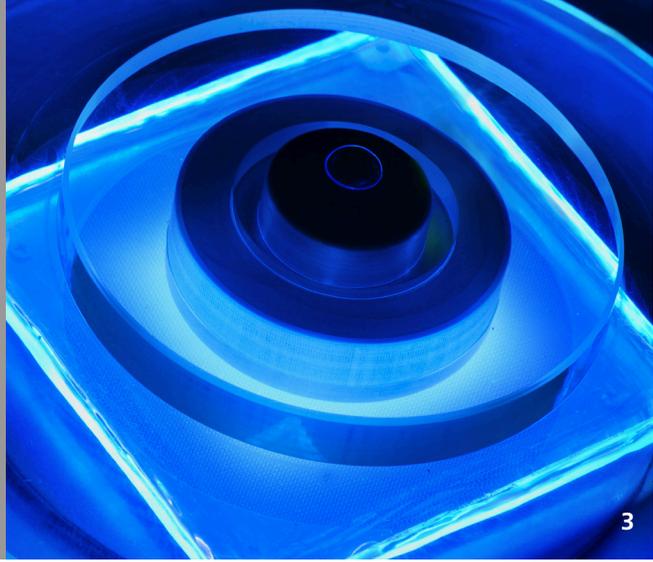


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COMBINED UV-PLASMA TREATMENT FOR SURFACE DISINFECTION

Task

UV radiation and plasmas are used today to disinfect and sterilize surfaces, respectively. However, there are limitations to both methods. In the case of UV radiation, there are losses due to shading of rough surfaces or the effectiveness is insufficient with certain types of pathogens. In the case of pure plasma treatment, the applications are restricted by the high energy required to generate the plasma and the high irradiance levels needed.

Method

To combine the advantages of both processes in one device, Fraunhofer ILT has built a demonstrator for a combined UV-plasma treatment. In a cascaded barrier discharge (Fig. 2), both UVC radiation at a wavelength of 222 nm and an air plasma are efficiently generated by applying an alternating high voltage. A continuous air flow is used to direct the reactive substances generated in the plasma – such as radicals, ozone and also atomic oxygen, as well as the UVC radiation itself – through a mesh electrode onto the surface to be cleaned. The electrical power consumption related to the surface of the UVC radiator is about 0.8 W/cm². The irradiance of the UVC component on the sample is 2 mW/cm².

Results

In initial experiments with *E. coli* and *Bacillus subtilis*, vital germs were reduced by up to five orders of magnitude with an electrical energy per radiator area of 3 J/cm². Germs were reduced by one order of magnitude to 10 percent with an irradiation of 10 mJ/cm² for the spectral UVC component. The concept can be scaled to smaller modules with a power consumption of a few watts and a small size, making this technology suitable for mobile use.

Applications

Possible applications for mobile use are in disinfection systems for clinics and medical facilities. Large-scale applications include the production of sterile packaging for medical devices and the sterilization of heat-sensitive equipment.

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2 Principle of combined UV plasma treatment.

3 UVC lamps in the demonstrator.