

HIGH FREQUENCY CHARACTERISTICS AND MAGNETIC PROPERTIES OF CoFeAlO/NATIVE OXIDE MULTILAYER FILMS

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Multilayers soft FeCoAlO/Native-Oxides structure films with excellent soft magnetic properties and ultrahigh frequency characteristics were investigated. Multilayers consisting of discontinuous CoFeAlO layers with native-oxides surfaces were fabricated using Co₃₀Fe₇₀ + Al chips alloys targets with a purity of 99.95%. The background pressure was $< 2.0 \times 10^{-7}$ Torr. CoFeAlO films with nominal thickness of about 150 Å were deposited onto Si (100) wafer through RF reactive magnetron sputtering in Ar atmosphere. Each layer was exposed for 15 s in situ to an O₂ flow of 2 sccm, yielding a

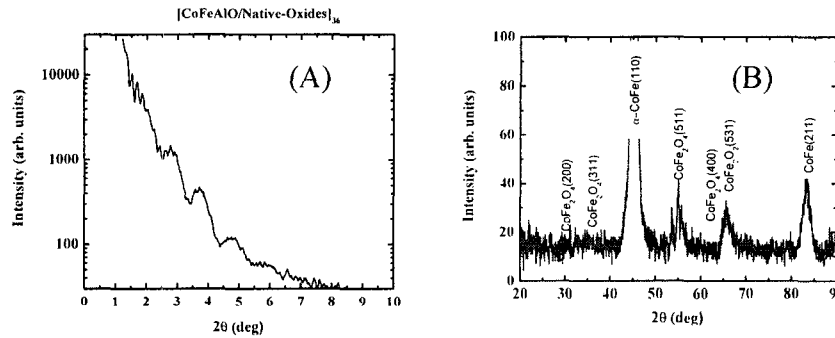


Figure 1. X-ray diffraction patterns of [CoFeAlO (150 Å)/Native-Oxides]₃₆ multilayers thin films. (A) low angle; (B) 2θ-θ

P_{O_2} of about 5×10^{-5} Torr. The O₂ flow was then terminated, followed by a pause for 2 minutes before depositing the next layers, which allowed the O₂ pressure to drop to its BP. This was repeated until the desired film thickness was reached. The notation [CoFeAlO(150 Å)/oxide]_n denotes a structure in which each of the n unit layers consists of nominal thickness 150 Å of (Co_xFe_{1-x})_n which has been oxidized using the prior procedure. Samples were characterized structurally by x-ray diffractometer (XRD) and transmission electron microscopy (TEM). The results were shown in the figure 1. The soft magnetic properties ($4\pi M_s \sim 17$ kG, $H_c < 0.3$ Oe, $H_k \sim 50$ Oe) of the multilayers films were measured by a VSM, as shown in figure 2. The electrical properties of the thin films (ρ) was measured using a four-point probe method. The ρ of [CoFeAlO(150 Å)/oxide]_n films exceeds $10^3 \mu\Omega$ cm, which is comparable to values obtained in CoFe-TM-O or metal/insulator [1-3] composites multilayers. The CoFeAlO/Native-Oxides multilayers films show $\mu_{\text{eff}} > 1000$, which is flat up to 2 GHz. The film can be a strong candidate for the materials used under ultra high frequency in GHz range.

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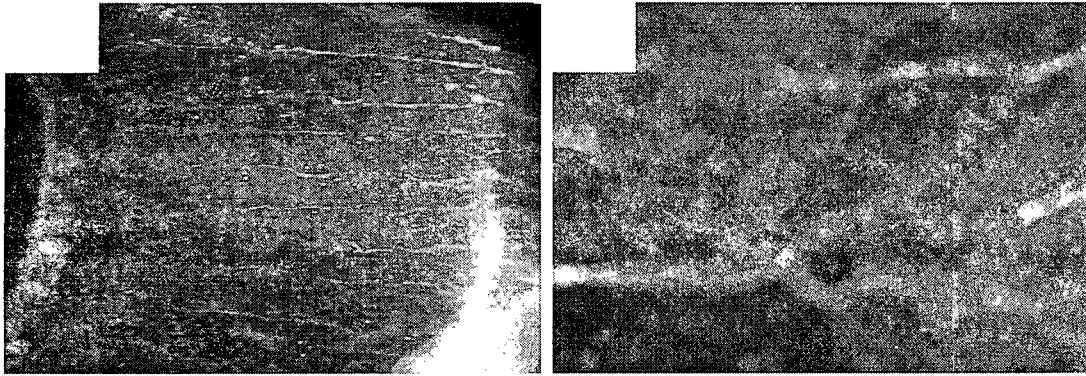


Figure 2. TEM micrograph of $[\text{CoFeAlO} (150 \text{ \AA})/\text{Native-Oxides}]_{36}$ multilayers thin films. (A) Cross-sectional TEM; (B) In-plane TEM

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