

# Latent images in EUV photoresists measured with a lab-scale EUV scatterometry setup

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The authors present their recent work on the identification and characterization of latent images in EUV photoresists using a small-scale EUV reflectometry and scatterometry setup at RWTH Aachen University. Optical metrology methods like scatterometry can identify latent images, if the photochemical changes in the resist lead to an optically detectable change of the material or a variation in the photoresist thickness [1,2]. In previous studies it was shown that these detectable changes might especially occur after a post exposure bake where the resist tends to shrink differently for exposed and unexposed areas [2].

In this experimental study, samples with the latent image of a line grating in an EUV photoresist are prepared by electron beam lithography and measured with EUV reflectometry and scatterometry. The samples are treated with a post exposure bake and one of the samples is developed to serve as a reference by providing the actual resist structure after development. Furthermore, two unstructured samples are prepared: one unexposed, the other exposed over the full surface at nominal dose-to-clear of the photoresist. These two samples are measured by EUV reflectometry to characterize the optical constants of the photoresist at the EUV spectral range which allows to identify if the chemical changes in the resist are detectable.

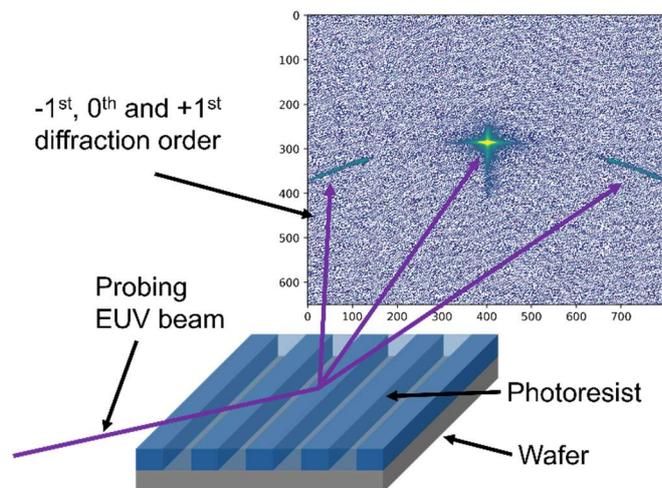


Figure 1 Schematic illustration of a latent image in a photoresist layer measured by EUV scatterometry. The inserted data shows the measured diffraction pattern of the prepared latent image grating sample (camera image in log-scaled for visualization).

Additionally, in a preliminary study the influence of an EUV dose induced by the measurement itself is evaluated. It is shown that the additional EUV dose on the tested photoresists after the post exposure bake has a reduced influence on the solubility, making EUV scatterometry a feasible inspection method for latent images.

[1] Q. Zhang, K. Andrie, W. Chao, Z. Peng, W. Holcomb, R. Miyakawa, D. Kumar, A. Hexemer, P. Naulleau, B. La Fontaine, R. Ruiz and C. Wang, 2024, JM3 **23(04)**, 044003.

[2] S. Schröder, L. Bahrenberg, B. Lüttgenau, S. Glabisch, S. Brose, S. Danylyuk, J. Stollenwerk, P. Loosen and C. Holly, 2022, JM3 **21(02)**, 021208.