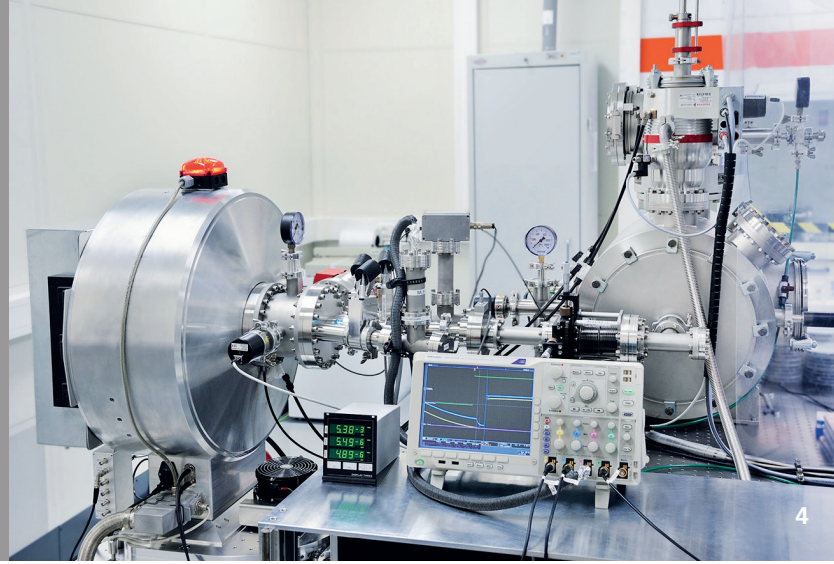


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CHARACTERIZATION OF HIGH-RESOLUTION EUV PHOTORESISTS FOR INDUSTRIAL APPLICATIONS

Task

High resolution and EUV-sensitive photoresists are required for the continuous reduction of structure sizes in industrial lithography with extreme ultraviolet radiation (EUV; standard wavelength: 13.5 nm). For characterization, however, suitable compact laboratory equipment is still not commonly available. To counter this, Fraunhofer ILT has developed the EUV laboratory exposure tool (EUV-LET), which enables EUV resists to be characterized in terms of sensitivity, contrast and resolution at the industrial standard wavelength of 13.5 nm.

Method

To characterize EUV resists for industrial lithography at 13.5 nm, the scientists at Fraunhofer ILT employ a multilayer mirror to spectrally filter the broadband EUV radiation of the plasma-based gas discharge source. Here, a main wavelength of 13.5 nm is applied with a relative spectral bandwidth of 4 percent. By means of a dose monitor, the pulse energy is continuously measured and used as the basis for the exposure time. The photoresist-coated wafer is located in a positioning unit, which allows a series of exposures to be made on the wafer. In addition, the mask-wafer distance can be adjusted down to an accuracy in the nm range. This way, resolution tests can be conducted in addition to simple contrast curves. For the highest possible resolution, the researchers use the method of achromatic Talbot lithography. Previously achieved resolutions are in the sub-30-nm range for hole arrangements and sub-40-nm for line arrangements.

Results

The EUV-LET is used to characterize different EUV resists with respect to contrast, sensitivity and resolution. Moreover, it enables fast and easy testing of new resist compositions at a wavelength of 13.5 nm.

Applications

This compact lithography system can be used to develop and characterize photoresists with extreme ultraviolet radiation for further use in industrial lithography.

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- 3 Transmission mask for resolution tests.
4 EUV laboratory exposure tool (EUV-LET).