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Development of a microfluidic refractive index sensor based on a porous waveguide and a ring resonator for high-precision analysis of liquid media

Partner's task: Development of an edge-emitting LED and a photodetector for integration with a porous waveguide

Type of collaboration

Technical cooperation

Theoretical base:

Optically transparent photoresist SU-8. Such a photoresist holds promise as a waveguide material for optical biosensors that can provide fast response, allow analysis outside the laboratory, and be easily embedded in microfluidic components of MEMS and MOEMS. The advantage of SU-8 is accurate and reproducible profiling in the manufacture of the sensor template, including the Mach-Zehnder interferometer and micro-ring resonator structures .

Key words

sensor,microfluidic, silicon, porous, waveguide

The performance of traditional planar optical sensors based on a high-contrast refractive index configuration is limited by the fact that only the attenuated field propagating outside the waveguide is used to detect the target molecule or substance, while the larger field component associated with the controlled mode propagates inside the structure itself.
This obstacle is typical not only for SU-8, but also for other non-porous materials that are used to make integral waveguides, including silicon and silicon oxide.

The work was carried out, aimed at overcoming this limitation by using a waveguide made of porous silicon connected to a micro-ring resonator, which was impregnated with an analyte solution and enabled to achieve a sensitivity of 439 nm/RIU due to the direct interaction of light with the target molecules. Porous silicon has quite high optical losses caused by light scattering on the pore walls, and can only work in the infrared range. Porous SU-8 can be used in planar optical sensors, because it is transparent in the visible range, and the effect of light scattering on the pore walls will be reduced.

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