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Fabrication of Pressure Sensor using Magneto-Optical Effect

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The technologies of 21st century have been advanced remarkably. And the need of human welfare has induced the various technologies to novel interdisciplinary research field. Especially the sensor technology has required the fusion of the adjacent research field above all. In previous works the many kinds of sensor have been proposed using MEMS (micro-electromechanical systems) technology [1][2]. There is also lots of research in pressure sensor. Karl et al. have reported a micromachined pressure sensor with FeSiBC magnetic thin film membrane for the magneto-optical response for detecting the deflection using magneto-optical interrogation[3]. In this paper we have investigated the feasibility of iron-platinum alloy which has large Kerr rotation angle for the reduction of noise level and good spontaneous volume magnetostriction of $1.7\sim1.8\times10^{-2}$ [4]. We have fabricated the multilayer thin film by sputtering method. All layers have been sputtered in argon pressure of 5×10^{-3} torr. We adopted co-sputtering method of Fe and Pt targets to obtain the various compositions of FePt thin films. We have controlled the applied rf-powers level of each targets for tuning the Fe or Pt composition. The Al layer was deposited up to 500 nm at 300 watts dc-power as an optical reflection layer for good magneto-optical signal detection and its good ductility for bending. The 57 nm thickness dielectric layer which sandwiches the FePt layer was deposited at 200 watts rf-power for having destructive interference thickness. The XRD patterns and AES composition analysis data have shown the FePt thin films have (111) textured tetragonal. The FePt thin film has a very fine grain without post annealing. Figure 1 shows the FePt thickness dependence of Kerr rotation angle for the multilayered films. *And we have showen the AGM data taken for each sample in the insets of the figure. The maximum Kerr rotation angle is* 0.82° at 10 nm thickness of $Fe_{35}Pt_{65}$ and 0.52° for $Fe_{23}Pt_{77}$ at the same thickness. However the Kerr angle slightly decreased to 0.62° when the thickness of FePt was increased up to 30 nm for $Fe_{35}Pt_{65}$ thin film. This value of Kerr rotation angle is bigger than that of the conventional magneto-optical materials. The Fe 3d-bands and Pt 5d-bands of larger spin-orbit coupling effect cause the Kerr rotation angle increments in the thinner film. When the FePt thickness is less than 10 nm, it is too thin to contribute significantly to the magneto-optical effect.On the other hand, if the FePt layer is greater than 10 nm, destructive interference between the incident and reflected beams reduce the Kerr rotation angle. In the calculated results, the maximum Kerr rotation angle was 2.01° at the thickness of 15 nm while the experimental θ_K exhibited the maximum of 0.82° at thickness of 10 nm. As the surfaces of each constituent layers are not fully flat state, the incident and reflection beam caused the interference which brings the loss of Kerr angle value. But the tendency is very similar and the calculated results relatively well supported the experimental data.

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Detection of microstructure changes in stainless steel by HTS-SQUID based suceptometer meter

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A portable RF HTS SQUID-based suceptometer is used to measure the structural change of type 304 stainless steel samples. The strain controlled tests were conducted for the samples at room temperature (RT), 300°C and 600°C respectively. *The magnetic moments were measured for the strained samples using HTS SQUID suceptometer* [1]. *The change of magnetic* moment was measured as a function of heat treatment temperature at constant strain rate. The magnetic moment of as-received samples did not change with the heat treatment temperature, but that of cold worked samples decreased with the increasing of temperature. The results are analyzed on the basis of motion of domain wall theory [1,2].

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