

Electricfield control of magnetic anisotropy, DMI and exchange interaction in ultrathin ferromagnetic films

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Magnetic anisotropy control using electricfield at room temperature in all solid-state devices was first done using an Fe ultrathin film grown on Au(001) surface and covered by an MgO layer [1]. The effect was soon applied to switch magnetization coherently [2], to excite ferromagnetic resonance (FMR) [3], and to modulate spin waves [4]. In this talk, recent progresses in controlling not only magnetic anisotropy (VCMA), but also symmetric/asymmetric exchange interactions in ultrathin ferromagnetic metal films will be shown. Larger VCMA was observed for a system with 1ML Pt insertion between MgO barrier and Fe. In the system, voltage effect to the asymmetric exchange coupling (DMI) was also enhanced. By a numerical simulation, it is shown that the voltage control of DMI allows us to stabilize and destabilize skyrmions in magnetic ultrathin film. Observation of thermally excited spin-wave modes in magnetic tunnel junctions allows us to investigate details of voltage effects in magnetic anisotropy and exchange coupling. Origin of the Voltage control of VCMA [5] and exchange coupling will be discussed.

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