AF-2-P18

Voltage control of a magnetization easy-axis in micrometer-size patterned piezoelectric/ferromagnetic hybrid films

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We report on the control of a magnetization easy-axis from the in-plane to the film normal or vice versa in ferromagnetic films by applying a voltage to a piezoelectric layer in a hybrid system comprised of ferromagnetic and piezoelectric films. The magnetization easy-axis is readily switchable by an applied voltage without applying an external magnetic field through both the inverse magnetostrictive and piezoelectric effects of CoPd and PZT films, respectively [1, 2]. In this work, we fabricated PZT/CoPd hybrid films in which thousands of patterned cells with a lateral dimension of 20 μm ×20 μm are periodically arrayed. The longitudinal and polar magneto-optical Kerr effects were used to investigate the switching behavior of the ensemble of individual cells, and a magneto-optical microscope magnetometer was used to observe the switching behavior of the individual cells. This challenging work provides a new switching way into various magnetic devices such as sensors and memory devices with ultrahigh bit densities. Though we have not achieved the cell selectivity of magnetization easy-axis switching yet, the potentiality in such micrometer-size devices has been considerably increased.

1. Sang-Koog Kim, Jeong-Won Lee, Sung-Chul Shin, Han Wook Song, Chang Ho Lee, Kwangsoo No, J. Magn. Magn. Mater. 267, 127 (2003).
2. Sang-Koog Kim, Sung-Chul Shin, Kwangsoo No, IEEE Trans. Mags. 40, 2637 (2004).