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Programmable manipulation of superparamagnetic microbeads at junctions using magnetic domain walls[1] ELIZABETH RAPOPORT, DAVID BONO, GEOFFREY BEACH, Massachusetts Institute of Technology — There has been a steady progression in the advancement of magnetic technologies for bead manipulation in chip-based devices. Recently, we demonstrated that with curvilinear magnetic tracks, both domain wall (DW)-driven transport and detection of superparamagnetic (SPM) beads can be achieved. Here, we demonstrate that the direction of bead motion at junctions in branched curvilinear structures can be precisely selected with a vertical field. Upon exiting a junction, a single DW is split into two of opposite configuration. A vertical field strengthens the bead-DW interaction for one DW configuration, while simultaneously weakening the interaction for the other. The result is preferential bead motion with one DW over the other, allowing for the design of complex bead routing networks. Numerical work is presented in support of the theoretical basis for selective motion, and experiment reveals a threshold vertical select field for a sample of nominally identical beads. This routing technique is also shown to be able to sort a mixed population of SPM beads by simple application of a vertical field. With this work, we add an essential capability to the set of DW-mediated SPM bead handling functions required for an integrated lab-on-a-chip platform.

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