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Structure Engineering And Shape Optimization To Decrease Switching Current For Spin Transfer MRAM Application

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We present a systematic study of spin transfer switching in magnetic tunneling junctions (MTJs) to decrease the switching current density through material and structural engineering and MTJ element shape optimization. Data are presented for switching on MgO-based MTJs with high TMR of 170 % and low intrinsic switching current density $J_{c0} \leq 1\text{x}10^6$ A/cm^2. Micromagnetic modeling is used to study the spin transfer switching mechanism in nanosecond regime for elliptical shape of the MTJ element. The results suggest that the elliptical shape provides faster switching (lower switching current) and more reproducible switching than the conventional shapes optimized for magnetic field switched MRAM (Magnetic Random Access Memory).