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## OPTICAL SYSTEM FOR MICROSTRUCTURING OF INNER SURFACES

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### Task

Among other applications, laser-based microstructuring is applied to functionalize surfaces. By selectively creating specific surface structures, users can adapt certain surface properties independently of the material used. Microscale surface structures, for example, can be used to minimize friction and wear during mechanical stress, to generate self-cleaning or antibacterial properties, to change optical properties or to optimize surfaces in terms of aero- or fluid-dynamics. For many fields of application, however, the surface to be processed is located in a tube or cavity, so that limited accessibility has prevented the use of laser structuring to a greater extent.

### Method

A special processing optical system has been developed for structuring internal surfaces. This system is designed for use with nanosecond or ultrashort pulsed laser radiation and can be immersed in cavities as well as integrated into existing structuring systems. A particular problem is preventing the optical system from being contaminated by the ablated material.

### Results

The optical system developed at Fraunhofer ILT can be used to structure tubes or other cavities of up to 400 mm immersion depth. Thanks to a newly designed solution for protecting the optical components, the system can be applied in productive processes with high material ablation rates over a comparatively long period of time. By using a CAD/CAM solution based on grayscale bitmaps, the researchers at Fraunhofer can also create complex structures on internal surfaces.

### Applications

The system can be applied for optimizing fluid dynamic properties in particularly stressed pipelines as well as for generating internal self-cleaning surfaces and structures for wear optimization for internal mechanical stressed surfaces. Other fields of application include the de-coating or cleaning of hard-to-reach areas.

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2 Internally structured tube.