Soft magnetic Co-Fe-Al-O thin films for high frequency applications

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In this report the fabrication and characterization of nanocrystalline films with special respect to possible integration for high frequency devices, like micro-inductors or micro-transformers. The electrical resistivity, magnetic properties and structure of Co-Fe-Al-O thin films, prepared by RF reactive magnetron sputtering with (Ar + O_2) gases, have been studied. Thin films prepared by deposited onto silicon substrates (100) with conditions as following: based pressure of less than 5 x 10^{-7} mTorr; the sputtering atmosphere: 2 mTorr; the O_2 partial pressure of 4%; the input power of 300W; the composite target was composed 8 pure aluminium chips of 5 x 5 x 1 mm on the $Co_{70}Fe_{30}$ target of ϕ100 and thickness about 3 mm, exhibit good magnetic properties: magnetic coercivity (H_c) of 0.8 Oe; anisotropy field (H_k) of 8.25 Oe; magnetization saturation ($4\pi M_s$) of 18.1 kG, and electrical resistivity of 560.67 μΩcm. The electrical resistivity of the films increases sharply on increasing the oxygen gas flow ratio in the sputtering gases, which is attributed to the oxidizing of the intergrain region. The resistivity of the thin films reach 1000 μΩcm but the films with resistivity less than 600 μΩcm exhibit good soft magnetic property. Especially, the nanocrystalline thin films of CoFe-based exhibit very low magnetostriction [1].The thin films are possible candidate for future ultra-high frequency devices such as high density read-write head or thin film inductors in GHz frequency range [2-5].

References

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