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Enhanced spin-torque efficiency in ferromagnetic metal systems characterized by Rashba-type structural inversion asymmetry[1]

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We investigate enhanced spin torque mechanisms based on spin-orbit effects in structurally asymmetric ferromagnetic metal layers. It is well known that spin-orbit coupling is ultimately responsible for magnetocrystalline anisotropy and damping. Under certain conditions, however, spin-orbit effects might additionally enhance or induce specific spin torque mechanisms. We analyze these effects by using two tri-layer structures (Pt/Co/Pt and Pt/Co/AlO) with similar magnetic properties but opposite structural inversion parity, evidencing a 50-fold increase of the nonadiabatic component of current-induced spin-torque in domain walls (DW) [1]. After characterizing the spin-torque by quasi-static measurements, further confirmation of the effect is obtained from the study of DW displacements under ultra-short current pulses. We observe ultrafast DW motion with velocities approaching 400 m/s. Despite the strong pinning characterizing these samples, the DW displacements show high reproducibility demonstrating the potential for applications. Future directions of research in this field as well as the possibility of combining different spin-torque mechanisms in Rashba-type magnetic layers will be outlined.

[1] Miron et al. Phys. Rev. *Lett.* **102**, 137202 (2009).

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