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Fluctuation in the depinning of edge magnetic domains due to edge defects in ultrathin films ADEBANJO ORIADE, SIU-TAT CHUI, Bartol Research Institute — Magnetic memory devices utilize an optimal reversal field to change the magnetic state of a magnetic memory element. Edge pinned domains (EPD) can lead to the restoration of the original magnetic state. Failure in reversal can occur when the external field is withdrawn before EPD's are completely depinned [1],[2]. We study, via Monte-Carlo simulations, the reversal of edge pinned domains in NiFe ultrathin films with dimensions $0.33\mu m \times 0.50\mu m \times 50$ Å and $0.20\mu m \times 1.00\mu m \times 50$ Å (aspect ratio 2:3 and 1:5 respectively) at different temperatures. Fluctuations in reversal field were computed relative to that of samples without edge defects, our control. Defects in the edges parallel to the easy axis increase the switching field by an average of 29% in 1:5 samples and 6.7% in 2:3 samples. Defects in the edges perpendicular to the easy axis reduce the switching field by an average of 3.6% in 1:5 samples and 4.2% in 2:3 samples. The averages are quoted for word ($H_{ext,x}$) and digit ($H_{ext,y}$) line fields that result in a net external field at an angle of 5° to 55° to the easy axis (digit line). We show the mechanism for edge pinned domain reversal is by the removal of 180° domain walls. This removal is by the nucleation of solitons propagating from one end of the sample to the other. Most of the time, the upper and lower walls are removed simultaneously from opposite ends. [1] J. Shi et al, Appl.Phys.Lett. 77, 1692 (2000). [2] A. A. Oriade et al, Jour. App. Phys. 97, 023905 (2005).

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