







Application of a fs laser-written

Mach-Zehnder interferometer for characterisation of Hydrogels

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Measurements with the Mach-Zehnder interferometer

The laser-written Mach-Zehnder interferometer (MZI) is an example of an optical integrated sensor. The MZI is composed of two near-surface waveguides connected by two evanescent waveguide couplers. One waveguide is used as the sensor arm, whereas the other serves as the reference arm.





Fig. 1: Scheme of fs laser-written MZI used for measurements.





Fig. 2: Experimental setup for measurements with laser-written MZI.





Fig. 3: Influence of applied water on the MZI outputs with marked areas used for data evaluation (**top**) and waveguide modes of MZI without and with applied sample in faslecolor (**below**).

Fig. 4: Relative Intensity (**left**) and Transmission of the MZI (**right**) in dependence of samples refractive index (marked areas were used, see Fig. 3).

Hydrogels and Mach-Zehnder interferometer

Hydrogels are three-dimensional polymer networks, which are made of monomers and crosslinkers. Because of their chemical nature, they can absorb many times their mass in water.



Water absorption, known as swelling, depends on the hydrogel structure and surrounding medium. This enables the use of hydrogels as sensor materials. In this study, the swelling behaviour of hydrogels will be examined using the laser-written MZI with the intention of investigating the composition of liquid samples.





Fig. 6: Immobilisation of Hydrogels on a glass surface for measurements with the MZI.



Fig. 7: Influence of applied Hydrogel on the MZI outputs.

waveguide chip.

References

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