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A study of perpendicular magnetic recording media using polarized SANS

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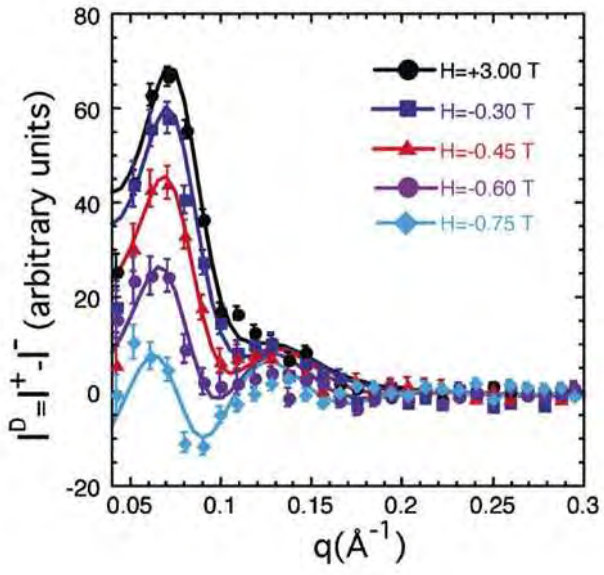
The study of thin film magnetic systems that are structured on the nanoscale is an area of intense interest. Small-angle neutron scattering is an extremely powerful probe of nanomagnetism in the bulk, but in thin-film systems the experiments are challenging due both to the small scattering volume available and also to scattering from other sources such as the substrate and sample environment. We have demonstrated that such experiments are however possible in magnetic films as thin as 10 nm. A good example to illustrate this is the case of perpendicular magnetic recording media. These materials are found in all modern magnetic hard drives, the data storage technology that continues to be of tremendous commercial and technological importance. These media are advanced functional multilayered materials, containing an active recording layer of only around 10 nm in thickness. This recording layer is compositionally segregated into 8 nm-sized grains of a magnetic CoCrPt alloy separated by a thin oxide shell, typically SiO2. These media have their magnetic moments oriented perpendicular to the plane of the film. Determining the local magnetic structure and reversal behavior is key to understanding the performance of perpendicular media in recording devices. Polarised SANS has proved to be a very effective tool to measure these materials at a sub-10nm length scales. The signal of interest must however also be distinguished from the scattering from other layers in the structure, some of which are also magnetic. We will present a summary of some recent results on recording media, including measurements of the grain-sized dependent switching with and without the presence of an exchange spring. We will also briefly mention experiments that demonstrate the viability of extending this approach to measurement for lithographically defined structures similar to those for application in bit-patterned media, including 2d artificial spin-ice and structurally glassy arrays.

[1] *S.J. Lister, T. Thomson, J. Kohlbrecher, K. Takano, V. Venkataramana, S.J. Ray, M. P. Wismayer, M.A. de Vries, H. Do, Y. Ikeda and S.L. Lee Appl. Phys. Lett., 2010, 97 (11) 112503.,* ***[2]*** *M. Wismayer, S.J. Lister, S.L. Lee, T. Thomson, Ken Takano, J. Kohlbrecher, C. Dewhurst J. Appl. Phys., 2009, 106, 063908.,* ***[3]*** *S.J. Lister, J. Kohlbrecher, V. Venkataramana, T. Thomson, K. Takano, S.L. Lee , International Journal of Material Research,2011, 102, 1142.*



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