

Anomalous behaviour of local M-H loop measured by MOKE due to thermal fluctuation effect in thin film

D. Y. Kim^{*1}, C. G. Kim², and C. O. Kim²

¹ SE team, IT Division, Hyundai Syscomm Inc., Ichon, Kyongki, 467-860, Korea

² Department of Physics, Chungnam National University, 220 Gung-Dong, Yu-Seong Gu, Daejeon, 305-764, Korea

*Corresponding author: e-mail: dykim30@hanmail.net, Phone: +82 31 639 6958, Fax: +82 31 630 2747

The local M-H loops have been measured using magneto-optical Kerr effect (MOKE) system with 2 μ m spatial resolution, on a T-shape magnetic layers with the structure of $\text{Co}_{70}\text{Fe}_{30}$ (25 Å)/NiFe(1000 Å)Ta(50 Å). In Fig. 1(a), the measured local M-H loop shows the anomalous magnetization behaviour, which indicates the magnetization reorientation at $H \approx 0$ regardless of the increment of applied magnetic field. Usually, the height of the potential barrier is much larger than thermal energy and the coherent rotation of all spins cannot be thermally activated. If, however, the thickness of thin film is so small that the height of the potential barrier is of the same order of magnitude as thermal energy, the coherent spin rotation becomes possible. This thermal fluctuation effect in thin film can be dominated at the critical switching field [1,2]. In this paper, the anomalous behaviour of local M-H loops in thin film has been analysed using Stoner-Wohlfarth (SW) model introducing thermal fluctuation effect. The M-H loop calculated using SW model is shown in Fig. 1(b). The anomalous reorientation of magnetization behaviours can be explained by the thermal fluctuation effect in thin film. This behaviour is depend on the angle between easy axis and field direction and is dominant at the angle of 45 degree.

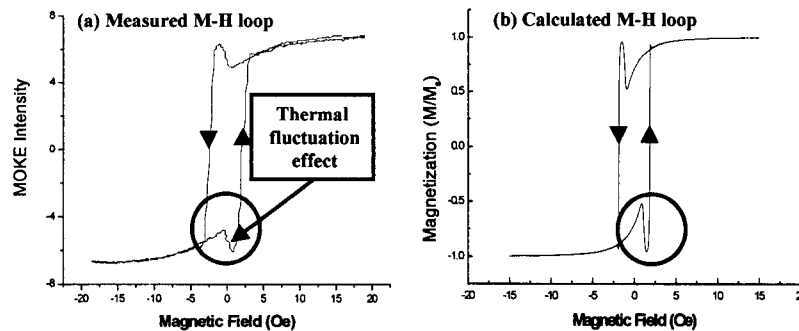


Fig.1 M-H loops (a) measured using MOKE, (b) calculated using SW model.

References

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