The Effect of Temperature Processing on the magnetic anisotropies of Ni-Fe-Cu-Cr soft Magnetic Alloy

Zhou Wei, J. T. Oh and H. H. Hng
School of Materials Engg., Nanyang Technological University
Singapore 639798, Singapore
E-mail: asjtoh@ntu.edu.sg

ABSTRACT

Nickel-based alloy is an important class of magnetic materials that have high permeability, large saturation and remnant magnetization, low hysteresis loss and low coercivity. These properties vary with the grain size, shape, magnetic domains and orientation but as the grain-size approaches nanoscale, an important averaging of the magnetocrystalline anisotropy over many grains coupled within an exchange length that results in an increase of the magnetic softness. In addition, the effect of internal thermal energy becomes significantly more pronounced. The Magnetic Anisotropies of the crystalline Ni-Fe-Cu-Cr alloy processed at different temperatures by high-energy ball milling (HEBM) and metal injection moulding (MIM) were investigated. The anisotropy constant increases with decreasing temperature by an exponential dependence that is always one or two orders of magnitude lower than the local magnetocrystalline anisotropy. The behaviour is consistent with the random anisotropy model generalized to HEBM samples.

Keywords: Nanostructured magnetic materials, Random Anisotropy, Permalloy

Materials Processing for Properties and Performance (MP^3) Vol. 3
Edited by K.A. Khor, R. V. Ramanujan, C. P. Ooi and J. H. Zhao
Institute of Materials East Asia, 2004