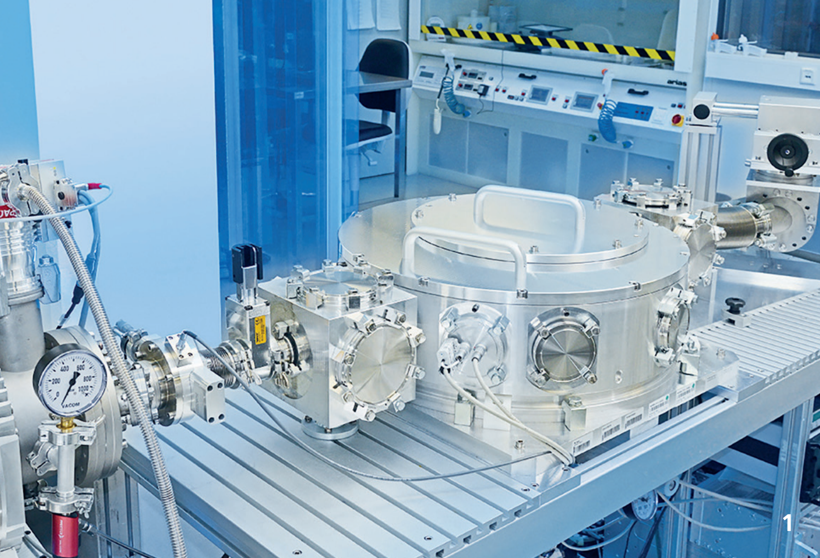

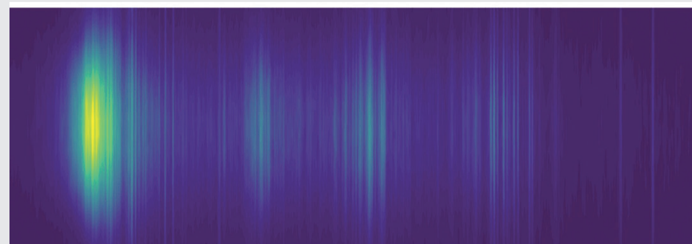

Subject to alterations in specifications and other technical information. 07/2021.

EUV MEASUREMENT TECHNOLOGY FOR INDUSTRIAL SEMICONDUCTOR PRODUCTION

Task

For the latest generation of microchips, the semiconductor industry commonly uses lithographic processes – with radiation of ever shorter wavelengths, currently extreme ultraviolet (EUV) radiation at 13.5 nm – to fabricate ever smaller and more complex structural arrays. Supporting metrology processes are required to meet the increasing demands resulting from this miniaturization. Compared to conventional photonic measurement processes, EUV metrology offers considerable advantages because it is highly sensitive to structures with nanoscale dimensions that lie within the resonance range of the radiation. Moreover, EUV radiation can also be used for actinic measurement processes, i.e. processes that use the same wavelengths as lithography systems.

Method

An EUV spectrometer is used to measure the reflectance of material and nanostructured samples in the wavelength range from 8 nm to 17 nm at various angles of grazing incidence. The optical constants and other geometric and chemical properties of the sample can be reconstructed from the determined reflectance values using model-based methods. These include the nanoscale structural dimensions of periodic surface structures, layer thicknesses and roughnesses of multilayer systems, and the stoichiometry and density of materials.

Results

The optical constants of novel materials could be determined in the EUV spectral range from 8 nm to 17 nm. Nanoscale grating structures and multilayer systems can be characterized at a resolution in the sub-nm range.

Applications

The development of the measurement process goes hand in hand with the latest generation of semiconductor products. For example, this process can be used to characterize novel absorber materials for mask fabrication. In addition, the compact design of the EUV spectrometer makes it suitable for direct process monitoring in semiconductor manufacturing.

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1 Experimental setup of the EUV spectrometer.

2 Measured EUV spectrum.

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