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Giant thermal spin torque assisted magnetic tunnel junction switching

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Spin-polarized charge-currents induce magnetic tunnel junction (MTJ) switching by virtue of spin-transfer-torque (STT). Recently, by taking advantage of the spin-dependent thermoelectric properties of magnetic materials, novel means of generating spin-currents from temperature gradients, and their associated thermal-spin-torques (TSTs) have been proposed, but so far these TSTs have not been large enough to influence MTJ switching. Here we demonstrate significant TSTs in MTJs by generating large temperature gradients across ultrathin MgO tunnel barriers that considerably affect the switching fields of the MTJ. We attribute the origin of the TST to an asymmetry of the tunneling conductance across the zero-bias voltage of the MTJ. Remarkably, we estimate through magneto-Seebeck voltage measurements that the charge-currents that would be generated due to the temperature gradient would give rise to STT that is a thousand times too small to account for the changes in switching fields that we observe. Reference: A. Pushp*, T. Phung*, C. Rettner, B. P. Hughes, S.-H. Yang, S. S. P. Parkin, 112, 6585-6590 (2015).