Abstract Submitted for the MAR15 Meeting of The American Physical Society

Calculating a parameter space to smoothly transport magnetically-trapped suspended superparamagnetic microbeads with electric-field domain wall control¹ BRENDA MCLELLAN, New York University Polytechnic School of Engineering, MARK NOWAKOWSKI, JEFFREY BOKOR, University of California, Berkeley, CHENG-YEN LIANG, JOSHUA HOCKEL, KYLE WETZLAR, SCOTT KELLER, HYUNMIN SOHN, GREGORY CARMAN, University of California, Los Angeles, ANTHONY YOUNG, ANDREW DORAN, MATTHEW MARCUS, Advanced Light Source, Lawrence Berkeley National Laboratory, MATHIAS KLAUI, Institute of Physics, University of Mainz, 55128 Mainz, Germany, ROBERT CANDLER, University of California, Los Angeles, California NanoSystems Institute, Los Angeles, CA — We demonstrate the capture and electrically-driven piecewise transport of superparamagnetic microbeads trapped in a magnetostatic potential energy well produced by the magnetic domain walls of Ni microrings on a $[Pb(Mg_{1/3}Nb_{2/3})O_3]_{0.66}$ $[PbTiO_3]_{0.34}$ (PMN-PT) substrate. Here I present micromagnetic simulations that illustrate the formation of field-initialized domain walls in Ni microrings and calculate the approximate force of attraction experienced by superparamagnetic microbeads near the domain walls. This force is estimated as a function of the ring geometry, bead diameter, and distance from the domain wall, and provides an upper bound for the strain-mediated, electrically-induced domain wall velocity that can be implemented to smoothly transport coupled microbeads within a fluidic environment. These results provide an initial estimate for important technological parameters and set a foundation for the optimization of this microfluidic magnetic control scheme. H. Sohn, M. Nowakowski, et al. submitted, 2014.

¹Supported by E3S and TANMS.

Brenda McLellan New York University Polytechnic School of Engineering

Date submitted: 07 Nov 2014

Electronic form version 1.4