Maskless Lithography Beyond EUV Using an Array of Transmissive Diffractive Microlenses

By

Henry I. Smith, M. E. Walsh, F. Zhang and T. Savas

LumArray, Inc.

15 Ward Street

Somerville, MA 02143

Abstract

Recent efforts to develop high-flux, narrow-band, free-electron lasers (FEL) for EUV lithography [1,2] has created an opportunity to use a more appropriate wavelength than 13.5 nm, i.e., 4.5 nm, together with transmissive diffractive optics (e.g., Fresnel zone plates and related microlenses) in either a mask-based or maskless scheme [3]. The critical component for maskless transmissive-diffractive lithography is a modulator that adjusts the x-ray flux delivered to each of an array of microlenses. The elements of such a modulator, efforts to develop a working model and how the modulator would be integrated with the FEL, an array of microlenses and the wafer-carrying stage to achieve lithography that outperforms current EUV, called X-ZPAL, will be described along with the microchip innovations that would result from the introduction of maskless lithography at 4.5 nm.

References:

[1] On the Compatibility of Free-Electron Lasers with EUV Scanners, Christopher N. Anderson, Optical and EUV Nanolithography XXXVII, edited by M. Burkhardt, Proc. SPIE,vol 12953,129530T © 2024 SPIE 0277-786X doi 10 1117/12.30124.12.

[2] J. Boyd, Is the future of Moore's Law in a particle accelerator, pp. 29-33, July 2024 Spectrum IEEE. Org.

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