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Write operation in MRAM with voltage controlled magnetic anisotropy KAMARAM MUNIRA, SUMEET PANDEY, GURTEJ SANDHU, Micron Technology, Inc. — In non-volatile Magnetic RAM, information is saved in the bistable configuration of the free layer in a magnetic tunnel junction (MTJ). New information can be written to the free layer through magnetic induction (Toggle MRAM) or manipulation of magnetization using electric currents (Spin Transfer Torque MRAM or STT-MRAM). Both of the writing methods suffer from a shortcoming in terms of energy efficiency. This limitation on energy performance is brought about by the need for driving relatively large electrical charge currents through the devices for switching. In STT-MRAM, the nonzero voltage drop across the resistive MTJ leads to significant power dissipation. An energy efficient way to write may be with the assistance of voltage controlled magnetic anisotropy (VCMA), where voltage applied across the MTJ creates an electric field that modulates the interfacial anisotropy between the insulator and free layer. However, VCMA cannot switch the free layer completely by 180 degree rotation of magnetization. It can lower the barrier between the two stable configurations or at best, cancel the barrier, allowing 90 degree rotation. A second mechanism, spin torque or magnetic field, is needed to direct the final switching destination.

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