RE06

Annealing Effect on Exchange-Biasing Co/IrMn System

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The top configuration of Co/IrMn exchange-biasing phenomenon has been studied. The Si(100)/Ta/Co(y)/IrMn/Ta samples were made by sputtering method with two conditions listed below: (a) the substrate temperature (T_s) was kept at room temperature (RT) only and (b) T_s = RT with an in-plane field (h) = 500 Oe deposition and postdeposition annealing in the field at T_A = 250 °C for 1h, then field cooled to RT. We have investigated exchange-biasing field (H_{ex}), coercivity (H_c), and crystalline structure of these samples. From high resolution electron cross-sectional transmission electron microscopy (HRX-TEM) pictures, the IrMn (111) texturing plays a main role on magnetic properties such as H_{ex} and interfacial energy (J_k). From the H_{ex} versus y result, it shows that H_{ex} increases when y decreases in the case (b). Since $J_k = H_{ex}M_s y$, where Ms is Co magnetization, it is easy to drive $H_{ex} = J_k/(M_s y)$. Therefore, if H_{ex} is inversely proportional to y, J_k/M_s is constant, we find $H_{ex}y$ = constant. In the case (a) H_{ex} is very small in general, while in the case (b) H_{ex} is of the order of 60-180 Oe. Moreover, the y dependence of J_k is similar to y dependence of M_s for each curve. Finally, the H_c is inversely to y, because of the surface pinning effects [1-2] from the Ta/Co and Co/IrMn interfaces. We conclude that the IrMn (111) structure is an important factor in governing the exchange biasing field.

Keywords : Exchange-biasing phenomenon, IrMn (111) texturing
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RE07

Correlation Between Crystal StrucTure and Exchange Bias of FePt/FeMn Multilayers in Parallel and Perpendicular Directions

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Although perpendicular exchange bias has recently received much interest, its physical origin is still open to question [1, 2]. In particular, there is very little work on the correlation between crystal structures of thin films and parallel and perpendicular exchange biases. The present paper therefore reports about the study of such correlation in FePt/FeMn multilayers fabricated onto MgO(100) substrates by using the ion beam sputter deposition system, where the crystal structure can be tuned by changing the deposition power.

Shown in Fig. 1-(a) are the XRD patterns of [FePt(3 nm)/FeMn(5 nm)]10 multilayers fabricated with various deposition powers. It is observed that samples deposited with small power show less well crystallinity. This result is in reasonable agreement with the magnetic properties of the samples characterized by using a VSM, as in Fig. 1-(b). This figure shows an increase of the blocking temperature, indicating that for samples with less well crystallinity, the antiferromagnetic phase is partially formed which results in a reduced Néel temperature.

More interestingly, it is observed the difference between the blocking temperatures in parallel and perpendicular directions. The reason for this discrepancy will be discussed in details in conjunction with LLG simulation results.

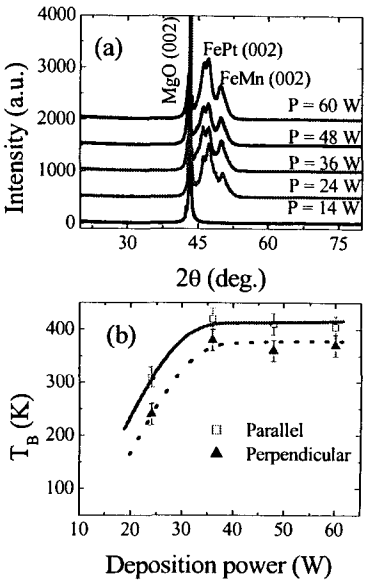

Fig. 1. (a)- XRD patterns for [FePt(3 nm)/FeMn(5 nm)]10 fabricated with various deposition power. (b)- The variation of the blocking temperatures and deposition power.

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