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Controlled formation of double-vortex configurations in a shape-engineered F/N/F trilayer stack studied by quantitative off-axis electron holography LEI HUANG, MARVIN SCHOFIELD, YIMEI ZHU, Department of Condensed Matter Physics and Material Science, Brookhaven National Lab — Vortex domain state, widely existing in submicron size patterned magnetic structures, can be very useful in high density magnetic data storage devices. In this report, we designed a shape engineered ferromagnetic-nonmagnetic-ferromangetic (F/N/F) trilayer stack that would generate four different vortex-based remnant states by applying defined sequences of in-plane magnetic field. These four states are distinguished by different relative chirality orientations of two vortices stabilized in the ferromagnetic layers. Experimentally, we lithographically patterned 400nm sized prototype device, and studied in-situ the switching behavior by off-axis electron holography. Using the integrated approach including single element hysteresis loop, induction contour mapping and quantitative electron phase shift measurement, we revealed the underlying reversal mechanism as separate vortex formation and annihilation in two magnetic layers. We also confirmed the field-control feasibility of such structure by distinguishing unambiguously the presence of all four states after each field recipe was applied.

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