【N-03】 분과초청

Half-metallic Fe_3O_4 thin films and their applications for spintronic devices

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Half-metallic Fe_3O_4 films were prepared at room temperature using an rf sputtering system specially integrated with an external rf source. Primary emphasis was placed on obtaining a large amount of active oxygen radicals through an external electrode for efficient deposition. The insertion of an external electrode was found to be critical for room temperature growth of Fe_3O_4 thin films. The structural and electrical properties gave shift and broadening effects to the Verwey temperature at various powers. The magnetization could only be saturated when a 300 Oe field was applied along an easy axis of magnetization *during growth*. However, there was no sign of saturation up to 5 T under zero-field growth. For the application of half metallic Fe_3O_4 films to spintronic device, Magnetic tunnel transistors (MTTs) based on double barrier were investigated to obtain high efficiency of spin-dependent hot electron transport. The MTTs consisted of two-terminal magnetic tunnel junctions with AlOx and AlN tunnel barriers and Fe_3O_4 electrode Those insulating barriers grown by a remote rf plasma oxidation method were used to enhance electrical and structural properties of MTTs. The basic structure of MTTs was IrMn/CoFe/AlOx/CoFe/AlN/Ta specially integrated with another emitter source *in-situ* fabricated by a conventional sputtering system. The highest magnetocurrent ratio of the MTTs was experimentally observed to be about 30% at room temperature. Especially, transfer ratio ofabout 10-3 was obtained by varying the barrier height of emitter and collector electrodes. In addition, the giant magnetoresistive (GMR) spin valves based on new Cu / Fe_3O_4 structures were investigated to improve the device performance of GMR with the advantage of half metallic Fe_3O_4 layer. Experimentally, the oscillation of coercivity in our spin valve structures was observed due to the interlayer exchange coupling oscillation with increasing metallic Co layer thickness.