RD08

Influence of Nb Substituted for Fe on the Microstructure and Magnetic Properties of Fe-Based Nanocomposite Alloy

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The influence of Nb substituted for Fe on the microstructure and magnetic properties including the magnetoimpedance effect of a Fe-based have been investigated. The nanocomposite structure composed of ultra-fine Fe(Si) grains embedded in an amorphous matrix was attained by annealing the Fe-based amorphous alloy prepared by rapid quenching method. The measurements of thermomagnetic curves indicated that the Curie temperature of the amorphous phase of the samples decreased with increasing Nb content. The optimal heat treatment was performed at Ta = 480°C for 30 min and showed that the ultrasoft magnetic properties of nanocomposite materials were obtained. The magnetoimpedance (MI) of these samples has been studied in range frequency from 1MHz to 5 MHz and varying a dc magnetic field within 300 Oe. The correlation between the MI effect and the soft magnetic properties is discussed. The incremental permeability ratio (PR) shows the drastic changes of soft magnetic properties as a function of annealing temperatures.

RD09

Effects of Residual Stress on Magnetic Properties of Fe-Ni Alloy

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Recent studies of Fe-Ni alloy [1]include nano-crystalline materials utilizing an electro-deposition process, and research and development [2] for thin film materials that can be applied to the magnetic head of a magnetic disk device. Studies on magnetic properties are quite common but since Fe-Ni alloy exhibits the Villari effect [3], where its magnetic properties vary according to external impact or internal residual stress, its utilization in force sensors such as torque sensor and tension sensor is expected. The purpose of this study is to obtain information on relieving the extent of stress induced in thin film and its effects on magnetic properties by preparing thin film and ribbon type specimens of Ni-Fe alloy, and then subjecting them to heat treatment at specific temperatures.

In this study, $Ni_{84}Fe_{16}$ thin films, with a thickness of 0.7 m, were sputtered onto Si (111) single crystal and 40-m thick $Ni_{79}Fe_{21}$ ribbons were fabricated using the rapid solidification process (RSP). Measurement of residual stress was conducted at the diffraction stage of POSCO beam-line in the Pohang Accelerator Laboratory (PLS).

Energy of X-ray incident upon the measurement of residual stress was about 8.2 KeV. $FeNi_3$(420) planes were used for the ribbon and $FeNi_3$ (311) planes for the thin film. Annealing Ni-Fe thin films and ribbons at various temperatures showed that the stress induced during the sample fabrication was released with a subsequent decrease in coercivity, which was determined from the measurements of magnetic properties using VSM. Decrease in coercivity of Ni-Fe thin films and ribbons were strongly dependent on annealing temperatures. Also noted was a high correlation between the extent and relief pattern of internal stress at different annealing temperatures and coercivity, indicating that magnetic properties are strongly influenced by residual stress induced in samples.

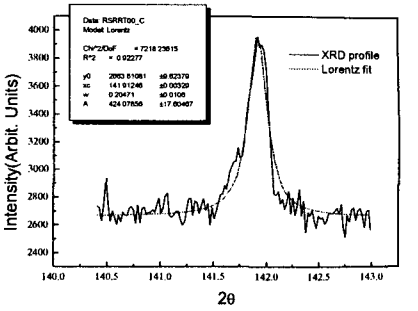

Fig. 1. X-ray diffraction profile ($\sin^2\psi$= 0) of the ribbon (in-situ)

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