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Thermal activation and switching dynamics in spin-torque-induced magnetic reversal in magnetic tunnel junctions with MgO barriers

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Spin-torque induced magnetic reversal has been unambiguously demonstrated in magnetic tunnel junctions with MgO barriers. During a quasi-static measurement, the reversal is dominated by events determined by spin-current amplified thermal activation, resulting in a measured average switching current below that of the zero-temperature dynamic threshold. Such sub-threshold switching current generally shows stronger and non-linear magnetic field dependence, following a shape determined by the magnetic field dependence of the thermal barrier height. Time-resolved measurements are usually required for adequately assessing the dynamic switching threshold current for fast (nano-second-level) deterministic switching, and for revealing the magnetic field dependence of the threshold current. The later would give direct experimental verification of the role a large easy-plane demagnetization field plays as it determines the value of the dynamic switching current threshold.