Impact of Multilayer Imperfections on EUV OPC and Patterning

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Imperfections in the multilayer EUV reflector stack pose a difficult problem for the generation of models for use in Optical Proximity Correction. The multilayer stack ideally is alternating layers of molybdenum and silicon or ruthenium and silicon. However, there are diffused interface regions between these layers that result in variation in thickness, reflectance and absorption. The interface regions can vary based on variations in the deposition tool, resulting in EUV masks with slight variations in the multilayer. This is a difficult problem for OPC models because slight variations in the multilayer can result in large variations in the feature printed on the wafer. Also, these stack variations are not precisely known for every reticle, rather a sample stack is used to gather data from a cross section of a representative reticle.

This study will investigate the impact of the model of the interface region and multilayer stack in general on the final wafer CD through OPC. The study will investigate the impact of n, k, and thickness variations on the final wafer CD. It will also investigate how to best discretize the interface regions for optimal results using both Mo/Si and Ru/Si stacks. The results will be used to understand CD variations observed in measured data.

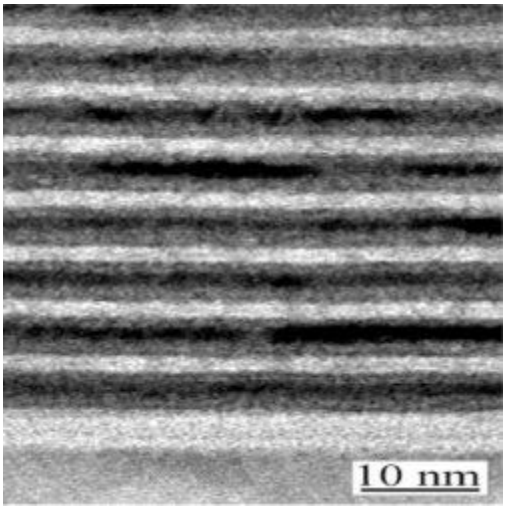

Figure 1. Cross sectional TEM of an EUV mask multilayer[1]. The multilayer is deposited in alternating Mo and Si layers, which should result in alternating black and grey lines in the TEM. However, an interface region between the Mo and Si is clearly visible resulting in 4 layers per multilayer repeating unit.

[1] Wu, Banqiu, and Ajay Kumar. 2009. "Extreme Ultraviolet Lithography:." *Optics and Photonics Focus* (Optic Society of America) Volume 7 . http://opfocus.org/index.php?topic=story&v=7&s=4.