Thermal stability and mechanical stress of B-based multilayers

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Abstract

In the last years, much effort has been put into the development of high reflective multilayer mirrors for a BEUV-lithography working at 6.x nm wavelength. It was previously shown that two main approaches lead to higher values of reflectivity: the introduction of ultrathin C-barriers in La/B_4C multilayers by Chkhalo et al.[1] as well as the transition from La/B to LaN/B multilayers by Tsarfati et al.[2] considerably enhanced the multilayers near normal reflectivity near the Boron K absorption edge (λ = 6,6 nm).

In this contribution the authors will have a close look on the thermal stability of high reflective B-based multilayer mirrors, i.e. investigating their structure, reflective properties and chemical processes in the multilayer and at the interfaces for elevated temperatures up to 800 °C. La/B_4C and LaN/B_4C multilayers will be compared with various characterization methods like XRR, XRD, HRTEM, XPS and EUVR.

Furthermore, the coatings for various applications should have low residual stresses to avoid form deformation of precise substrates. The authors will present results on the residual stress of different B-based multilayer coatings. The physics of the temperature dependent development of the stress will be discussed, too.

[1] Chkhalo, N. I. et al., Appl. Phys. Lett. 102(1), 2013.

[2] Tsarfati, T. et al., Thin Solid Films 518(5) ,2009.