

Pushing EUV lithography development beyond 22-nm half pitch

Patrick P. Naulleau,¹ Christopher N. Anderson,² Paul Denham,¹ Simi George,¹
Kenneth A. Goldberg,¹ Brian Hoef,¹ Gideon Jones,¹ Chawon Koh,³ Bruno La Fontaine,⁴
Warren Montgomery,³ and Tom Wallow⁴

¹Center for X-Ray Optics, Lawrence Berkeley National Laboratory, Berkeley, CA 94720

²Applied Science & Technology Graduate Group, University of California, Berkeley, CA
94720

³SEMATECH, Albany, NY 12203

⁴Advanced Micro Devices, Sunnyvale, CA 94088

Microfield exposure tools (METs) have and continue to play a dominant role in the development of extreme ultraviolet (EUV) resists and masks. One of these tools is the SEMATECH Berkeley 0.3 numerical aperture (NA) MET. Here we investigate the possibilities and limitations of using the 0.3-NA MET for sub-22-nm half-pitch development. We consider mask resolution limitations and present a method unique to the centrally obscured MET allowing these mask limitations to be overcome. We also explore projection optics resolution limits and describe various illumination schemes allowing resolution enhancement. At 0.3-NA, the $0.5 k_1$ factor resolution limit is 22.5 nm meaning that conventional illumination is of limited utility for sub-22-nm development.

In general resolution enhancing illumination encompasses increased coherence. We study the effect of this increased coherence on line-edge roughness, which along with resolution is another crucial factor in sub-22-nm resist development.

Finally, the presentation will also include a summary of the latest resist characterization results including resolution, line-edge roughness, and sensitivity including results at 20 nm and smaller.

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