

## Soft magnetic properties in FeCoVAlNbO thin films

L.A. Tuan\*, N.D. Ha\*, C.O. Kim\*, Y.S. Kim\*\*, and Heebok Lee\*\*

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

*E-mail: [heebok@kongju.ac.kr](mailto:heebok@kongju.ac.kr)*

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

Soft magnetic properties in conjunction with longitudinal incremental permeability for FeCoVAlNbO thin films prepared by reactive RF magnetron sputtering method at input power of 300W have been systematically investigated. These thin films exhibited excellent soft-magnetic properties such as high saturation magnetization ( $4\pi M_s$ ) of 17-20 kG, high anisotropy field ( $H_k$ ) of 20-22 Oe and low coercivity ( $H_c$ ) of 1-2 Oe. A drastic change of the longitudinal incremental permeability ratio (LPR) which is directly related to the magneto-impedance (MI) effect, as a function of the external magnetic field for the films measured at various frequencies and ac drive fields was observed. This is likely due to a considerable variation in the magnetic softness in the samples. Therefore, the magnitude of LPR spectra and their shape were changed. It is obvious that the magnitude of LPR increased with the increment of the ac drive field due to the changes of magnetization. Besides, the maximum values of LPR were observed at nearly zero field, the LPR spectra showed a single peak pattern since the easy axis was parallel to the direction of the measurement, indicating large changes of the permeability without anisotropy behavior. The large changes of LPR in low external fields can be useful for the evaluation of the magnetic softness in thinfilm-type materials as well as magnetic-sensor applications.

1. M.H. Phan, S.C. Yu, J.S. Chung, J.S. Kim, and Y.M. Kim, *J. Appl. Phys* **93**, 9913 (2003).