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PMagnetic properties of Fe55Pd45 nano-dots deposited on top of the nano-meterwide Si(100) pillars

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Magnetic nano-dot arrays with (tilted) perpendicular anisotropy are useful for the high-density magnetic recording. In this study, we deposited $Fe_{55}Pd_{45}$ alloy on top of the 54 nm wide and 430 nm long Si(100) nano-pillars. The size of each FePd nano-dot formed on top of a pillar-tip or -tips is 90-110 nm in length and 66-130 nm in diameter. After fabrication, each sample underwent a rapid thermal annealing (RTA) treatment; with a heating rate of 40°C/sec up to 500°C, being annealed there for 30 minutes, and then quenched to room temperature. X-ray diffraction (XRD) indicated that after RTA the FePd alloy transformed from the fcc to the fct phase with lattice constants: a=0.380 nm and c=0.378 nm. Magnetic domain (MD) pattern of the FePd nano-dot array was studied by MFM. The dot-like MDs, with the size from 300 to 400 nm, show the tendency of perpendicular anisotropy. The squareness ratio (SQR) of the magnetic hysteresis loop reaches the largest value, when the field (H) is along the (z) direction or the long-axis of the pillars; i.e., $(SQR)_z$=0.65> $(SQR)_x$ and/or $(SQR)_y$. Because $(SQR)_z$ is still not close to 1, the easy-axis (EA) of the FePd dots is slightly tilted relative to the z (or perpendicular) direction. From the in-plane rotation angle (φ:azimuth) and the out-of-plane tilting angle (θ:inclination) dependencies of the coercivity (HC), we find that the former exhibits the characteristics of the curling-mode-like switch, while the latter exhibits the Stoner-Wohlfarth-like switch. The relative half-width ($\Delta H/H_C$) of the switching field distribution reaches the minimum, 1.61, when θ=0°, and the maximum, 2.30, when θ=φ= 90°.

Biography

Liu Chi-Ching is doing his Ph.D. with National Chiao Tung University under the guidance of Professor Jen, Shien-Uang. His research mainly focused on Magnetostriction and application; Magnetic domains and domain walls; Ferromagnetic resonance.

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