

Mo/Be multilayers for extreme-ultraviolet lithography**S. Bajt, R. D. Behymer, M. Wall, C. Montcalm, S. P. Vernon, F. J. Weber, F. R. Grabner, and J. A. Folta**

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Multilayer mirrors with high reflectivity, low stress and long term stability are important for the success of extreme ultraviolet (EUV) lithography. Typically, these multilayer coatings consist of alternating layers of Mo and Si and normal incidence reflectances of up to 67% in the 13.0-13.5 nm wavelengths region are routinely achieved. However, Mo/Be multilayer mirrors, which operate at the slightly shorter wavelength region of 11.1-11.5 nm, are now considered as an alternative to the Mo/Si. The Mo/Be system has a higher theoretical reflectivity and values up to 69% have already been measured in the past.^{1,2} This material combination is also favored because of intensity considerations for the laser plasma-based sources currently being developed for EUV lithography.

We report on the performance of Mo/Be multilayer mirrors deposited in our newly constructed DC magnetron sputtering system and relate the results to the microstructure of the multilayers. The normal incidence reflectance of 69% at 11.4 nm was reproducibly achieved. The multilayers were characterized by various techniques including SAXRD, HRTEM, SIMS, RBS and a synchrotron based EUV reflectometer. Also, the performance of the deposition system in terms of run-to-run reproducibility and coating uniformity is discussed.

[1] K. M. Skulina, C. S. Alford, R. M. Bionta, D. M. Makowiecki, E. M. Gullikson, R. Soufli, J. B. Kortright, and J. H. Underwood (1995) *Applied Optics* 34, 3727.

[2] D. G. Stearns, K. M. Skulina, M. Wall, C. S. Alford, R. M. Bionta, D. M. Makowiecki, E. M. Gullikson, R. Soufli, J. B. Kortright, and J. H. Underwood (1995) *Mat. Res. Soc. Symp. Proc.*, Vol. 382, 1995 Materials Research Society, 329.

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