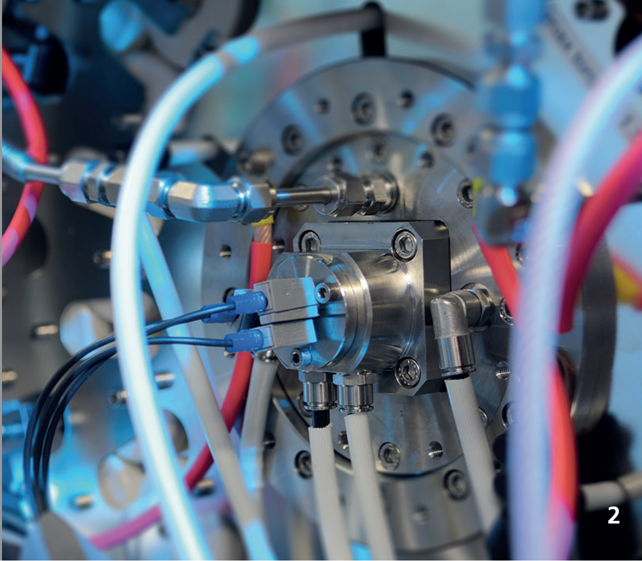

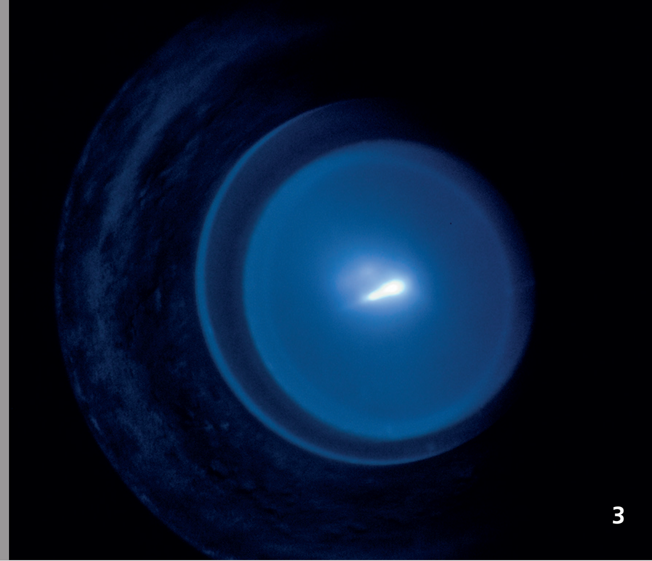

# COMPACT RADIATION SOURCES IN EXTREME ULTRAVIOLET

### Task

Discharge-based radiation sources in the extreme ultraviolet provide a cost effective and user friendly solution in the wavelength regime interesting for future chip production at 13.5 nm. In such sources, dense and hot plasma is generated by a pulsed discharge of electrically stored energy. Fraunhofer ILT has developed these sources and converted them for use in commercial applications. To make these programs more attractive to users and also to open up new areas of application, the institute has focused its development on increasing the intervals between maintenance work.

### Method

By using other electrode materials, Fraunhofer ILT has aimed its work at reducing the inevitable erosion of the electrodes in contact to the plasma. But the institute is also developing parameters that make the operation of the source tolerant to the geometric changes of the electrodes. In particular, this was achieved by a new electric circuit used to ignite the plasma. Not only has the operation of the source been demonstrated with electrodes that would have otherwise already needed to be replaced, but the efficiency of the conversion of electrical energy into EUV radiation has also been increased through access to a larger field of operating parameters.

### Result

With the solutions found, maintenance intervals can be increased by at least a factor of five, corresponding to a continuous operation of about one week (24/7).

### Applications

The radiation source is suitable for various applications in the field of semiconductor lithography such as the characterization of optical systems, contamination studies, or the development of new photoresists.

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### Contacts

Dipl.-Phys. Jochen Vieker
Telephone +49 241 8906-397
jochen.vieker@ilt.fraunhofer.de

Dr. Klaus Bergmann
Telephone +49 241 8906-302
klaus.bergmann@ilt.fraunhofer.de

*2 Back side of the electrode system of the EUV radiation source.*

*3 Off-axis image of the plasma in the coaxial electrode system.*

Subject to alterations in specifications and other technical information. 06/2016.