Perpendicularly Magnetized Mn-Based Binary Alloy Films: A Kind of Promising Material for High-Density MRAM

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Perpendicularly magnetized Mn-based binary alloys, like ferromagnetic $L1_0$-MnGa and ferrimagnetic $D0_{22}$-Mn_3Ga have attracted special attention in the past decades, which have great potential in nonvolatile magnetoresistive random access memory (MRAM). In this talk, I will first present the MBE growth of high-quality ferromagnetic $L1_0$-MnGa films on GaAs with giant perpendicular magnetic anisotropy energy, one order larger than that of Ta/CoFeB/MgO multilayers which is the core structure of the current spin-transfer torque MRAM (STT-MRAM) [1]. Then, I will focus on the design and fabrication of magnetic tunneling junctions based on ferromagnetic $L1_0$-MnGa, with MgO layer as an insulator, which show the obvious tunneling magnetoresistance at room temperature [2-4]. Following that, I will report our recent investigation on spin-orbit torque (SOT) induced magnetization switching in ferromagenetic $L1_0$-MnGa film, as well as in ferrimagnetic $D0_{22}$-Mn_3Ga film with and without the assistance of magnetic field [5-6]. Our experimental data indicate that these perpendicularly magnetized Mn-based binary alloy epitaxial films are compatible well with the mainstream semiconductors, and could be a kind of promising material for the next generation of MRAM.

References:

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