STRUCTURE AND THE STABILITY OF 2.4 nm PERIOD AMORPHOUS Ni-Nb/C MULTILAYERS

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ABSTRACT

The amorphous Ni-Nb/C multilayers with a period of 2.4 nm were prepared by pulsed laser ablation deposition. The as-deposited multilayers were found to have an interdiffused layer of $Ni_{1/3}Nb_{1/3}C_{1/3}$ present between the $Ni_{1/2}Nb_{1/2}$ and C layers. The thickness of the interdiffused layer is found to be 0.55 nm, comparable to the thickness of $Ni_{1/2}Nb_{1/2}$ and C layers, 0.66 nm each. The specular reflectivity studies show that the interfaces have a roughness of about 0.4 nm. The diffuse scattering studies however do not show the presence of interface induced scattering, indicating that the interface roughness is chemical and not morphological in origin.

Since the formation of intermediate interdiffused layer, $Ni_{1/3}Nb_{1/3}C_{1/3}$, is chemical in origin the temporal stability of the structure was investigated using grazing incidence x-ray scattering studies. The layered structure, chemistry and morphology, is found to be unaltered even after a period of about 2.5 years indicating that the chemical driving force for interdiffusion present in the multilayer structure is insufficient to destroy the layered structure at room temperature. The grazing incidence x-ray scattering results together with the simulations will be presented and discussed in this paper.

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