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Ultra Low Energy Switching of Ferromagnet with Perpendicular Anisotropy on Topological Insulator by Voltage Controlled Magnetic Anisotropy[1] BAHNIMAN GHOSH, TANMOY PRAMANIK, RIK DEY, URMIMALA ROY, LEONARD REGISTER, SANJAY BANERJEE, Microelectronics Research Center, Univ of Texas at Austin — We propose and demonstrate, through simulation, an ultra low energy memory device on a topological insulator thin film. The device consists of a thin layer of Fe deposited on the surface of a topological insulator, Bi_2Se_3. The top surface of Fe is covered with MgO so that the ferromagnetic layer has perpendicular anisotropy. Current is passed on the surface of the topological insulator which switches the magnetization of the Fe ferromagnet through strong exchange interaction, between electrons contributing to the surface current on the Bi_2Se_3 and the d electrons in the ferromagnet, and spin transfer torque due to shunting of current through the ferromagnet. Voltage controlled magnetic anisotropy enables ultra low energy switching. Our micromagnetic simulations, predict switching time of the order of 2.4 ns and switching energy of the order of 0.16 fJ for a ferromagnetic bit with thermal stability of 90 k_BT. The proposed structure combines the advantages of both large spin torque from topological insulators and those of perpendicular anisotropy materials.

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