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Domain wall motion in sub-100 nm magnetic wire SAIMA SIDDIQUI, SUMIT DUTTA, JEAN ANNE CURRIVAN, Electrical Engineering and Computer Science, Massachusetts Institute of Technology, CAROLINE ROSS, Department of Materials Science and Engineering, Massachusetts Institute of Technology, MARC BALDO, Electrical Engineering and Computer Science, Massachusetts Institute of Technology — Nonvolatile memory devices such as racetrack memory rely on the manipulation of domain wall (DW) in magnetic nanowires, and scaling of these devices requires an understanding of domain wall behavior as a function of the wire width. Due to the increased importance of edge roughness and magnetostatic interaction, DW pinning increases dramatically as the wire dimensions decrease and stochastic behavior is expected depending on the distribution of pinning sites. We report on the field driven DW statistics in sub-100 nm wide nanowires made from Co films with very small edge roughness. The nanowires were patterned in the form of a set of concentric rings of 10 μm diameter. Two different width nanowires with two different spacings have been studied. The rings were first saturated in plane to produce onion states and then the DWs were translated in the wires using an orthogonal in-plane field. The position of the DWs in the nanowires was determined with magnetic force microscopy. From the positions of the DWs in the nanowires, the strength of the extrinsic pinning sites was identified and they follow two different distributions in two different types of nanowire rings. For the closely spaced wires, magnetostatic interactions led to correlated movement of DWs in neighboring wires. The implications of DW pinning and interaction in nanoscale DW devices will be discussed.

Saima Siddiqui
Electrical Engineering and Computer Science,
Massachusetts Institute of Technology

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