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Tunneling Anisotropic Magnetoresistance with Half-Metallic Electrodes J.D. BURTON, EVGENY Y. TSYMBAL, University of Nebraska - Lincoln — Tunneling anisotropic magnetoresistance (TAMR) is the difference in resistance of a magnetic tunnel junction due to a change in direction of the magnetization of one or both of the magnetic electrodes with respect to the flow of current, i.e. tunnel conductance for magnetization in the plane differs from magnetization out of the plane. The origin of the effect is spin-orbit coupling (SOC). We will present results of first-principles density functional calculations of the TAMR effect in a half-metallic material, i.e. a metal that has free carriers only in one spin channel. In particular we explore the TAMR effect in magnetic tunnel junctions with La0.7Sr0.3MnO3 (LSMO) electrodes and a SrTiO3 (STO) tunneling barrier. We find $\sim$ 500% difference in resistance between magnetization in the plane and out of the plane. This large TAMR effect originates from the half-metallic nature of LSMO: when magnetization is out-of-plane SOC contributions to the transmission comes only from spin-flip scattering, which is still inherently small due to the half-metallicity. For in-plane magnetization, however, there is a large non-spin-flip SOC contribution to the conductance. The spin-flip vs. non-spin-flip dichotomy along with the orbital character of the states on the Fermi surface of LSMO leads to the large TAMR effect. This effect should be a general feature of half-metallic or highly spin-polarized magnetic electrodes and could open the door to enhanced spintronic device functionalities.

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