Switching Field Distribution of Arrays of Co-Pt Nanodots Determined by Anomalous Hall Effect Measurements

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Anomalous Hall Effect (AHE) measurements have previously been used to measure the magnetization of $L1_0$-FePt [1] and Co/Pt multilayer nanodots [2]. The high sensitivity allows us to measure the magnetization reversal behaviour of sub-100-nm dots. In this work, we investigate the magnetization reversal of 180 nm $Co_{80}Pt_{20}$ dots, with a focus on the switching field distribution (SFD) of individual dots in an array. Fig. 1 shows hysteresis curves of an array of $Co_{80}Pt_{20}$ dots measured by AHE. Several steps and plateaus, due to the independent reversal of individual dots, are clearly visible. By consecutively measuring several hysteresis curves, one can observe different switching field values for a single dot (inset Fig. 1). A mathematical model was derived to calculate the effect of thermal activation on this SFD, which depends mainly on the anisotropy, switching volume and the magnetization reversal mechanism of the dot. The SFD was determined from 1000 curves and coincides with the modelled distribution (Fig. 2). By investigating different dots in the array, we conclude that there is a difference in reversal mechanism between weak and strong dots in the array.

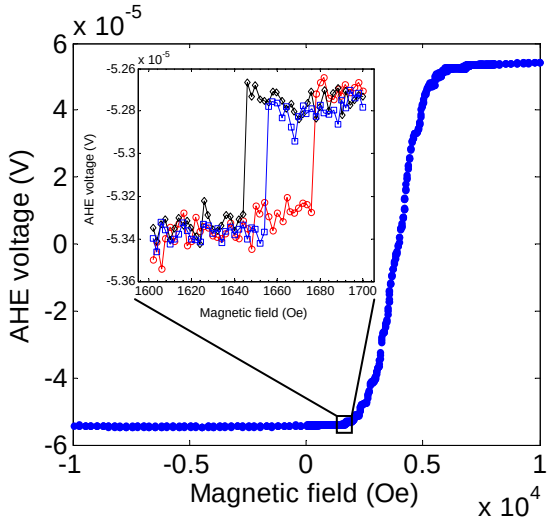

Fig. 1: Three AHE curves of a $Co_{80}Pt_{20}$ dot array. The inset shows a magnification of the magnetization reversal of the first dot.

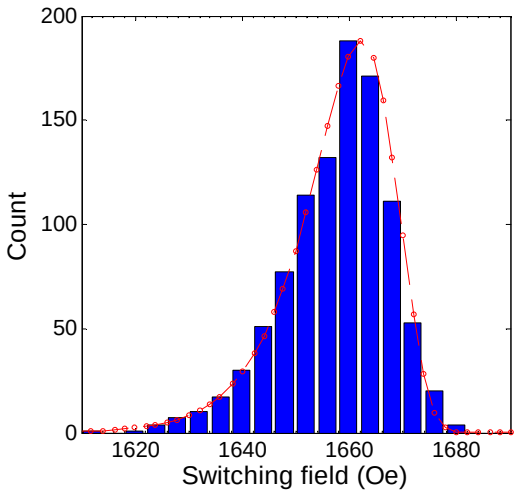

Fig. 2: SFD of a single $Co_{80}Pt_{20}$ dot from 1000 measurements. The line shows the model's best fit to the measured data.

[1] N. Kikuchi, S. Okamoto, O. Kitakami, Y. Shimada, and K. Fukamichi, *Appl. Phys. Lett.* **82**, 4313 (2003).

[2] N. Kikuchi, R. Murillo, J.C. Lodder, *J. Magn. Magn. Mater.* **287**, 320 (2005).

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