Bias-voltage Dependence of Perpendicular Spin-transfer Torque in Asymmetric MgO-based Magnetic Tunnel Junctions

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Spin-transfer torque (STT) allows the electrical control of magnetic states in nanostructures. The STT in magnetic tunnel junctions (MTJs) is of particular importance owing to its potential for device applications. It has been demonstrated [1] that the magnetic tunnel junction (MTJ) has a sizable perpendicular spin-transfer torque (p-STT), which could substantially affect current-driven magnetization dynamics. In contrast to symmetric MTJs where the bias dependence of p-STT is quadratic [2], it is theoretically predicted that the symmetry breaking of the system causes an extra linear bias dependence [3]. In this talk, we present experimental results that are consistent with the predicted linear bias dependence in asymmetric MTJs [4]. The linear contribution is significant and its sign changes from positive to negative as the asymmetry is modified. This result opens a way to design the bias dependence of the p-STT, which is useful for device applications by allowing, in particular, the suppression of the abnormal switching-back phenomena.

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