Development of CoX/Pd multilayer perpendicular magnetic recording media with granular seed layers

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CoCrRu-based granular seed layers are studied to control the hysteresis properties of CoX/Pd multilayer based perpendicular magnetic recording media. Proper choice of the CoCrRu growth conditions is found to reduce the hysteresis slope parameter and to improve the switching field distribution, suggesting that this granular seed layer is effective in producing exchange decoupled columnar structures. The results are confirmed by magnetic force microscopy studies of recorded patterns as well as by DC/AC-erase noise measurements, remanent coercivity studies and microstructural observations by transmission electron microscopy.


Effects of the introduction of a Pd/Si dual seedlayer on the microcrystalline structure and magnetic properties of [Co/Pd]n multilayered perpendicular magnetic recording media were investigated. The Pd/Si dual seedlayer was composed of a Pd upper seedlayer and a Si under seedlayer. The Pd upper seedlayer with a thickness of up to 10nm markedly increased the coercivity of [Co/Pd]n multilayered media in the direction perpendicular to the film surface. The highest coercivity of 7.8kOe was obtained for the [Co/Pd]10 medium with a Pd(10nm)/Si(100nm) dual seedlayer. The Pd upper seedlayer not only facilitated the formation of regular interfaces between the Co and Pd layers, but also reduced the thickness of the deteriorated initial layer in the [Co/Pd]n multilayer, resulting in enhancement of the magnetic anisotropy field. The [Co/Pd]n multilayered medium with the Pd/Si dual seedlayer exhibited weak intergranular exchange coupling between [Co/Pd]n grains, which led to excellent read-write characteristics.

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FePt/BN granular films for high-density recording media

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Nanostructured Ni---W films (140 nm) containing from zero to 18-wt. % W have been electrolytically processed and analyzed. XRD, SEM and TEM investigations revealed that films consist of Ni columnar nanoparticles of fcc-type whose [111] axis is oriented perpendicular to the film plane and have 140 nm tall and d = 6 - 27 nm in diameter. Depending on film composition, two types of nanostructures were observed: (a) single-phase nanostructure(<7-wt. %W, d = 14 - 27 nm), and (b) two-phase nanostructure(7 - 18-wt. %, d = 6 - 14 nm). The particle size dependence of saturation magnetization, in-plane and, respectively, perpendicular coercivity is typical for a single-domain Ni particle system, and can be controlled by W content. Typical film containing 13-wt. % W behaves that a system of perpendicular Ni columns 12 - 13 nm in diameter embedded in an amorphous Ni---W matrix with perpendicular magnetic anisotropy. Such film has the following magnetic parameters: Ms = 420, Hc// = 49, Hk = 118, Hk = 455 kA m – 1, quite high squareness ratio S = 0.6 and very high coercivity squareness S* = 0.83. It is conclude that such a film may be used as a perpendicular magnetic recording media with ultrahigh density.


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Segmental Anisotropy in Strained Elastomers Detected with a Portable NMR Scanner

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Single-side NMR is particularly suitable for measurements of segmental anisotropy induced in elastomers by uniaxial forces or local strain. Proton transverse nuclear magnetic relaxation was investigated with the NMR-MOUSE by recording the Hahn-echo decay in cross-linked natural rubber bands. This provided information on the dependence of the Hahn-echo decay on the angle between the direction of the uniaxial stretching force and the axis defined direction perpendicular to the magnet pole faces of the NMR-scanner. The anisotropy effect on the Hahn-echo decay is correlated with the extension ratio, and it is more evident in the liquid-like regime of the decay. A weaker segmental anisotropy is detected by 1H solid- and Hahn-echo decays recorded by multi-pulse sequences. A qualitative understanding of the angular dependence is obtained by an analytical theory of the Hahn-echo decay adapted to the case of stretched elastomers and to strongly inhomogeneous magnetic fields. Using angular-dependent 1H residual second van Vleck moments and correlation times reported previously [P.T. Callaghan and E.T. Samulski, Macromolecules 30, 113 (1997)] from stretched natural rubber bands the segmental anisotropy measured in inhomogeneous magnetic fields by the Hahn-echo decay was numerically simulated. As an example of a macroscopic distribution of local segmental anisotropy, 1H Hahn-echo decays were measured by the NMR-MOUSE sensor in a stretched cross-linked natural rubber plate with a circular cut in the center.


Improvement in the crystallinity of ZnO thin films by introduction of a buffer layer

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The influence of pre-deposition of homo-buffer layers on film quality is studied as functions of temperature and duration of pre-deposition, for zinc oxide(ZnO) crystalline films prepared by pulsed laser deposition on sapphire(0001) substrates. This preparation technique is necessary to prepare high quality films suitable for the development of ZnO devices. Crystallinity and surface morphology were characterized by X-ray diffraction(XRD), reflection high energy electron diffraction and scanning electron microscopy. The line width of the rocking curve observed for ZnO(0002) XRD of ZnO films decreases from 0.09° to 0.2-0.38° upon introduction of a buffer layer of ZnO itself at a
low temperature approximately 500°C, indicating the formation of high quality films. The surface morphology and flatness were also improved. The film prepared under optimal conditions shows a high optical transmittance of ~90% with a steep falloff at 380 nm and a fairly small carrier concentration (1.8 \times 10^{16} \text{cm}^{-3}). These results imply that the buffer layer relaxes the strain due to lattice mismatch between ZnO and sapphire (by 18%) and improves the film crystallinity.

- Keywords: thin film; Epitaxy; Pulsed laser deposition; Self-buffered ZnO film; Crystallinity


- 논문 제목
Piezoelectric thin AlN films for bulk acoustic wave (BAW) resonators

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- 논문요지
Thin film bulk acoustic wave (BAW) resonators and filters are well suited for mobile communication systems operating at high frequencies between 0.5 and 10GHz. Piezoelectric thin film materials investigated for bulk acoustic wave devices within Philips include AlN thin films. The relationship between sputter deposition conditions, AlN films structure, electromechanical coupling factor k₃ and relevant electrical parameters of BAW devices is discussed.

- 총 처
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- 논문 제목
Li:CO doped ZnO films prepared by RF magnetron sputtering technique for acoustic device application

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- 논문요지
It is necessary for zinc oxide film to have high resistivity for piezoelectric applications. The ZnO films have been deposited by RF sputtering deposition system using Li-doped ZnO ceramics as the target and high oxygen ratio (100% oxygen) for high film resistivity. The maximum resistivity of ZnO film measured was 10³\text{Ω}cm in our experiments, and stronger intensity of c-axis orientation was grown at 50% oxygen ratio. Postdeposition annealing ZnO films in vacuum circumstance were found to relieve stress, avoid the electrode oxidation and increase resistivity one order. The preferred deposition conditions and annealing condition were obtained for piezoelectric application. Then, an over-mode resonator was made and showed a large return loss of 42dB at the center frequency of about 2GHz after annealing for 1h in vacuum circumstance at 400°C.
Keywords: ZnO; RF sputtering; Annealing; Over-mode resonator

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The authors have fabricated two types of piezoelectric bulk acoustic wave resonators using ZnO thin films with negative temperature coefficient of frequency (TCF) and substrates with positive TCF. One resonator is made of ZnO thin film on a Si substrate, and the other is made of ZnO thin film on a SiO₂ substrate.

In this paper, polycrystalline ZnO films with c-axis(002) orientation have been successfully grown on the silicon substrate by r.f. magnetron sputtering technique. The deposited films were characterized as a function of deposition temperature, argon oxygen gas flow ratio, and r.f. power. Crystalline structures, stress, and roughness characteristics of the films were investigated by X-ray diffraction(XRD), scanning electron microscopy(SEM) and atomic force microscopy(AFM) measurement. By controlling deposition parameters and annealing temperature, we could improve intrinsic stress and surface roughness of ZnO film. Preferred deposition condition was found to show good film quality for SAW device applications.

Control of temperature coefficient of frequency in zinc oxide thin Film bulk acoustic wave resonators at various frequency ranges


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