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NEWS

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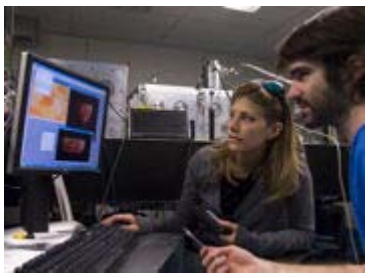
EUV microscope inspects masks on-site

The first reflection microscope to use an EUV laser illumination source could provide chip manufacturers with a rapid, on-site method for inspecting lithography masks.



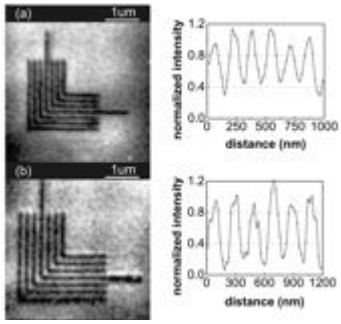
US researchers build EUV microscope

A tabletop extreme ultraviolet reflection microscope that captures images in 20s with a half-pitch spatial resolution of around 55nm has been demonstrated by researchers in the US. The microscope uses a 13.2nm laser source making it a practical mask inspection tool for semiconductor manufacturers (*Optics Letters* **34** 271).

"Our microscope is the first to use a laser as an illumination source," Fernando Brizuela, a researcher at Colorado State University, told *optics.org*. "This means that semiconductor manufacturers could have one in each of its facilities carrying out characterization of defects on masks on-site before the masks are loaded into the printing tool."

Extreme ultraviolet lithography (EUVL) is considered to be the technology of choice to print the next-generation of semiconductor chips. One of the main challenges standing in the way of its commercialization is the availability of masks free of printable defects.

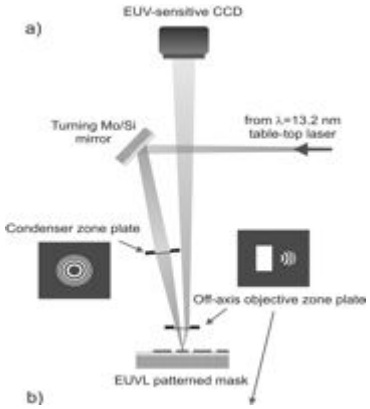
"Masks are typically 6x6 inches glass substrates coated with a molybdenum/silicon multilayer that has around 70% reflectivity at 13.5 nm, which is the wavelength that will be used to print the wafers," explained Brizuela. "Any defect located on or under these layers will produce artifacts in the printed wafer making the chip unusable."



EUV images elbow patterns

A crucial aspect of characterizing defects in EUVL masks is that the microscope must 'see' the defects under the same illumination conditions that the defects would print in the stepper tool. This means it is critical to match the angle of incidence of the light on the mask, the numerical aperture as seen by the EUVL mask on the stepper and the coherence conditions of the illumination that affect image formation.

Previous demonstrations of imaging systems use light generated at large synchrotron facilities for illumination. The key advantage of using a laser illumination source is that it would allow the imaging system to be used by semiconductor manufacturers on-site for EUVL mask inspection.



Microscope set-up

"The geometry of our reflection microscope mimics a 4x EUVL stepper in the angle at which the mask is illuminated, the numerical aperture of the objective lens and the overall coherence of the system," explained Brizuela. "The microscope can detect defect features down to 55 nm on an EUVL mask, which would print as a 14 nm feature on a wafer when using a 4x demagnification stepper."

Currently the entire setup including the laser source occupies several small optical tables, but as laser sources continue to develop, the US team hopes to reduce the footprint of the microscope. "We are working on improvements to the microscope's illumination system and expect to start evaluating the performance of EUVL masks in the next few months," concluded Brizuela.

About the author

Marie Freebody is the science and technology editor for *optics.org* and *Optics & Laser Europe* (http://optics.org/cws/Ole/Welcome.do).