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## Recent Work

### Title

Progress in actinic mask imaging: the closest look at lines, defects in phase roughness

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Title:

"Progress in actinic mask imaging: the closest look at lines, defects and phase roughness"

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Lawrence Berkeley National Laboratory, Sematech

The SEMATECH Berkeley Actinic Inspection Tool (AIT) is a high-resolution synchrotron based EUV mask imaging microscope operating with diffraction-limited performance. In the past year, the imaging performance of the AIT has improved dramatically as a result of a dedicated effort to analyze and reduce the imaging aberrations to zero in the center of the field of view. At 0.0875 NA (equivalent to 4x, 0.35 NA) the AIT now resolves lines as small as 60 nm (16 nm at 4x), and isolated defects as small as 30 nm.

Illumination uniformity improvements from a new angle-scanning mirror improve every pattern-imaging metric. The AIT can measure contrast, linewidth, and NILS with high repeatability, and measured linewidth roughness (in the images) down to 8-nm 3-sigma (mask units). Further improvements have come from a new constant-flux "top-off mode" at the Advanced Light Source, which provides stable illumination at more than twice the time-integrated flux levels.

The AIT is now routinely used to measure mask pattern properties, to image programmed and native defects in patterned and blank masks, to calibrate the sensitivity of non-actinic inspection tools, to qualify defect repair recipes, to validate defect modeling, to quantify the severity of multilayer phase roughness, and to investigate early work in optical proximity correction for EUV masks, among other tasks.

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