Forschungszentrum Karlsruhe
in der Helmholtz-Gemeinschaft

Timo Mappes [a], Uwe Hollenbach [b], Benjamin Ross [b], Dominik Rabus [c], Jürgen Mohr [b]
[a] Universität Karlsruhe (TH), Institut für Mikrostrukturtechnik, Kaiserstr. 12, DE-76128 Karlsruhe
[b] Forschungszentrum Karlsruhe GmbH, Institut für Mikrostrukturtechnik, Postfach 36 40, DE-76021 Karlsruhe
[c] Baskin School of Engineering,University of California, Santa Cruz, CA 95064, USA
eMail: timo.mappes@imt.fzk.de; phone: ++49 7247 824426

Planar Micro Optical Sensors Based on Polymer Waveguides

Process

Fabrication of monomode waveguides in a planar monolithic polymethyl-methacrylate (PMMA) substrate for the wavelength regime of the visible and near infrared by deep UV exposure[1]

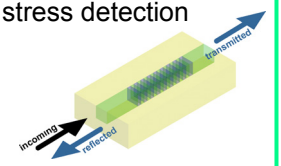
[1] P. Henzi, K. Bade, D.G, Rabus, J. Mohr "Modification of polymethylmethacrylate by deep UV radiation", J. Vac. Sci. Technol. B, vol. 24, nr. 4, p. 1755-1761, 2006

integrated Bragg grating

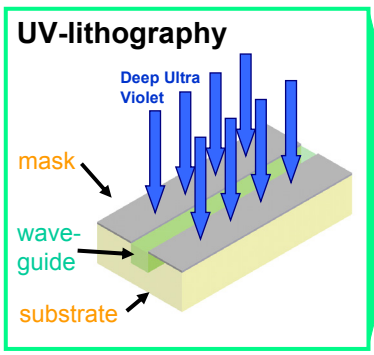
Bragg gratings are exposed into the volume of the wave-guide (Fig. 2) by the same technology.

allowing for

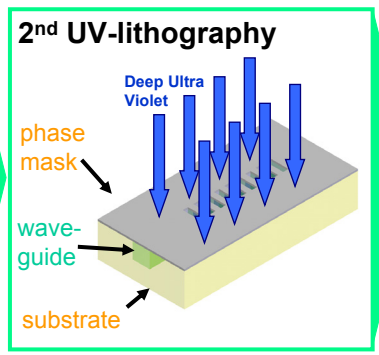
planar optical sensors for temperature or stress detection



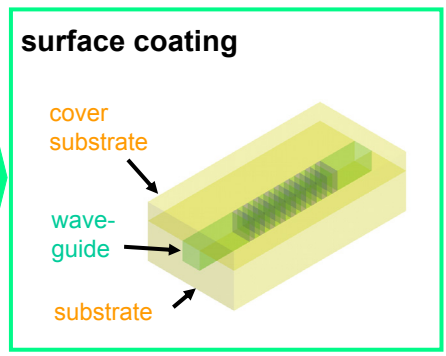
The sensors can be much smaller than those based on optical fibers



Generating of a waveguide in polymethylmethacrylate (PMMA) by Deep UV-lithography and subsequent covering of the substrate.



Generating of Bragg-gratings in the already exposed waveguide by using a phase mask.

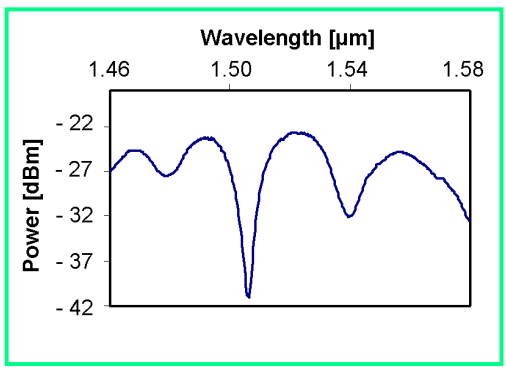


Covered waveguide and implemented Bragg grating in a PMMA substrate.

Filter Behaviour

Calculations predict filter behaviour at 1550 nm for an optical waveguide in polymethylmethacrylate (PMMA) with an integrated volume Bragg grating of 260 nm line/space period.

Measurements of the transmitted power of the optical waveguide with Bragg grating shows the expected transmission loss (18 dB) at 1506 nm. The peak width FWHM is about 6 nm.



Measurements of transmitted power [dBm] for an optical waveguide of 5 µm width and 4 cm length, with Bragg-grating of 260 nm line/space period and 2 cm length. Waveguide, exposure dose 3.2 J/cm^2, Bragg grating 260 nm line/space, exposure dose 2.5 J/cm^2.