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Quadratic magneto-optical Kerr effect and chirality of magnetization reversal in Py/SmFe/Py exchange spring magnet thin films
JIYEONG GU, HANMING YUAN, California State University, Long Beach — Magnetic switching behavior of the exchange spring magnet, Py(Permalloy)/SmFe/Py thin films, was investigated by magneto-optical Kerr effect (MOKE). Exchange spring magnet shows a unique magnetic hysteresis loop due to the non-collinear magnetization developed by magnetic coupling of the soft and hard magnetic layers. Py/SmFe/Py thin films were deposited on silicon substrate by DC magnetron sputtering. Experimental Kerr rotation measurement showed asymmetric hysteresis loops as a result of superimposed quadratic MOKE (QMOKE) contribution to linear MOKE (LMOKE). Overall MOKE signal was separated into LMOKE and QMOKE signals using loop symmetrization and antisymmetrization operation. The longitudinal (M_L) and transverse (M_T) magnetization components with respect to the plane of light incidence were extracted and QMOKE signal was simulated from the two mixed terms, $M_L M_T$ and M_L^2- M_T^2. QMOKE signal not only showed the nature of magnetization reversal in exchange spring magnet system from the information of M_T at switching field but also determined the direction of magnetization rotation from the positions of the peaks. Our work demonstrated that the chirality of magnetization reversal can be determined from analysis of QMOKE signal.

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