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## GISAXS reconstruction of grating profiles produced using self-aligned multiple patterning

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New approaches are needed for the fast, non-destructive dimensional measurement of complex nanostructures in the semiconductor industry. One technique being considered is Small-Angle X-ray Scattering (SAXS), which has already been used in transmission geometry to reconstruct the line profile of gratings with low uncertainties. Grazing-Incidence SAXS (GISAXS) in reflection geometry additionally provides surface sensitivity, but the interpretation of the scattering is complicated by multiple scattering effects.

In order to produce structures beyond the diffraction limit of a single lithographic image, self-aligned multiple patterning can be used. In self-aligned multiple patterning, sidewalls are deposited on the original line and the original line is removed, such that the sidewalls form lines with a doubled structure density. If the sidewall width and the original linewidth do not match, an alternating pitch error is introduced, impacting the performance of the resulting structures.

We present GISAXS measurements of a series of grating samples with a nominal pitch of 32 nm. The samples were produced by self-aligned multiple patterning, and different pitch errors were introduced on purpose. From the intensities of the grating diffraction orders we quantify the pitch errors and compare our results to previous transmission SAXS measurements of the same samples.

**Primary authors:** PFLÜGER, Mika (Physikalisch-Technische Bundesanstalt (PTB)); Dr SOLTWISCH, Victor (Physikalisch-Technische Bundesanstalt (PTB)); Dr KLINE, R. Joseph (National Institute of Standards and Technology (NIST)); Dr KRUMREY, Michael (Physikalisch-Technische Bundesanstalt (PTB))

Presenter: PFLÜGER, Mika (Physikalisch-Technische Bundesanstalt (PTB))

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