N1-P013

Shape anisotropy and magnetic properties of Co/Ni anti-dot arrays

N. G. Deshpande[1], M. S. Seo[1], J. M. Kim[1], S. J. Lee[1], Y. P. Lee[1], J. Y. Rhee[2], K. W. Kim[3]

[1]q-Psi and Department of Physics, Hanyang University, Korea, [2]Department of Physics, Sungkyunkwan niversity, Korea, [3]Department of Information Display, Sunmoon University, Asan, Korea

Recently, patterned magnetic films and elements attract a wide interest due to their technological potentials in ultrahigh-density magnetic recording and spintronic devices. Among those patterned magnetic structures, magnetic anti-dot patterning induces a strong shape anisotropy in the film, which can control the magnetic properties such as coercivity, permeability, magnetization reversal process, and magneto-resistance. While majority of the previous works have been concentrated on anti-dot arrays with a single magnetic layer, there has been little work on multilayered anti-dot arrays.

In this work, we report on study of the magnetic properties of bilayered anti-dot system consisting of upper perforated Co layer of 40 nm and lower continuous Ni layer of 5 nm thick, fabricated by photolithography and wet-etching processes. The magnetic hysteresis (M-H) loops were measured with a superconducting-quantum-interference-device (SQUID) magnetometer (Quantum Design: MPMS). For comparison, investigations on continuous Co thin film and single-layer Co anti-dot arrays were also performed. The magnetic-domain configuration has been measured by using a magnetic force microscope (PSIA: XE-100) equipped with magnetic tips (Nanosensors). An external electromagnet was employed while obtaining the MFM images.

The MFM images revealed well-defined periodic domain networks which arise owing to the anisotropies such as magnetic uniaxial anisotropy, configurational anisotropy, etc. The inclusion of holes in a uniform magnetic film and the insertion of a uniform thin Ni layer, drastically affected the coercivity as compared with single Co anti-dot array, without severely affecting the saturation magnetization (M_s). The observed changes in the magnetic properties are closely related to the patterning that hinders the domain-wall motion as well as to the magneto-anisotropic bilayer structure.

Keywords: patterned magnetic films, anti-dot arrays, magnetic properties