E-Beam Evaporated FeNi/FeCo Multilayer Film

A. Azizi[1,2*], S.K. Sadrnezhaad[1,2], Gh. Aliannejad

[1]*Department of Materials Science and Engineering, Sharif University of Technology, P.O. Box 11155-9466, Tehran, Iran*
[2]*Department of New Materials, Materials and Energy Research Center (Merc), P.O. Box 14155-4777, Tehran, Iran*

*Corresponding author: Tel. +98 2166165215, Fax: +98 2166005717, E-mail address: azizi@alum.sharif.edu

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Abstract

In this study, the fabrication and characterization of a fine and uniform FeNi/FeCo multilayer thin film by electron beam physical vapor deposition (EBPVD) are discussed. First, FeNi and FeCo nano powders were synthesized by a mechanochemical process [1,2] as target materials for evaporation source. The coatings were deposited on (110) surface of a silicon wafer as the substrate. X-ray diffraction (XRD) was used to identify the phases present in the synthesized FeNi and FeCo powders. Microstructural characteristics such as the morphology and the particle size of the powder were analyzed by field emission scanning electron microscope (FESEM). The topography and morphology of the films were examined by atomic force microscopy (AFM). Magnetic properties of the coatings were also evaluated with a vibrating sample magnetometer (VSM). A reduction in coercivity (Hc) which is suitable for recording head applications was found in e-beam deposited FeCo film by utilization of a narrow (~20 nm thickness) FeNi film as an underlayer.

Fig 1 indicates the AFM image of Fe-Ni, Fe-Co, and Fe-Ni/Fe-Co multi layered thin films. Samples A and B have been grown on the silicon layer, while sample C has been grown on the Fe-Ni thin layer which is shown in fig 1.a. The circumstances of deposition have been the same for samples B and C. Comparing the Fe-Co layer deposited on silicon without and with Fe-Ni underlayer shows that the perpendicular growth of particulates is occurred in the multilayer film, which can be related to grains nucleation on the capable locations and their growth in the preferred orientations. Since the indicated peaks in FeNi layer are capable spots for nucleation, new nucleation happens in these locations, and this happens repeatedly and causes the particulates to growth perpendicularly and in preferred orientations. This leads also to the increase of the surface roughness and particulates' size.

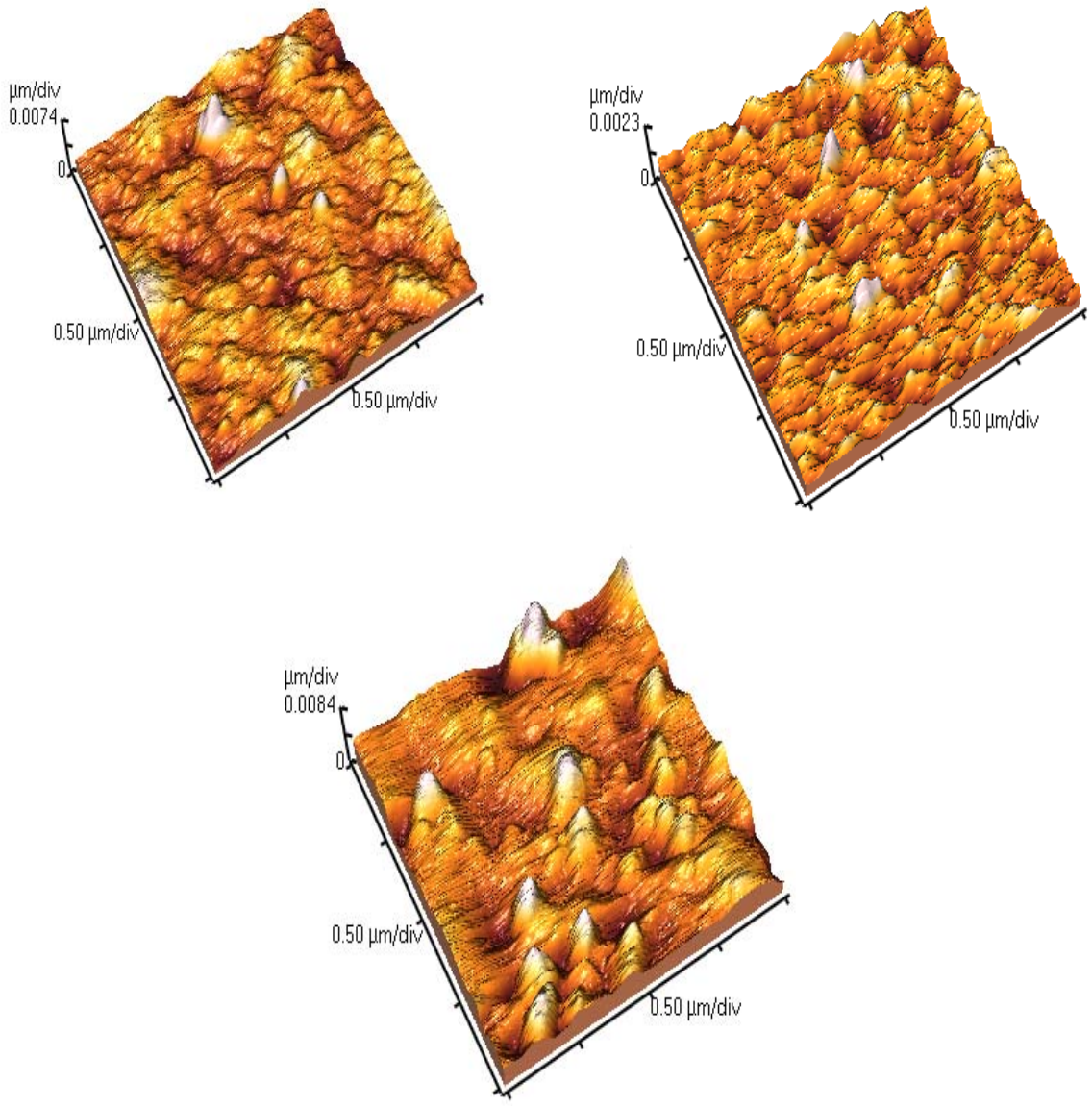

Fig. 1 AFM images of (a) Fe-Ni, (b) Fe-Co, and (c) Fe-Ni/Fe-Co multi layered thin films fabricated by EBPVD

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References

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