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Microstructure and magnetic properties of Au-doped Finemet-type alloy

L.A. Tuan*, N.D. Ha*, C.O. Kim*, N.Chau**, N.D. Tho**, and Heebok Lee***

* *Department of Materials Engineering, Chungnam National University, Daejeon, Korea*

E-mail: heebok@kongju.ac.kr

** *Center for Materials Science, National University of Hanoi, Hanoi, Vietnam*

*** *Department of Physics Education, Kongju National University, Kongju, Korea*

Microstructure and magnetic properties including giant magneto-impedance (GMI) effect of $Fe_{73.5}Si_{13.5}B_9Nb_3Au_1$ alloy prepared by a rapid quenching technique have been thoroughly investigated. X-ray diffraction indicated that the as-quenched samples were amorphous and became nanocrystalline samples under a proper heat treatment. Thermomagnetic analyses showed the behaviors of the crystallization process in the sample through the variations in Curie temperatures of the initial amorphous phase, the remaining amorphous matrix, and the Fe(Si) nanocrystals. By annealing precursor alloys at 530°C for 30, 60, and 90 minute, soft magnetic properties have been improved considerably. Among the samples investigated, the sample annealed at 530°C for 90 min exhibits the best magnetic softness. Accordingly, the incremental permeability ratio (PR) and the magneto-impedance ratio (MIR) as a function of an external magnetic field of the samples were studied. It was found that the highest values of MIR and PR were observed in the nanocrystalline sample annealed at 530°C for 90 min. This is likely ascribed to the largest magnetic softness in the sample. The correlations between the microstructure magnetic properties and GMI behaviors were discussed in detail.

1. N.Chau, N.Q. Hoa, and N.H. Luong, J. Magn. Magn. Mater **290**, 1547(2005).