

Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Switching field of ultra-thin films dependence on edge roughness and external magnetic field orientation ADEBANJO ORIADE, SIUTAT CHUI, Bartol Research Institute, University of Delaware, Newark, DE 19716 — There is a demand in the physics and the technological application of micro-magnetics to thin films nanostructures to achieve a high degree of control over the switching process of its magnetization. To attain high bit selectivity, that is a robust control of millions of magnetoresistive random access memory (MRAM) devices, it is important to understand how edge roughness and the orientation of these ultra-thin films affect the switching process. In MRAM elements, for example, the hard and easy axis switching fields can be effected by word and digit lines. We compute the switching field H_c in permalloy films, dimensions $0.2\mu m \times 1\mu m \times 50\text{\AA}$, considering different edge roughness for different orientation ψ of the sample in external field $H_{ext,\psi}$. We investigate edge roughness parameters and their effect on the switching process making comparison with a “perfect” sample. Edge roughness parameters like amplitude - depth of the roughness (maximum of 100\AA), and frequency - number of defects in the edge, are considered. We present plots of hard axis switching field H_{cy} against easy axis switching field H_{cx} for different roughness parameters, to show how edge roughness affects the switching process. External magnetic fields $H_{ext,\psi}$ that switch a “perfect” sample but not samples with a defined maximum roughness fall in a region of our plot, prescribing control of switching.

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Date submitted: 24 Nov 2004

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