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Effect of Multilayered MnBi Films on Magnetic and Microstructural Properties

Authors : Hyun-Sook Lee, Hongjae Moon, Hwaebong Jung, Sumin Kim, Wooyoung Lee

Abstract : Low-temperature phase (LTP) of MnBi has attracted much attention because it has a larger coercivity than that of Nd-Fe-B at high temperature, which gives high potential as a permanent magnet material that can be used at such high temperature. We present variation in magnetic properties of MnBi films by controlling the numbers of Bi/Mn bilayer. The thin films of LTP-MnBi were fabricated onto glass substrates by UHV sputtering, followed by in-situ annealing process at an optimized condition of 350 °C and 1.5 hours. The composition ratio of Bi/Mn was adjusted by varying the thickness of Bi and Mn layers. The highest value of (BH)max ~ 8.6 MGOe at room temperature was obtained in one Bi/Mn bilayer with 34 nm Bi and 16 nm Mn. To investigate the effect of Bi/Mn multilayers on the magnetic properties, we increased the numbers of Bi/Mn bilayer up to five at which the total film thicknesses of Bi and Mn were fixed with 34 nm and 16 nm. The increase of coercivity was observed up to three layers from 4.8 kOe to 15.3 kOe and then suppression was appeared. A reversed behavior was exhibited in the magnetization. We found that these were closely related to a microstructural change of LTP-MnBi and a reduction of growth rate of LTP-MnBi by analyzing XRD and TEM results. We will discuss how the multilayered MnBi affects the magnetic properties in details.

Keywords : coercivity, MnBi, multilayer film, permanent magnet
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