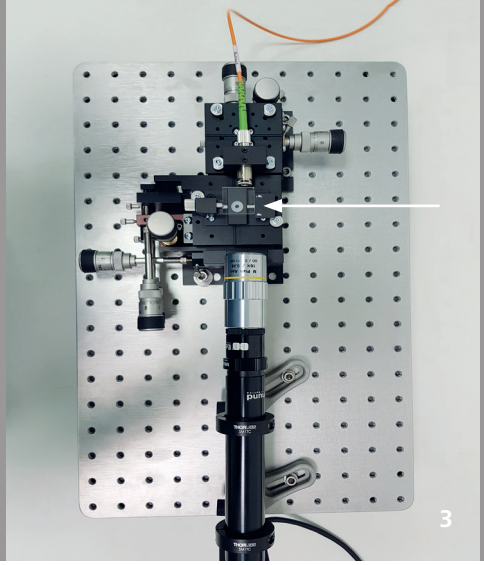

3

4

WAVE GUIDES FOR ANGULAR RESOLVED LIGHT SCATTERING

Task

Angular resolved light scattering is an analytical method that can be used to determine not only particle sizes, but also approximate particle forms. This so-called static laser light scattering analyzes particles with a size between a few 10 nm and several 100 µm with laboratory equipment. However, the process is not yet suitable for inline-capable, process-analytical immersion probes. In a research project with partners from industry, Fraunhofer ILT is developing a compact, inline-capable immersion probe for particle analysis in which the scattered light is measured with angular resolution.

Method

Waveguides transport the light scattered by the particles with angular resolution so that the optics can be miniaturized and integrated into a submersible probe. A short pulse laser is used to inscribe the waveguides in glass chips. A CCD line detector on an outer surface of the glass chip detects the stray light guided through the waveguides.

Results

Waveguides are written with different laser parameters and then examined for their applicability to scattered light guidance. For the characterization of waveguides, Fraunhofer has developed different optical measuring methods. In addition to transmission microscopy, it also uses laser-based methods.

A test stand with an adjustable laser beam source and a CCD camera with a microscope objective visualizes the laser beam guided through the waveguide. It and its direct neighborhood can be examined with a laser scanning microscope detecting in the transmission direction. This way, shapes and structures of the waveguides can also be analyzed.

Applications

The scattered light probe can measure the size of particles in the range of a few 10 nm up to many µm. It can be applied, for example, in bioprocess and chemical process analytics. Growth processes in biofermenters or particle formation in chemical crystallizations should be recorded inline during an ongoing process.

The R&D project underlying this report has been carried out on behalf of the Federal Ministry of Education and Research BMBF under grant number 13N14176.

Contact

Dr. Christoph Janzen
Telephone +49 241 8906-8003
christoph.janzen@ilt.fraunhofer.de

Prof. Reinhard Noll
Telephone +49 241 8906-138
reinhard.noll@ilt.fraunhofer.de

3 Test stand for the characterization of waveguides; the arrow marks the glass chip with waveguides.

4 Laser scanning microscope image of a laser-structured waveguide.