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ABSTRACTS

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10:00

AG-06. Magnetic properties of water-based sol-gel derived BaFe12O19/SiO2/Si(100) thin films. Sung Yong An, *Sang Won Lee*, In-Bo Shim, and Chul Sung Kim (Kookmin Univ., Dept. of Phys., 861-1, Sungbuk-Gu, Seoul, 136-702, KR)

Thin films with barium hexaferrite (BaM) layers on thermally oxidized silicon wafers were fabricated by water-based sol-gel method. Polycrystalline BaM/SiO_2/Si(100) thin films were characterized with Rutherford backscattering, x-ray diffraction, vibrating sample magnetometer, atomic force microscope and Fourier transform infrared spectroscopy (FT-IR) as well as field-emission scanning electron microscopy. The thin films were annealed at 600 ~ 900 °C in air atmosphere for 2 hours. The pattern for the sample annealed at temperature above 650 °C indexed well on the M-type hexagonal structure and no other phases were detectable. The films were composed of uniformly distributed hexagonal-type grains, which diameter was between 400 and 1000 Å. Surface roughness of the films was between 40 and 60 Å. Mössbauer specta of the thin films we recorded using the conversion electron Mössbauer spectroscopy (CEMS). The perpendicular coercivity $H_{C\perp}$ and in-plane one $H_{C\parallel}$ were 3819 Oe and 3981 Oe, respectively, at room temperature under an applied field of 10 kOe annealed at 650 °C for 2 hours.

10:12

AG-07. Relation between the microstructure and the magnetic properties of BaFe12O19 thin films. *Abdellah Lisfi* and Cock Lodder (ISTG, MESA+ Res. Inst., Univ. of Twente, P.O. Box 217, Enschede, Twente, 7500 AE, NL)

Barium ferrite (BaFe12O19) is a very promising material for a medium of magnetic as well magneto-optic high density recording. Among the multiple reasons, which support its application in such kind of technology, the good chemical stability, the mechanical hardness and a large magnetocrystalline anisotropy. The later property is very crucial because, in one hand a perpendicular orientation of the anisotropy is possible in the thin film media [1] and in the other hand, very small grains with a stable magnetization, can be achieved, allowing the satisfaction of some requirements of high density recording. In this paper, we report about the domain structure, the magnetic properties and the microstructure of BaFe12O19 layers grown by pulsed laser deposition on sapphire substrate under various conditions. The as-grown films at high temperature (770 C) exhibit a granular structure (70 nm) and a perfect perpendicular anisotropy. However it was established that two different sources, which are the exchange coupling and the incoherent rotation mode, contribute to the reduction of the coercivity (Hc=200 KA/m) in comparison to the anisotropy field (Hk =1300 KA/m). The study performed with MFM shows a cluster-like structure in which many grains are coupled to form one magnetic domain. The as-deposited film at low temperature (620 C) shows an amorphous structure without any magnetization. However with the annealing, a magnetization with perpendicular easy axis, arises. Annealing affects strongly the magnetic properties such as the coercivity, which is largely reduced (Hc=50 KA/m). Moreover, the magnetic domains exhibit a stripe structure (Fig. 1), which looks similar to that observed by Kooy-Enz [2] in the bulk single crystal. The drastic change in the magnetic properties and the domains, was found to be caused by the microstructure, which shows big platelets favorable to multi-domains, as confirmed by the AFM, SEM and MFM analyses.

[1] A. Lisfi, J. C. Lodder, P. de Haan, and F. J. G. Roesthuis, IEEE Trans. Magn. 34, 1654 (1998)
[2] C. Kooy and U. Enz, Philips Res. Repts 15, 7 (1960)

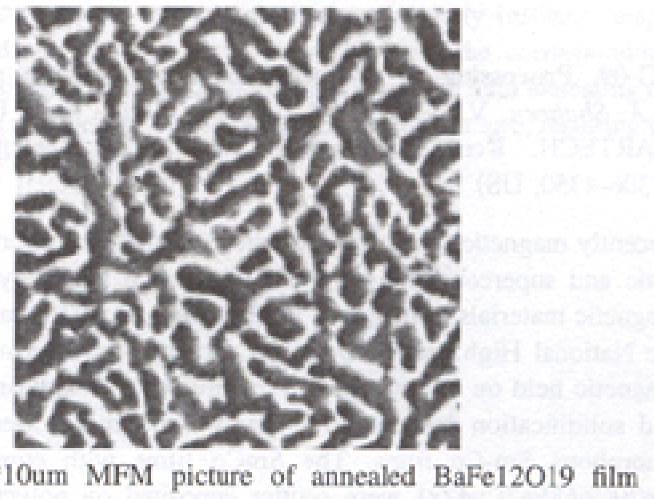

FIG. 1. (10um*10um MFM picture of annealed BaFe12O19 film at 900 C)

10:24

AG-08. Barium ferrite and strontium ferrite perpendicular media with sendust soft magnetic underlayer. *Zailong Zhuang*, Bo Bian, Robert M. White, and David E. Laughlin (Carnegie Mellon Univ., Dept. of Elec. and Computer Eng., 5000 Forbes Ave., Pittsburgh, PA, 15213, US)

We have developed sendust ($FeSiAl$) with a nominal composition of $Fe(85)Si(9)Al(6)$ at% as a magnetically soft underlayer for barium/strontium ferrite($(Sr)Fe_{12}O_{19}$) thin films. A special requirement for this underlayer is an ability to maintain the soft magnetic properties during ex-situ high temperature annealing to crystalize the barium/strontium ferrite. We first studied $Ba(Sr)Fe_{12}O_{19}/FeSiAl$ bilayer films on Si substrates. The thickness of the sendust layer was fixed at 30 nm, while the barium/strontium ferrite layer was fixed at 90 nm. A post-deposition RTA annealing was applied at 800C for 60 s to crystallize the barium/strontium ferrite films. Sendust films were found to retain the soft magnetic properties after the annealing; the Hc and Ms are about 25 Oe and 1000 emu/cc respectively. X-ray diffraction (XRD) showed that the dominant texture in sendust films is bcc (110). Meanwhile, only (107) and (114) reflection peaks were observed for barium/strontium ferrite films in the bilayer structure, indicating a weak perpendicular c-axis texture. To improve the perpendicular c-axis texture in barium/strontium ferrite films, a 5 nm-thick Pt intermediate layer was introduced under the barium/strontium ferrite layer. A 5 nm-thick strontium ferrite buffer layer was also deposited between the Pt layer and the sendust layer. Meanwhile, the thicknesses of the barium/strontium ferrite layer and the sendust layer remained the same as in the bilayer structure. The resulting $Ba(Sr)Fe_{12}O_{19}/Pt/SrFe_{12}O_{19}/FeSiAl/Si$ multilayer structure films were also annealed at 800C for 60s. The thin buffer layer of strontium ferrite between Pt and sendust was found to remain amorphous after annealing, and effectively prevented Pt from diffusing into the sendust layer. The sendust film exhibits similar soft magnetic properties as those of the bilayer structure films. The c-axis texture of the barium/strontium ferrite film was significantly improved with the use of the Pt intermediate layer, as indicated by the strong (00*l*) reflection peaks in the XRD spectrum. These results show that the use of a Pt intermediate layer and an amorphous strontium ferrite buffer layer is very effective in improving the perpendicular c-axis texture in barium/strontium ferrite films while keeping the soft magnetic properties of sendust film unchanged. In conclusion, we have successfully demonstrated the use of sendust films as the soft magnetic underlayer for barium/strontium ferrite perpendicular thin film media in both the $Ba(Sr)Fe_{12}O_{19}/Pt/SrFe_{12}O_{19}/FeSiAl/Si$ multilayer structure and the $Ba(Sr)Fe_{12}O_{19}/FeSiAl/Si$ bilayer structure. Further reduction of the coercivity of sendust films by post annealing in nitrogen atmosphere and nitrogen reactive sputtering will also be reported.

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