Electrical magnetization reversal in ferromagnetic semiconductors

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Abstract

III-V magnetic semiconductors, (Ga,Mn)As and (In,Mn)As, exhibit carrier-induced ferromagnetism and their magnetic properties are explained well by a mean-filed model [1]. They are among the promising materials for semiconductor spintronics because of novel spin-related phenomena in devices based on them, e.g. large tunneling magnetoresistance in a (Ga,Mn)As/GaAs/(Ga,Mn)As magnetic junction [2], a circular-polarized light-emission in a diode with a (Ga,Mn)As emitter [3], and isothermal magnetic phase transition in a field-effect transistor (FET) with an (In,Mn)As cannel [4]. Here, we show our recent studies on the electrical manipulation of the magnetization reversal in ferromagnetic semiconductor structures; (i) electric-field assisted magnetization reversal of (In,Mn)As in an FET structure, where the magnetic coercivity is modulated by external electric field thorough the change of carrier concentration [5], (ii) current-driven magnetization reversal of a patterned area of (Ga,Mn)As by magnetic domain wall propagation [6], and (iii) current-driven magnetization reversal of a (Ga,Mn)As electrode in a magnetic tunnel junction [7].

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