1. Title:	Aerial Image Linewidth Measurement Capabilities of the Actinic Inspection Tool
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5. EUVL topic (check only one by "X")	☐ Exposure Tools (ET) ☐ Optics & ML Coatings (ML) ☐ Sources (SO) ☐ Optics Contamination (OC) ☐ Resists (RE) ☐ Device Integration (DE) ☒ Masks (MA) ☐ Technology Readiness (TR) ☐ Defect Inspection (DI) ☐ Cost of Ownership (CO) ☐ Reticle Contamination (RC)
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7. Abstract body:

Characterizing extreme ultraviolet (EUV) lithography masks using high-resolution EUV-light microscopy is essential for the development and qualification of EUV mask technologies. Actinic, EUV-wavelength imaging provides quantitative aerial image feedback in ways that photoresist printing and non-EUV inspection methods cannot.

The SEMATECH Berkeley Actinic Inspection Tool (AIT) is a prototype EUV zoneplate microscope dedicated to mask research. In 2008, the AIT optics have been upgraded for higher magnification, and 4x NA values from 0.25 to 0.35. These upgrades give the AIT high contrast imaging at 100-nm mask linewidth and below. The AIT is used for defect and repair inspection, mask architecture studies, and more.

We report the linewidth measurement capabilities of the AIT. Making nanometer-scale linewidth measurements pushes the capabilities of the tool. High-accuracy requires a low aberration magnitude and uniform or well characterized illumination; while measurement precision depends on a high signal to noise ratio. Both precision and accuracy are affected by the presence of static, nanoscale phase roughness which we observe on all masks. The severity of this roughness is affected by the illumination coherence and by the residual aberrations that arise from the zoneplate alignment and field of view. We characterize the AIT's linewidth measurements, and compare with available MET printing and SEM data.

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