Deposition and X-ray performance of W/B4C multilayers with d-spacings of 1.1nm - 1.4nm.

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W/B4C multilayers with d-spacings of 1.1 nm - 1.4 nm and number of bi-layers N=300 have been deposited by the magnetron sputtering technique. Performance of the multilayers at Cu-K (Lambda=0.154 nm) was studied at Osmic Inc. and reflectivity in soft X-ray range at Al-K (Lambda=0.834nm) , Mg-K (Lambda=0.989 nm), and O-K (Lambda=2.36 nm) radiation lines was measured at the Institute for Physics of Microstructures, Nizhniy Novgorod, Russia.

The uniformity of d-spacing distribution across the area of 60 mm by 60 mm was found to be better than +/-0.0025 nm.

The experimentally observed reflectivity at Lambda=0.154 nm is the following: 18.3% for d=1.17 nm, 24.5% for d=1.20 nm, 28.6% for d=1.25 nm, 31.7% for d=1.32 nm, and 44.9% for d=1.4 nm with the angle resolution tan(theta) / delta(theta) is 262, 253, 239, 228, and 206 respectively.

The reflectivity at Mg-K line lies from 3.3% for d=1.17 nm to 9.2% for d=1.4 nm with the angle resolution from 287 to 236 respectively.

The interfacial roughness of the multilayers has been calculated from the measured reflectivity at the different wavelengths of radiation by assuming that the layer material densities were equal to the bulk densities. The interfacial roughness was found to be from 0.3 nm to 0.33 nm with no dependencies on the d-spacing of the multilayers or on the radiation wavelengths used.

In this work a W/B4C multilayer with relatively large d-spacing of 1.73 nm has been also investigated.