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Investigations on the Magneto-optical Properties of Bilayered Co/Ni Micro-patterned Anti-dot Arrays

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A lot of studies are undergoing on the magneto-optical (MO) properties of patterned magnetic systems for the reason that they have potential application to information technology such as ultra-high-speed computing. Moreover, they can be considered as the future candidates for high-density MO storage devices. Not only the technical aspects, but there have been also tremendous interests in studying their properties related to the fundamental physics. The MO Kerr-rotation effects (both in reflected and the diffracted modes) and the magnetic force microscopy (MFM) are very useful techniques to investigate the micromagnetic properties of such periodic structures. Hence, in this study, we report on the MO properties of bilayered Cobalt (Co)/ nickel (Ni) micro-patterned anti-dot arrays. Such a ferromagnetic structure was made by sequentially depositing co (40 nm)/Ni (5 nm) bilayer on a Si substrate. The anti-dot patterning with hole diameter of 1 μm was done only on the upper Co layer using photolithography technique, while the Ni underlayer was kept uniform. The longitudinal Kerr rotation (LKR) of the zeroth- and the first-order diffracted beams were measured at an incidence of 30° by using a photoelastic modulator method. The external magnetic field was applied perpendicularly to the reflected and the diffracted beams using an electromagnet capable of a maximum field of ±5 kOe. Significantly, it was observed that the LKR of the first-order diffracted beam is nearly 4 times larger than that of the zeroth-order beam. The simulated results for the hysteresis loops matched qualitatively well with the experimentally obtained ones. In conjunction with the LKR, we also investigated the magnetic-domain structure by using a MFM system, which were analyzed to elucidate the origin of the enhanced MO rotation.

Keywords: Magnetic array, Magnetic-optical properties