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Magnetoelectric Control of Magnetic Anisotropy in Ultrathin Fe Films[1] UWE BAUER, Massachusetts Institute of Technology, Cambridge, USA, MAREK PRZYBYLSKI, JURGEN KIRSCHNER, Max-Planck-Institut fur Mikrostrukturphysik, Halle, Germany, GEOFFREY S. D. BEACH, Massachusetts Institute of Technology, Cambridge, USA — Magnetoelectric switching of the magnetization vector could enable new low-power logic devices and non-volatile memory cells. Magnetoelectric switching typically requires complex multiferroic oxides or strain coupled magnetostrictive/piezoelectric composites. However, recently it has been demonstrated that surface magnetic anisotropy in ultrathin ferromagnetic metal films can be directly controlled by application of a strong electric field [1]. In this work we apply an electric field across a high-k oxide stack of MgO and ZrO_2 to induce charge at the surface of an ultrathin Fe film. By using high-k dielectric materials more charge can be induced at the surface of the ferromagnetic film and the efficiency of the magnetoelectric effect can be enhanced. Under application of just a few volts across the oxide stack we observe a strong magnetoelectric effect which results in a shift of the spin reorientation thickness by 0.5 atomic layers and a change in perpendicular surface anisotropy of $\sim 120 \mu J/m^2$. Moreover, by engineering the high-k oxide stack we realize a novel charge pumping mechanism that permits optical imprinting of the magnetic state in the continuous Fe film. [1] T. Maruyama *et al.* Nature Nanotechnology 4, 158 - 161 (2009)

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