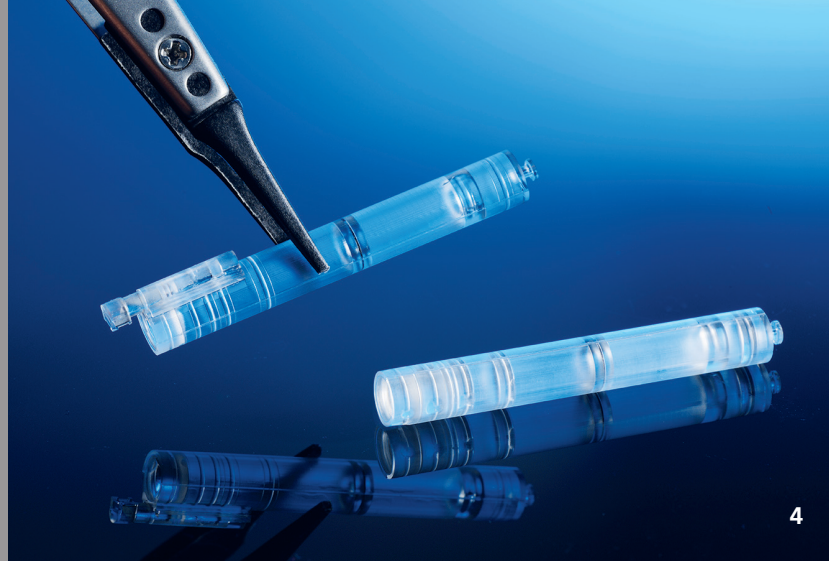


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MINIATURIZED OPTICAL MEASURING PROBE

Task

Optical metrology is already being used in many areas – distance/3D component measurement, optical material determination and optical coherence tomography, among others – with great success. To open up further fields of application, research is developing new methods in order to reduce the size of the measuring equipment. In cooperation with Fraunhofer ILT, the Chair for Optical Systems (TOS) at RWTH Aachen University is miniaturizing an existing measuring system using a measuring probe for measuring drop sizes in steam power turbines. For this purpose, the institute has adapted the optical system to the special requirements of small installation spaces and used a novel manufacturing system to mount the system mechanically.

Method

To measure the local droplet size distribution, optics are required which, on the one hand, introduce light into the measuring volume and, on the other, detect the light scattered by the droplets and transmit it to a photomultiplier. As a measurement, the system detects the intensity of the control light induced by passing drops. To precisely measure the local drop size distribution, a sharply defined and well-defined measuring volume is required (illumination optics: focus diameter 10 μm , back focal length 3 mm). As a result of the miniaturized size ($\varnothing \leq 8 \text{ mm}$), mechanical lens mounts have been manufactured as fused silica tubes for the holders of the optical components using Selective Laser Etching (SLE). The optical system consists

of two assemblies, one for focusing the laser radiation coupled via an optical fiber into the measuring volume and the other for the directional reception of the laser radiation scattered by the drops.

Results

The measuring probe – developed in cooperation with the RWTH Aachen University chairs LLT, DAP and IKDG – has already been successfully used in experimental tests. The new miniaturized measuring probe allows precise measurements of the local drop size distribution. The holders for the optical system manufactured with SLE have proven themselves and will be optimized in further projects.

Applications

In principle, optical measuring methods, in which a small installation space plays an important role, can benefit from the knowledge gained in this project. The use of SLE-manufactured lens mounts allows miniaturization while maintaining mechanical and thermal stability. In addition to the measurement methods, the findings can also be transferred to laser material processing at powers < 100 W, thus opening up new areas of application.

Contact

Dipl.-Ing. Marcel Prochnau
 Telephone +49 241 8609-8220
 marcel.prochnau@tos.rwth-aachen.de

Dr. Jochen Stollenwerk
 Telephone +49 241 8609-411
 jochen.stollenwerk@ilt.fraunhofer.de

3 Focusing and acquisition module.

4 Mounted measuring probe.