Interlayer formation in Mo/CrB2/Si multilayer x-ray mirrors

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Impact of CrB_2 barrier layers on structure of interfaces in Mo/Si multilayer X-ray mirrors (MXMs) is investigated by small-angle x-ray diffraction technique. The 0.1-1.7 nm thick barriers are applied to Mo-on-Si interfaces of sputter-deposited Mo/Si multilayers with a period (bi-layer thickness) of 6.6-7.3 nm. Ultrathin diffusion barriers are found to hamper interface interaction between Mo and Si layers, while the barriers beginning from the thickness of ~0.5 nm prevent Mo-Si intermixing completely. Reaction of the barrier materials with the Mo and Si layers accompanied with contraction of a multilayer period by 0.40-0.45 nm is revealed. A dependence of composition and interface thickness on a barrier layer thickness is investigated. The fabricated Mo/CrB2/Si MXMs demonstrate enhanced reflectance in EUV wavelength range as compared to regular normal-incidence Mo/Si one.