EXTREME ULTRAVIOLET LITHOGRAPHY

1. Title:	Imaging characteristics of dark-field actinic mask blank inspection
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3. Abstract body:

Actinic mask inspection platform demonstrated at MIRAI is based on a dark field imaging and has a capability of detecting multilayer phase defect with a height of smaller than 2 nm. To clarify whether all critical defects can be detected and to optimize the detection optics, the inspection image intensity for several defect dimensions and for various types of phase defects were analyzed. Simulation results indicated that as defect dimension increased, inspection signal did not always monotonically increase. This is due to a combination of the numerical aperture (NA) of inspection optics and the central obscuration NA. Through-focus characteristics on various types of programmed phase defects were also examined. The surface shapes of programmed defect include bump, pit, line, and groove. Optical simulation results suggested that best focus position where maximum image intensity is obtained is different between defect shape types, especially with the bump and pit. The predictions of pixel intensity derived from optical calculation were consistent with the experimental results of detecting programmed defects and natural defects. By analyzing several factors of limiting inspection sensitivity, a conceptual design of a prototype inspection tool for practical use was made. These technologies developed at MIRAI have been transferred to Selete (Semiconductor Leading Edge Technologies, Inc.) where prototype of full-field mask blank inspection tool is being developed.

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