Imaging complex domain wall structures in magnetic nanostripes

April 19 2012

(Phys.org) -- Researchers from the NIST Center for Nanoscale Science and Technology and Massachusetts Institute of Technology have used the scanning electron microscopy with polarization analysis (SEMPA) technique to provide the first direct images of the magnetic structure of highly twisted domain walls in patterned thin film magnetic nanowires.

This imaging method allows these complex and delicate structures to be easily compared to magnetic simulations, a useful step for developing technology that uses domain walls in nanowires for high density data storage and for field or current driven magnetic logic.

A typical domain wall separates two opposite regions of magnetization, making it a “180° wall”. The researchers showed that several 180° walls could be injected into a nanowire, where they either annihilated each other or they combined to form complex walls in which the magnetization rotated by up to 540°. The 360° walls were of particular interest, since their magnetic behavior is dramatically different from the 180° walls currently used in prototype memory and logic devices.

The researchers believe that, in addition to providing information about how 180° walls interact in domain wall-based nanowire memories, this work may lead to new magneto-electronic applications using 360° domain walls, such as manipulating bits using highly localized magnetic fields in magnetic logic circuits.

More information: Formation and structure of 360 and 540 degree

domain walls in thin magnetic stripes, Y. Jang, S. R. Bowden, M. Mascaro, J. Unguris, and C. A. Ross, *Applied Physics Letters* 100, 062407 (2012). apl.aip.org/resource/1/applab/v100/i6/p062407_s1