F-05

# Direct observation of the transition in domain evolution patterns with variation of substrate temperature in FePt thin films

Hyun-Seok Ko* and Sung-Chul Shin

*Department of Physics and Center for Nanospinics of Spintronic Materials, Korea Advanced Institute of Science and Technology, Daejeon 305-701, Korea.*

Recently, there have been several studies related to the structure and improvement of magnetic properties in $L1_0$ ordered FePt alloy thin films because of its outstanding nature for ultrahigh density magnetic recording media such as extremely high magnetocrystalline anisotropy energy [1]. So far, much studies have been performed to obtain small grain size and uniform grain size distribution as well as high coercivity and magnetic anisotropy for high density magnetic recording [2]. For the achievement of high-density magnetic recording, it is essential to understand the magnetization reversal behavior in FePt thin films. However, there is no direct observation on magnetization reversal behavior by real time measurement. In this letter, the magnetic domain reversal patterns were investigated in equiatomic FePt thin films with increasing the substrate temperature in real time using a magneto-optical microscope magnetometer (MOMM). Figure 1 shows the domain evolution patterns of FePt thin films deposited at the substrate temperatures of (a) 225 ℃, (b) 250 ℃, (c) 275 ℃ and (d) 300 ℃, respectively, where each color represents the switching time of the local region. Interestingly, the domain reversal patterns were remarkably changed from nucleation dominant to wall motion dominant behavior with increasing the substrate temperature. As shown in Figure 2, this results are consistent with the increasing trend of the ratio of wall motion speed over nucleation rate, quantitatively determined from the time-dependent domain reversal patterns using a domain reversal model [3]. To understand the origin of the sensitively changed domain evolution patterns, we have measured the magnetic anisotropy energy and the saturation magnetization. With increase of substrate temperature in this films, the determined anisotropy energy and saturation magnetization are from $1.45 \times 10^6$ erg/cm$^3$ to $5.5 \times 10^6$ erg/cm$^3$ and from 1100 emu/cm$^3$ to 750 emu/cm$^3$, respectively,. It can be understood that the reduced

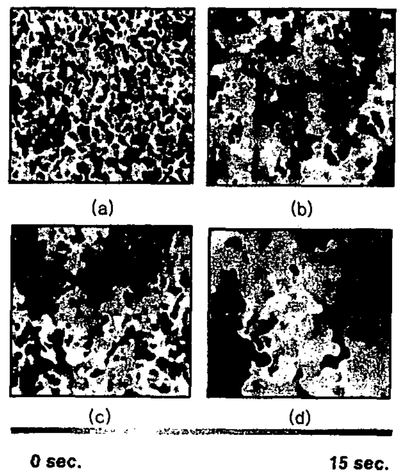


Fig 1. Domain reversal patterns with various preparation temperature of (a) 225 ℃, (b) 250 ℃, (c) 275 ℃, (d) 300 ℃

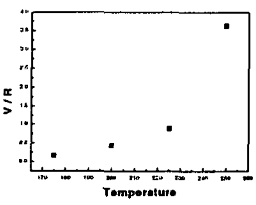


Fig 2. V/R vs. substrate temperature

magnetostatic energy caused by decreased saturation magnetization and domain wall energy enhanced by increased magnetic anisotropy result in the transition of domain evolution patterns from nucleation to wall motion dominant patterns with increasing the substrate temperature.

Reference

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