

Characterization of Mg/Sc System for X-Ray Spectroscopy in the Water Window Range

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Abstract : Periodic multilayer mirrors have potential application as optical components in X-ray microscopy, particularly working in the water window region. The water window range, located between the absorption edges of carbon (285 eV) and oxygen (530eV), along with the presence of nitrogen K absorption edge (395 eV), makes it a powerful method for imaging biological samples due to the natural optical contrast between water and carbon. We characterized bilayer, trilayer, quadrilayer, and multilayer systems of Mg/Sc with ZrC thin layers introduced as a barrier layer and capping layer prepared by ion beam sputtering. The introduction of ZrC as a barrier layer is expected to improve the structure of the Mg/Sc system. The ZrC capping layer also prevents the stack from oxidation. The structural analysis of the Mg/Sc systems was carried out by using grazing incidence X-ray reflectivity (GIXRR) to obtain non-destructively a first description of the structural parameters, thickness, roughness, and density of the layers. Resonant soft X-ray reflectivity measurements in the vicinity of Sc L-absorption edge were performed to investigate and quantify the atomic distribution of deposited layers. Near absorption edge, the atomic scattering factor of an element changes sharply depending on its chemical environment inside the structure.

Keywords : buried interfaces, resonant soft X-ray reflectivity, X-ray optics, X-ray reflectivity

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