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Metrology of EUV Masks by EUV-Scatterometry and Finite Element Analysis

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Extreme ultraviolet (EUV) lithography is seen as a main candidate for production of future generation computer technology. Due to the short wavelength of EUV light (around 13 nm) novel reflective masks have to be used in the production process. A prerequisite to meet the high quality requirements for these EUV masks is a simple and accurate method for absorber pattern profile characterization. In our previous work we demonstrated that the Finite Element Method (FEM) is very well suited for the simulation of EUV scatterometry and can be used to reconstruct EUV mask profiles from experimental scatterometric data. In this contribution we apply an indirect metrology method to periodic EUV line masks with different critical dimensions (140 nm and 540 nm) over a large range of duty cycles (1:2, ..., 1:20). We quantitatively compare the reconstructed absorber pattern parameters to values obtained from direct AFM and CD-SEM measurements. We analyze the reliability of the reconstruction for the given experimental data. For the CD of the absorber lines, the comparison shows agreement of the order of 1nm. Furthermore we discuss special numerical techniques like domain decomposition algorithms and high order finite elements and their importance for fast and accurate solution of the inverse problem.

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