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Abstract An integrated intra-laser-cavity microparticle sensor based on a dual-wavelength distributed-feedback channel waveguide laser in ytterbium-doped amorphous aluminum oxide on a silicon substrate is demonstrated. Real-time detection and accurate size measurement of single micro-particles with diameters ranging between 1 μm and 20 μm are achieved, which represent the typical sizes of many fungal and bacterial pathogens as well as a large variety of human cells. A limit of detection of ~500 nm is deduced. The sensing principle relies on measuring changes in the frequency difference between the two longitudinal laser modes as the evanescent field of the dual-wavelength laser interacts with micro-sized particles on the surface of the waveguide. Improvement in sensitivity far down to the nanometer range can be expected upon stabilizing the pump power, minimizing back reflections, and optimizing the grating geometry to increase the evanescent fraction of the guided modes.

ORIGINAL PAPER

Intra-laser-cavity microparticle sensing with a dual-wavelength distributed-feedback laser

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