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Synthesis of sponge-like hydrophobic $NiBi_3$ surface by 200 keV Ar ion implantation

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Abstract

Sponge-like nanostructures develop under Ar-ion implantation of a Ni-Bi bilayer with increasing ion fluence at room temperature. The surface morphology features different stages of evolution as a function of ion fluence, finally resulting in a planar surface at the highest fluence. Our investigations on the chemical composition reveal a spontaneous formation of $NiBi_3$ phase on the surface of the as deposited bilayer film. Interestingly, we observe a competition between crystallization and amorphization of the existing polycrystalline phases as a function of the implanted fluence. Measurements of contact angle by sessile drop method clearly show the ion-fluence dependent hydrophobic nature of the nano-structured surfaces. The wettability has been correlated with the variation in roughness and composition of the implanted surface. In fact, our experimental results confirm dominant effect of ion-sputtering as well as ion-induced mixing at the bilayer interface in the evolution of the sponge-like surface.

1. Introduction

$NiBi_3$ is an inter-metallic compound of Ni-Bi system, which is being extensively studied for its superconducting and magnetic properties[1, 2, 3, 4, 5].

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