

Multilayer coated optics for an alpha-class extreme ultraviolet lithography system

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Abstract

We present the results of coating the first set of optical elements for an alpha-class extreme-ultraviolet (EUV) lithography system, the Engineering Test Stand (ETS). The optics were coated with Mo/Si multilayer mirrors using an upgraded DC-magnetron sputtering system. Characterization of the near-normal incidence EUV reflectance was performed using synchrotron radiation from the Advanced Light Source at the Lawrence Berkeley National Laboratory. Stringent requirements were met for these multilayer coatings in terms of reflectance, wavelength matching among the different optics, and thickness control across the diameter of each individual optic. Reflectances above 65% were achieved at 13.35 nm at near-normal angles of incidence. The run-to-run reproducibility of the reflectance peak wavelength was maintained to within 0.4%, providing the required wavelength matching among the seven multilayer-coated optics. The thickness uniformity (or gradient) was controlled to within $\pm 0.25\%$ peak-to-valley (P-V) for the condenser optics and $\pm 0.1\%$ P-V for the four projection optics, exceeding the prescribed specification for the optics of the ETS.

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