



EUV REFLECTOMETRY TO CHARACTERIZE THIN FILMS

Task

Angle-resolved reflectometry in grazing incidence using polychromatic, extreme ultraviolet (EUV) radiation in the range 5-40 nm allows thin layers to be characterized with nanometer precision. Composition, thickness and surface roughness of a layer system can be indirectly identified from its reflectivity. Previously, such measurements were only possible with costly synchrotron-based radiation sources, where the wavelength and the angle of incidence have to be varied stepwise with long measuring times of several hours.

Method

EUV light of a polychromatic plasma source is used to measure wavelength and angle-resolved spectra. These spectra are detected with a spectrograph before and after reflection on the sample in order to obtain the reflectivity of the sample from the ratio of the spectra. Thanks to an additional mirror, mounted in parallel to the sample on a common rotary table, different angles of incidence can be compensated for. The properties of the sample can be determined through the modeling of a layer system and the step wise convergence of the modeled reflectivity spectrum to the measured spectrum. The typical measurement duration amounts to several minutes.

Result

The method has been used on various industrially relevant samples. For this purpose, samples of HfO_2 with different thicknesses on a silicon substrate were examined. The variation in the layer thickness produced – between 1 nm and 9 nm HfO_2 – could be detected with this method as well as a parasitic SiO_2 interlayer with a thickness of 0.2 nm.

Applications

The newly developed method for angle-resolved measurement of reflectivity is particularly suitable for applications in the silicon-based semiconductor industry, since the spectral range of the plasma source is tailored to the silicon L-edge at 12.4 nm.

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