Investition in Ihre Zukunft!

EUROPÄISCHE UNION
Europäischer Fonds für
Regionale Entwicklung
www.efre.brandenburg.de

Why NPs?

TOC

n



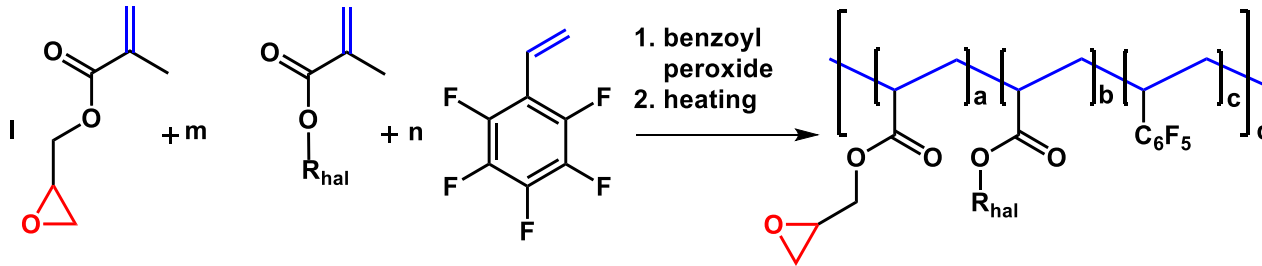
Basis: 1. epoxy polymer 2. acrylate mixture



Investition in Ihre Zukunft!

EUROPÄISCHE UNION
 Europäischer Fonds für
 Regionale Entwicklung
www.efre.brandenburg.de

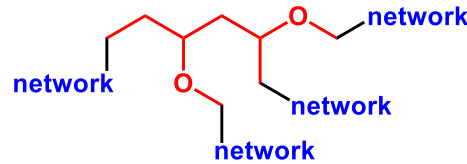
1.



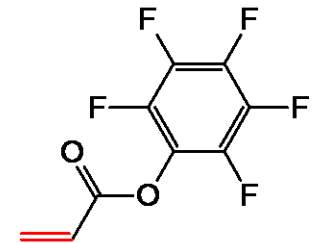
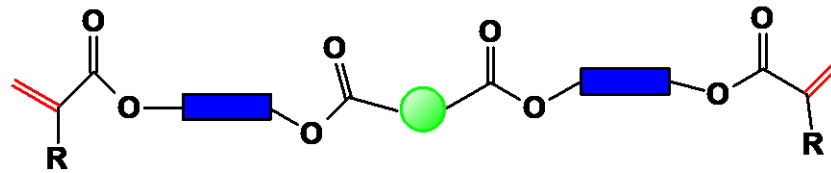
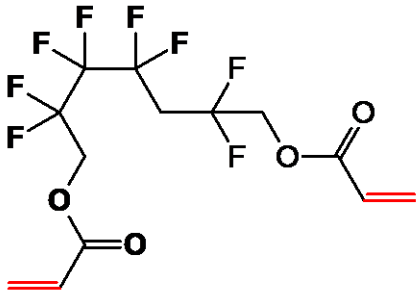
R_{hal} = chlorinated, brominated or fluorinated group

Photoacid generator

UV exposure and heating to 130 °C



2.

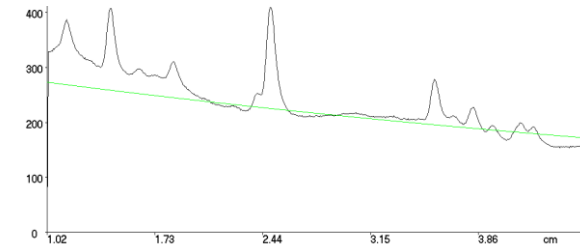
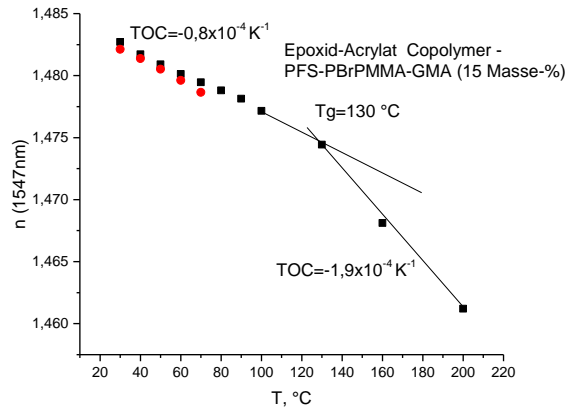
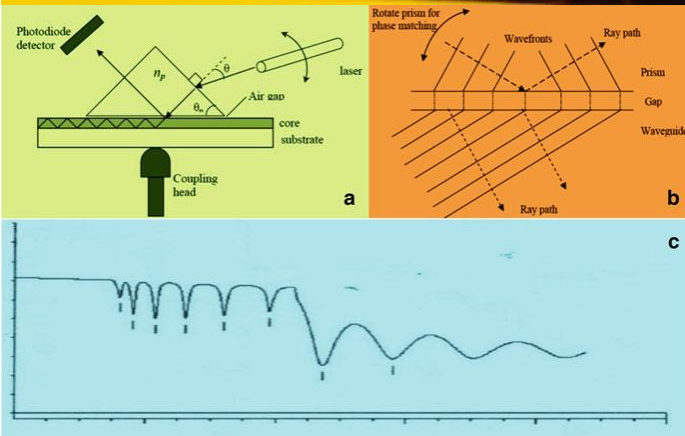
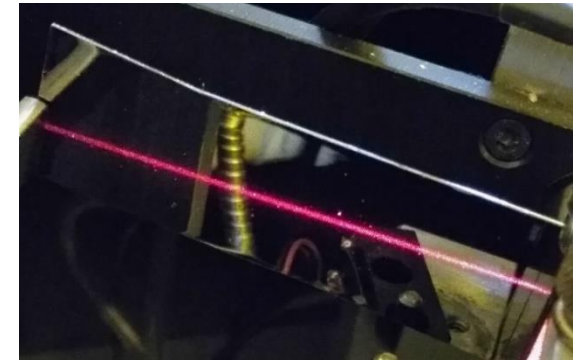
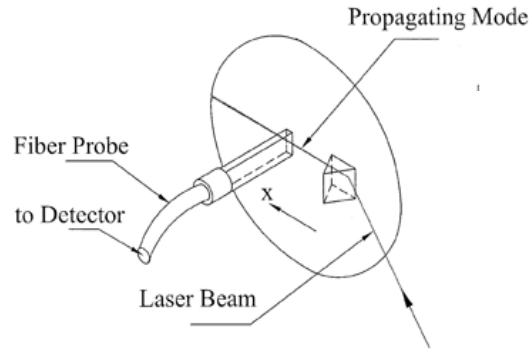
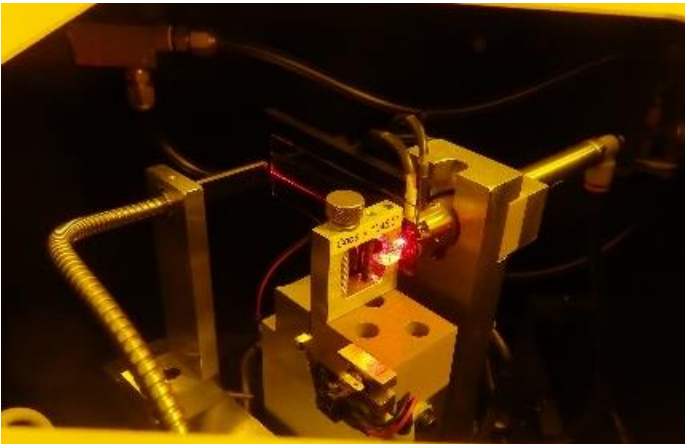


Characterization

M-Line Prism Coupler, Metricon (USA):
Refractive index, thickness, birefringence,
propagation losses, thermo-optic coefficient



Investition in Ihre Zukunft!

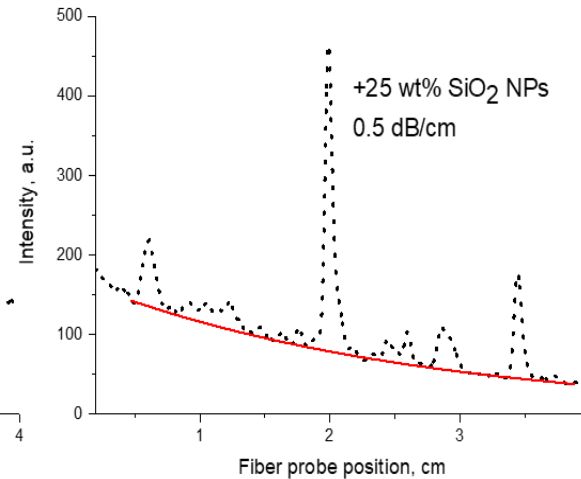
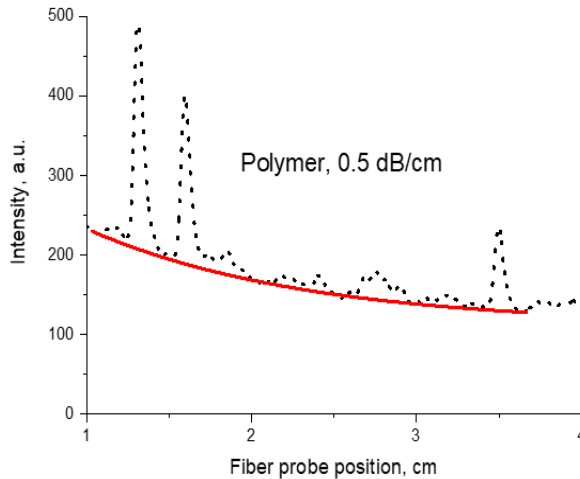
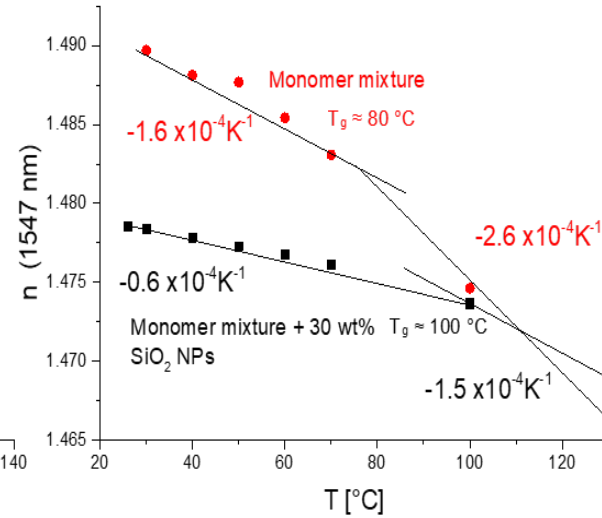
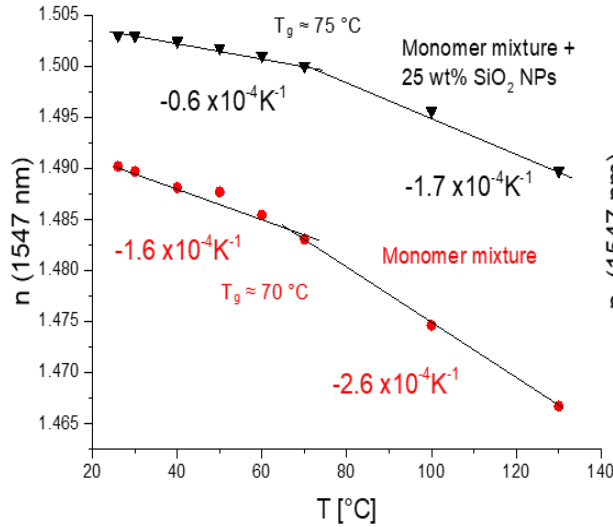


Till 200 °C



Investition in Ihre Zukunft!

EUROPÄISCHE UNION
Europäischer Fonds für Regionale Entwicklung
www.efre.brandenburg.de

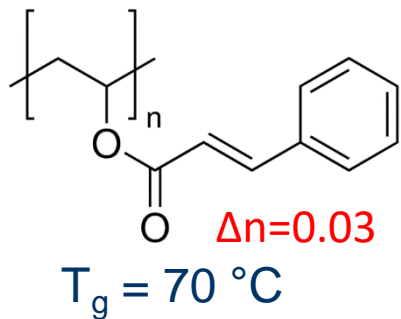
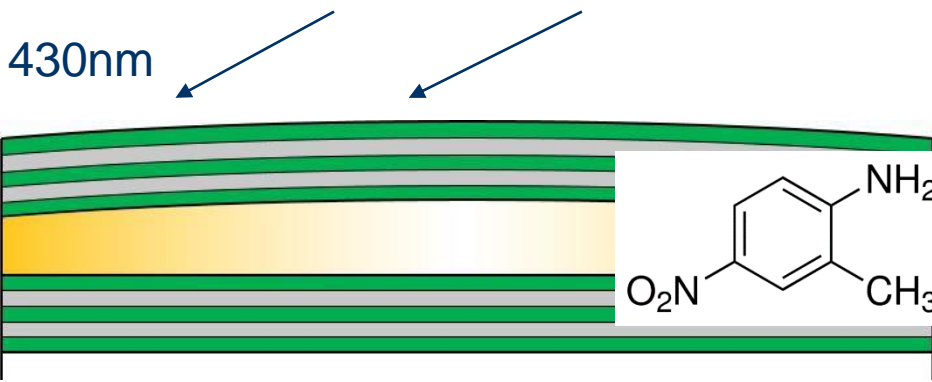




E/O polymer with phototuning for Fabry-Pérot Sensor



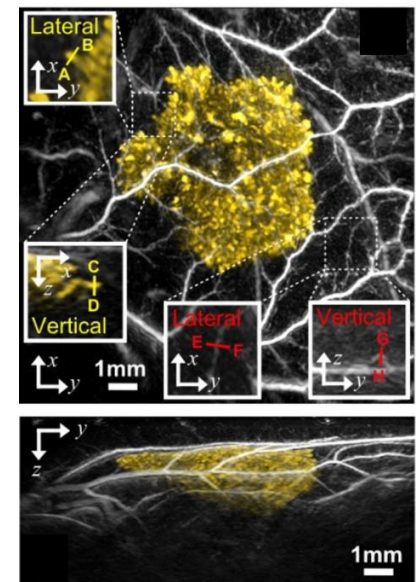
Investition in Ihre Zukunft!
EUROPÄISCHE UNION
Europäischer Fonds für Regionale Entwicklung
www.efre.brandenburg.de



Increase E/O activity

Increase E/O stability

516 nm – low absorption

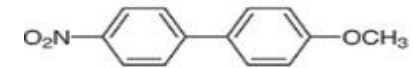
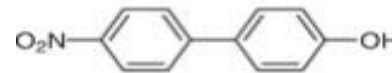
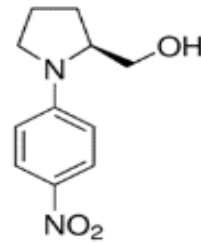
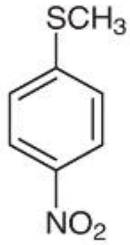




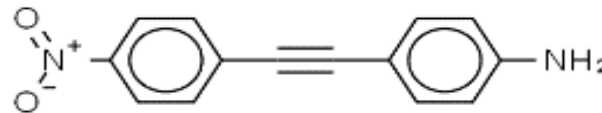
Problem of absorption and solvatochromy

Investition in Ihre Zukunft!

EUROPÄISCHE UNION
Europäischer Fonds für
regionale Entwicklung
www.efre.brandenburg.de



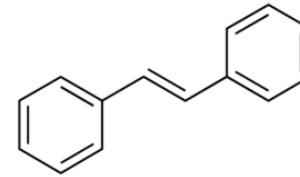
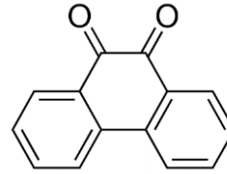
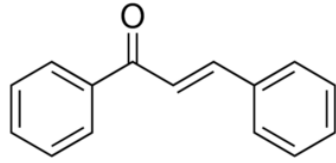
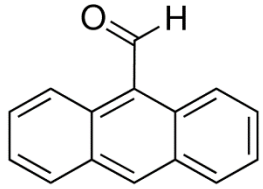
Lower E/O activity



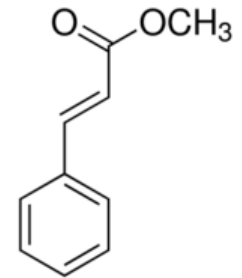
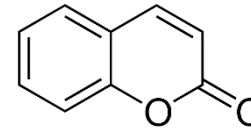


Investition in Ihre Zukunft!

EUROPÄISCHE UNION
Europäischer Fonds für
Regionale Entwicklung
www.efre.brandenburg.de



Best in guest-host systems



Guest-host system in PC with MNA as E/O dye

$T_g = 85-90 \text{ }^\circ\text{C}$ sufficient E/O effect and photonutability,

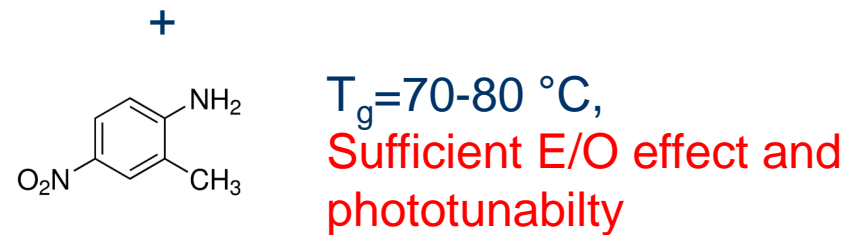
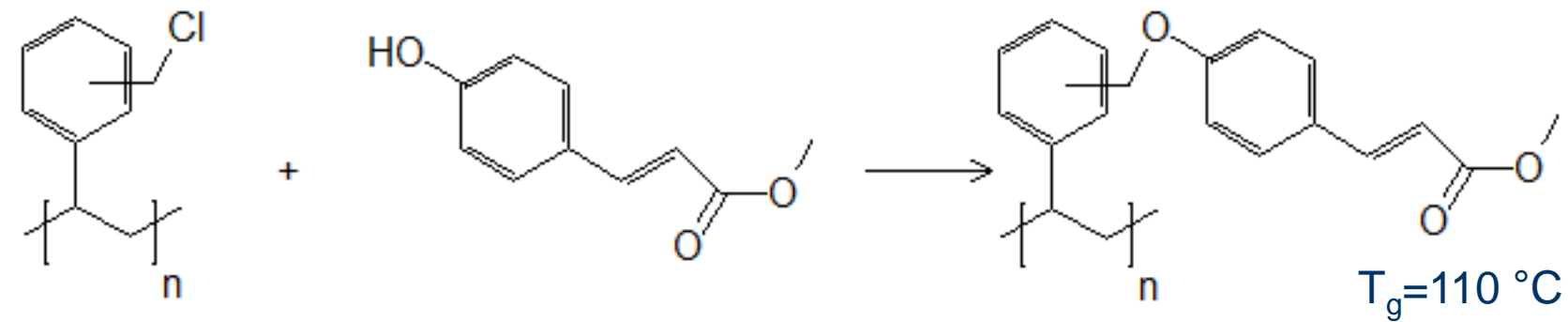
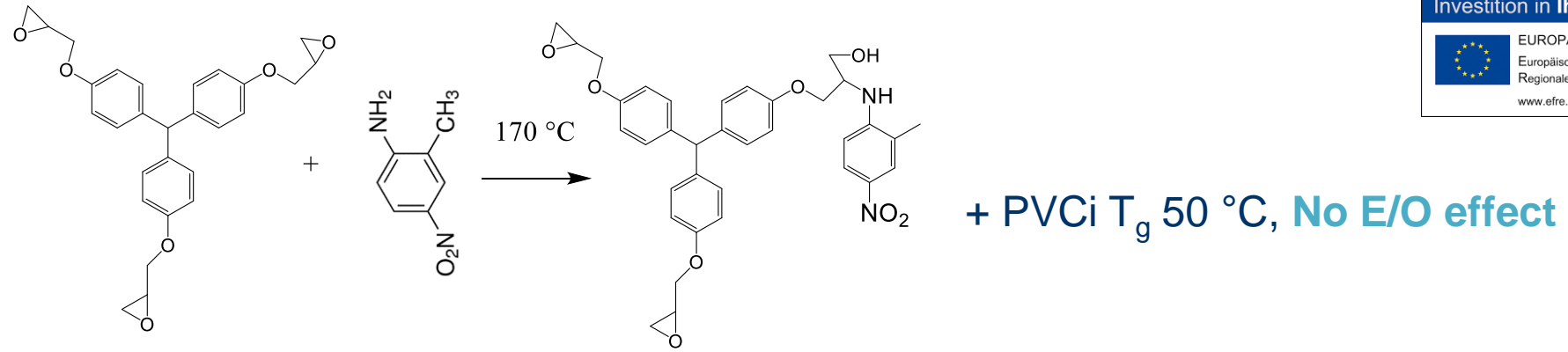
E/O polymer



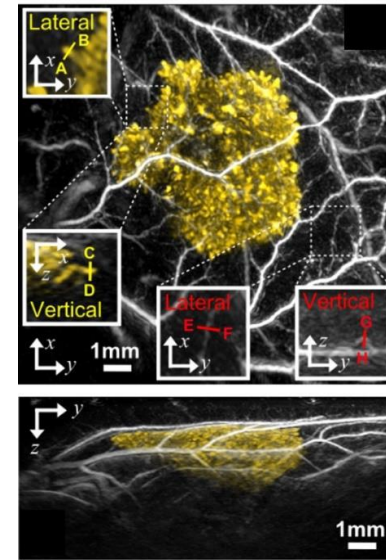
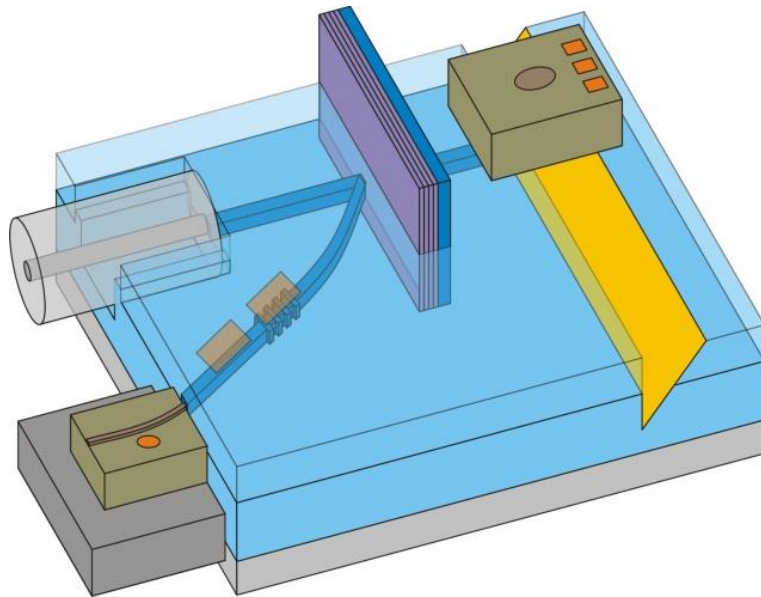
Investition in Ihre Zukunft!



EUROPÄISCHE UNION
Europäischer Fonds für
Regionale Entwicklung
www.efre.brandenburg.de



Thank you very much for your attention!

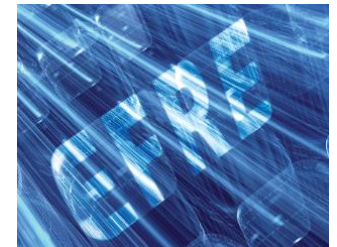


Great in Optics - Small in Size

Investition in **Ihre Zukunft!**



EUROPÄISCHE UNION
Europäischer Fonds für
Regionale Entwicklung
www.efre.brandenburg.de



Bundesministerium
für Bildung
und Forschung



PolyPhotonics Berlin

WACHSTUMSKERNE
UNTERNEHMEN
Die BMBF-Innovationsinitiative
Neue Länder REGION