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Current-Driven Domain Wall Motion in Permalloy Nanowires MASAMITSU HAYASHI, LUC THOMAS, CHARLES RETTNER, XIN JIANG, RAI MORIYA, STUART PARKIN, IBM Almaden Research Center — The current-driven motion of magnetic domain walls (DW) in permalloy ($Ni_{81}Fe_{19}$) nanowires is discussed. The nanowires were fabricated by electron-beam lithography from permalloy films 10 to 40 nm thick. The wire lengths and widths were varied from 2 to 10 μm, and from 70 to 300 nm, respectively. DWs are injected into the nanowires using magnetic fields, generated either by a large electromagnet or locally by using micron-wide gold wires fabricated above and transverse to the permalloy nanowires. The injected DWs are trapped at triangularly-shaped notches fabricated along one or both edges of the nanowires. Current-driven DW motion is probed using anisotropic magnetoresistance measurements and magnetic force microscopy (MFM). DWs can be moved in the absence of any external magnetic field by current pulses, varying in length from nano- to micro- seconds. Current densities of the order of 10^8 A/cm^{2}are needed. MFM images show unambiguously that DWs can be moved from one notch to another, in either direction along the nanowire, depending on the current pulse polarity, intensity and duration. The dependence of the critical current density required to move the DWs between notches on the nanowire width and notch shape and size will be discussed.

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