

Stability issues in Pd/B₄C multilayers

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ABSTRACT

Low d-spacing sputtered Pd/B₄C multilayers are attractive candidates for x-ray optical devices operating near photon energies of 20 keV. They form smooth interfaces and provide high reflectance. However, they turn out to be unstable under ambient conditions. They grow with excessive compressive stress and form defects. When exposed to oxygen, boron depletion and oxidation rapidly lead to a significant reduction of the d-spacing and to considerable damage of the layered structure. Several series of multilayers were studied using analytical tools such as x-ray reflectivity, in-situ stress monitoring, scanning electron microscopy, transmission electron microscopy, and energy dispersive x-ray spectroscopy. The sample properties were investigated over periods of time of up to two years. Various types of protection layers were added, which can slow down the degradation process by orders of magnitude.