



CHARACTERIZATION OF PHOTORESISTS IN EUV RADIATION RANGE

Task

When microchips are manufactured, one important process step is the patterning of photoresists with lithographic methods. Only after resist structures have been created they can be transferred into the actual (underlying, partially masked) target material by means of ion etching. The characterization of these photoresists is, therefore, particularly important since the resist needs to be able to resolve the intensity distribution provided by the optical system. For the photoresist to be successfully implemented into a process chain with given manufacturing tolerances (time, accuracy), their sensitivity and contrast must be sufficiently high at the required resolution.

Method

Resists are exposed to extreme ultraviolet radiation (EUV, in a wavelength range of 10 nm to 17 nm) over large areas with the EUV Laboratory Exposure Tool (EUV-LET). In this setup, a dose of 1 mJ/cm² can be introduced in the resist within one second. Thus, typical exposure times for the photoresists utilized are in the range of only a few minutes. So that so-called contrast curves can be determined, the exposure dose is increased stepwise. After the wet chemical development of the photoresist, its contrast can be extracted from the exposure result. The contrast curve also supplies information about the sensitivity of the photoresist including its development procedure. Furthermore, the EUV-LET is equipped with a quadrupole

mass spectrometer that allows the outgassing behavior of the resist to be monitored before and during the exposure in order to prevent possible contamination of the nearby optics.

Result

With the measurement method developed here, various photoresists can be precisely characterized in the EUV range regarding their contrast, sensitivity and outgassing behavior.

Applications

Both companies in the field of resist development as well as research institutions now are able to characterize novel photoresists with a compact laboratory setup in-house. In addition, alternative developers and development procedures can be evaluated for their potential to increase the contrast.

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2 Exposure results.

3 Exposure station EUV-LET.