AB01

Tailor-Made Spin Nano-Structures in Highly Qualified Spin Related Devices

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Highly qualified spin related devices such as ultra-high density hard disk drive (HDD) and magnetic random access memory (MRAM), inductor and antenna for high frequency use are inevitable requirements for recent IT technology. Tailor-made spin nano structured materials by precisely controlled fabrication technology with nano-scale in each devices and understanding their nanomagnetics are essential from the view point of material, process, and physics. Artificial control of the exchange coupling among ferromagnetic layers through the RKKY interaction (indirect) and the direct exchange coupling represented as the exchange bias at the ferromagnetic(FM)/antiferromagnetic(AFM) interface are paid hot attention to induce newly modulated spin structures in conventional simple ferromagnetic material. Especially, Exchange Coupled Composite (ECC) media introducing the exchange coupling between ferromagnetic layers and the giant exchange anisotropy at FM/AFM interface have been attracted much attention from the view point of real applications.

High frequency response in GHz range using conventional metallic ferromagnetic material has a frequency limit determined by Snoek's law. To overcome this physical limit, we newly proposed magnetic-dielectric material consisting of magnetic nanoparticle assembly, which shows superparamagnetic response, with polymer hybridization for possible application to the high-frequency devices.

Within the frame work of the present paper, correlation between tailor-made nano structured material and magnetic properties developed for each categorized research items mentioned above will be widely discussed in connection with spin related devices.

AB02

Anomalous Growth-mode Transition during the Initial Growth Stages of $SrRuO_3$ Thin Films on Atomically Flat Single-terminated $SrTiO_3$ (111) Surface

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$SrRuO_3$ (SRO), a conducting ferromagnetic oxide, has attracted much attention due to its favorable integration with other functional oxides into heteroepitaxial-multilayered electronic devices[1], which would require atomically sharp interfaces. Although oxide films grown on SrTiO3 (STO) (001) substrates have been extensively studied [2-4], the growth of SRO films on STO (111) is lacking, because an atomically well-defined, single-terminated STO (111) surface has proved difficult to achieve. However, the recent successful fabrication of such a STO (111) surface by Chang et al. [5] has opened the door to layer-by-layer growth of SRO thin films on STO (111).

In this presentation, we report on observations of the layer-by-layer growth and growth-mode transitions of $SrRuO_3$ thin films on atomically flat Ti^{4+} single-terminated $SrTiO_3$ (111) substrates by reflection high-energy electron diffraction and atomic force microscopy. Over the first ~9 unit cells, the dominant growth mode changes from island to layer-by-layer for the growth rate of 0.074 unit cells/sec and the growth temperature of 700 ℃. Moreover, in the course of growing $SrRuO_3$ films, the governing growth mode of interest can be manipulated by changing the growth temperature and the growth rate, which change allows for the selection of the desired layer-by-layer mode. The present study thus paves the way for integrations of $SrRuO_3$ thin layers into (111)-orientated oxide heterostructures, and hence multi-functional devices, requiring control of the sharp atomic-level interfaces and the layer-by-layer growth mode.

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