Abstract Submitted to the
The International Conference on Magnetism - ICM 2009
in Karlsruhe, Germany
July 26-31, 2009

Direct Observation of Stochastic Domain-Wall Depinning in Magnetic Nanowires*

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Tunable and repeatable domain wall (DW) motion is important for achieving high performance in DW logic and memory devices, and the stochastic nature of DW motion is a major challenge to be overcome to apply the scheme of DW motion to next generation memory technologies. Using magnetic soft X-ray transmission microscopy at the ALS in Berkeley, CA, which provides a spatial resolution down to 15 nm we have investigated the stochastic nature of DW motion in notch-patterned Ni80Fe20 nanowires. We found that the depinning process of DW around a notch of Ni80Fe20 nanowire is stochastic for repeated hysteretic cycles and the depinning-field distribution in Ni80Fe20 nanowires considerably depends on the wire width and the notch depth. The difference in the multiplicity of domain-wall types generated in the vicinity of a notch is responsible for the observed dependence of the stochastic nature of the domain wall depinning field on the wire width and the notch depth.

Supported by the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.