Simulation of position sensitivity of the anomalous Hall effect on a single magnetic dot

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To overcome the superparamagnetic effect caused by scaling bit and grain sizes in magnetic storage media different approaches are investigated. One alternative is bit patterned magnetic media (BPM) where each bit is represented by a single domain magnetic dot. A key problem with BPM is the large difference in magnetic field necessary to switch the magnetization direction of the various dot which is characterized by the switching field distribution.

One of the techniques which may be used to determine the switching of the magnetic nanodots is the anomalous Hall effect (AHE) [1]. A cross shape is etched into the array of dots. When measuring a sample the number of steps in the AHE signal is much larger than the total number of dots in the centre of the cross, which might be caused by the dots present in the arms of the cross. This effect is investigated using a sample created by E-beam lithography [2] with a row of Co/Pt magnetic dots along one axis of the cross and an electrostatic finite element (FEM) simulation representing the sample.

In this presentation we show that the measured position dependence agrees very well with the electrostatic FEM simulations. This allows us to identify the position of a dot in an array by means of its AHE signal providing an elegant way to study the switching field of patterned media.

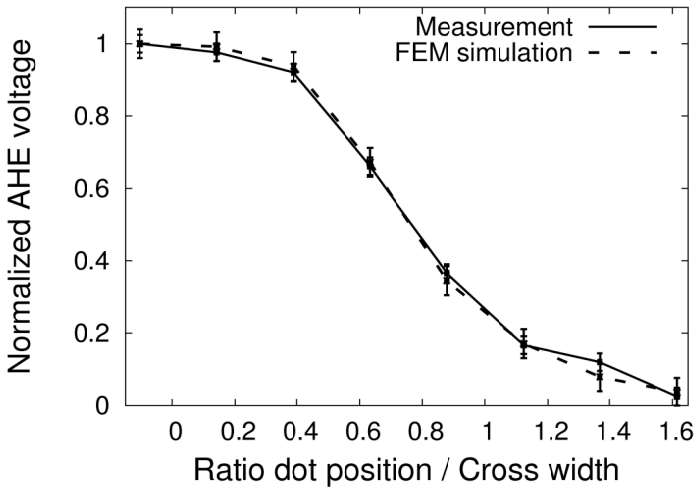

Fig 1. Hall voltage normalized on the first measurement point with respect to the dot position for a sample with 250 nm dots

[1] J.B.C. Engelen, M. Delalande, A.J. le Fèbre, T. Bolhuis, T. Shimatsu, N. Kikuchi, L. Abelmann and J.C. Lodder Nanotechnology **21**, 035703 (2010)
[2] X. M. Yang, Y. Xu, K. Lee, S. Xiao, D. Kuo, D. Weller, IEEE Trans. Mag. **45**, 833 (2009).