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Magnetization switching of a nanomagnet by spin polarized surface states of a topological insulator[1] URMIMALA ROY, RIK DEY, TANMOY PRAMANIK, BAHNIMAN GHOSH, LEONARD F. REGISTER, SANJAY K. BANERJEE, Microelectronics Research Center, The University of Texas at Austin — Due to the spin-momentum helical locking, a charge current supported by the topological insulator (TI) surface states leads to a spin accumulation at the TI surface. In this theoretical study, we consider a thermally-stable, conducting nanomagnet subject to spin-polarized current injection from TI surface states, in order to evaluate possible non-volatile memory applications such as in spin-transfer-torque random access memory. We simulate parallel transport in the TI and the ferromagnetic metal, and evaluate the efficiency of magnetization switching for varying ease of transport between the TI and the ferromagnetic metal. With the assumed parameters, transport in the TI beneath the ferromagnetic metal is diffusive in nature at room temperature and is modeled by drift-diffusion simulation, which we believe to be sufficient for this purpose, and allows for ready interpretation. We use self-consistent transport and magnetization dynamics calculation to predict switching time and energy spent per write operation. Based on our simulation, we believe that a large in-plane resistivity of the ferromagnetic layer–perhaps not a simple ferromagnetic metal layer–along with an interface with the TI that is transparent to charge transport, will lead to minimum switching time and write energy.

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