

Effects of Nitrogen Concentrations in Molybdenum Nitride Underlayer for Spin valve Structure

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1. Introduction

Recently, electron transport and scattering phenomena in spin valves have been intensively studied[1]. The high sensitive and high power spin valve devices with GMR effect are used for reproducing head for hard disk drive. And, these devices are used not only GMR devices of current perpendicular to plane (CPP) method but also for various applications for biochip of biology and medical field[2]. To apply the magnetic devices on Si substrate, diffusion barrier is necessary for semiconductor application.

2. Experiment

Spin value films of substrate/MoN_x(35 Å)/NiFe(21 Å)/ Cu(22 Å)/CoFe(18 Å)/IrMn(65 Å)/Ta(25 Å) were deposited on the SiO₂ substrates by using DC magnetron sputtering system. Processing pressure and gases were 6 mTorr and Ar and N₂ gas, respectively. MoN films were deposited with various N₂ gas flow rates between 0 and 11 sccm. Generally, most of people used Ta underlayer for spin valve structure. In our cases, we used Mo and MoN_x thin film instead of Ta and TaN_x underlayer for thermal stabilities and magnetic properties[3].

3. Results and discution

Figure 1 shows that the XRD pattern of Mo thin film with various N₂ gas flows. Fig. 1(a) shows (310), (330), and (211) oriented α -Mo peak occurs at 40.0°, 57.0°, and 73.2°. Figure 1(b)-1(d) show that (107) oriented tetragonal Mo₂N peak and (100) oriented hexagonal MoN peak

are occurred over than N_2 gas flows of 3 sccm. Figure 2 shows that the MR ratio of spin valve structure with various N_2 gas flow rate. The MR ratio is almost constant of 7.25 % as a N_2 gas flow is less than 5 sccm. After then the variation of MR ratio is from 7.25 % to 4.93 % as N_2 gas flow is from 0 to 11 sccm. We examine the mechanical, structural, and magnetic properties later.

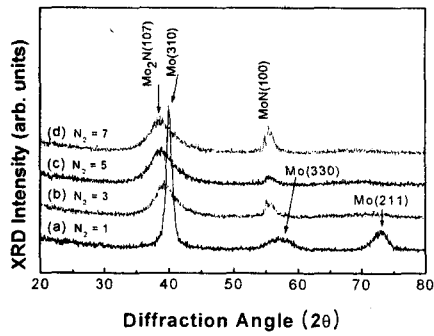


Fig. 1. XRD pattern of MoN_x thin films as a function of N_2 gas flow

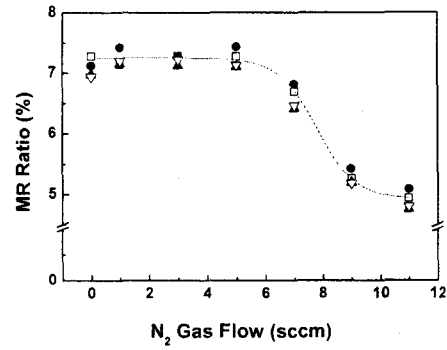


Fig. 2. MR ratio of spin valve structures as a function of N_2 gas flow.

4. Reference

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