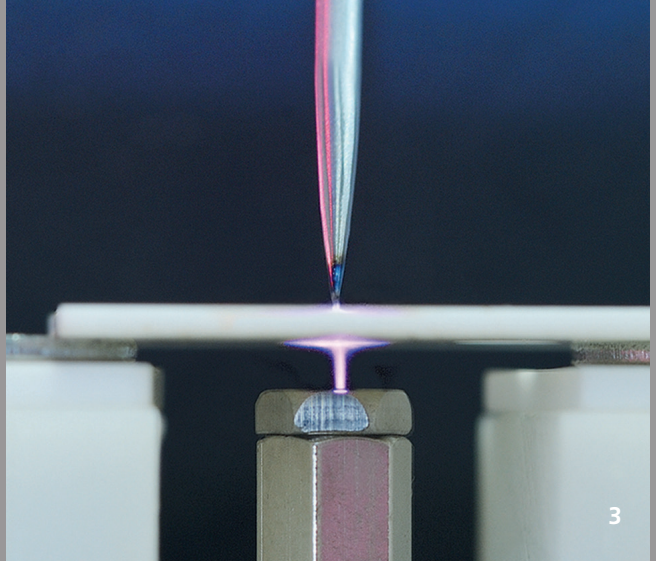

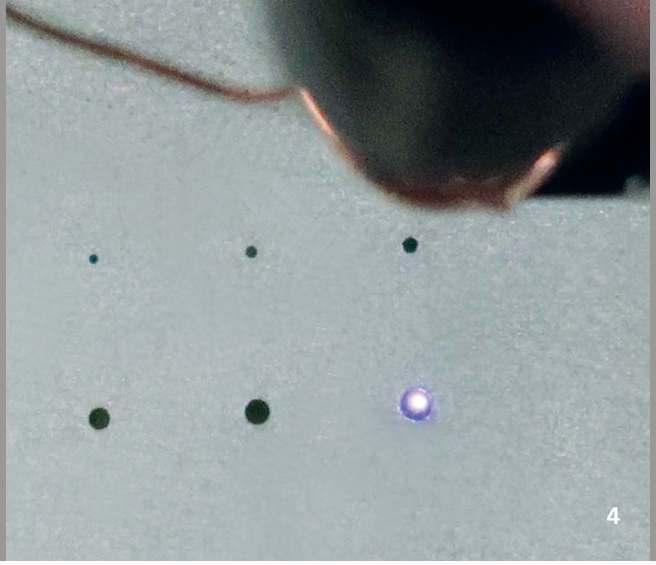

COMPACT AND BRILLIANT UV-VIS LIGHT SOURCE FOR ANALYTICS

Task

Barrier discharges have long been used as efficient light sources, e.g. as excimer emitters. In such sources, short-lived plasma filaments are generated in a gas at atmospheric pressure by applying a pulsed or high AC voltage, thus efficiently converting electrical power into light. It should then be possible to create a radiation source of high brilliance if the light can be coupled out along the filament axis and if the filaments are always ignited at the same position. Such an approach has not yet been pursued.

Method

Fraunhofer ILT has conducted initial experiments to investigate how light can be generated and radiation coupled out along the filament axis. The electrode system used consists of a pointed electrode and a flat counter electrode with an opening. The tip allows the filaments to be ignited in a stationary manner; the emission is coupled out along the axis through the opening of the counter electrode.

Results

First, the institute demonstrated that the stationary ignition of the filaments was feasible. Figure 3 shows the emission in temporal average whereupon it reaches a diameter of a 100 to 300 µm. Experiments with ambient air showed that the emission of the intense nitrogen lines between 300 nm and 400 nm is comparably high from axial and lateral directions of observation. For excimer radiation this is given by the mechanism of light generation in the plasma.

Applications

The generation of single-filament discharges makes it possible to design very compact brilliant light sources, which in particular enables new applications in online analytics. One example is compact 2D fluorescence probes, in which different wavelengths are generated in an array of several single-filament discharges in combination with spectral filters for fluorescence excitation of a target.

The 2D intensity distribution can be used to draw conclusions about pollutants contained in water, for example. Thanks to this technology, significantly more information can be obtained than with the absorption measurements at a fixed wavelength, which are widely used in water analysis today.

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3 Side view of a single filament barrier discharge.

4 Single filament barrier discharge in axial direction of observation.