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Reversible electrically-driven magnetic domain wall rotation in multiferroic heterostructures to manipulate suspended on-chip magnetic particles[1] MARK NOWAKOWSKI, University of California, Berkeley, HYUNMIN SOHN, CHENG-YEN LIANG, JOSHUA HOCKEL, KYLE WETZLAR, SCOTT KELLER, University of California, Los Angeles, BRENDA MCLELLAN, NYU Polytechnic School of Engineering, MATTHEW MARCUS, ANDREW DORAN, ANTHONY YOUNG, Advanced Light Source, Lawrence Berkeley National Lab, MATHIAS KLÄUI, University of Mainz, GREGORY CARMAN, JEFFREY BOKOR, University of California, Berkeley, ROBERT CANDLER, University of California, Los Angeles — We experimentally demonstrate reversible electrically-driven, strain-mediated domain wall (DW) rotation in Ni rings fabricated on piezoelectric $[Pb(Mg_{1/3}Nb_{2/3})O_3]_{0.66}$-$[PbTiO_3]_{0.34}$ (PMN-PT) substrates. An electric field applied across the PMN-PT substrate induces a strain in the Ni rings producing DW rotation around the ring toward the dominant PMN-PT strain axis by inverse magnetostriction. We observe DWs reversibly cycled between their initial and rotated state as a function of the applied electric field with x-ray magnetic circular dichroism photo-emission electron microscopy. The DW rotation is analytically predicted using a fully coupled micromagnetic/elastodyanmic multi-physics simulation to verify that the experimental behavior is caused by the electrically-generated strain in this multiferroic system. Finally, this DW rotation is used to capture and manipulate magnetic particles in a fluidic environment to demonstrate a proof-of-concept energy-efficient pathway for multiferroic-based lab-on-a-chip applications.

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