EQ04

Study of Discontinuous FeCoSi/ Native-oxide Multilayer Films Operating in Gigahertz Frequency Range

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Two important parameters of soft magnetic materials required for high frequency applications are permeability and ferromagnetic resonance (FMR) frequency. For a magnetic film with in-plane uniaxial anisotropy field H_k and saturation magnetization 4 πM_s, the initial permeability μ_i (the real part of the complex permeability $\mu = \mu' - j\mu'$ at zero frequency) and resonance frequency fr are given by

$$\mu_i = 1 + \frac{4\pi M_s}{H_k} \quad (1)$$

$$f_r = \frac{\gamma}{2\pi}\sqrt{4\pi M_s \times H_k} \quad (2)$$

where γ is the gyromagnetic factor. Equations (1) and (2) reveal an inherent tradeoff, known as the snoek limit [1], between initial permeability and ferromagnetic resonance frequency. Therefore, the ability to easily optimize μi and f_r for the high frequency application of soft magnetic thin film is desirable.

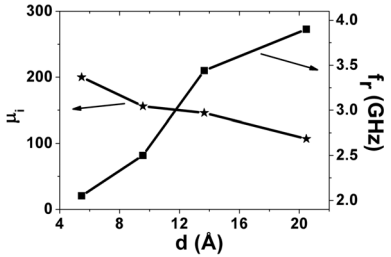

Fig. 1. The initial permeability μi and resonance frequency fr for the samples at various magnetic FeCoSi thicknesses d.

In this work, discontinuous [FeCoSi (d)/native-oxide]$_{50}$ multilayer films with tunable Hk and 4πMs were prepared by DC magnetron sputtering without using gradient sputtering method or any postfabrication treatment. The results reveal that H_k and 4 πM_s of the films increase simultaneously as magnetic FeCoSi layer thickness d was increased from 5.5 to 20.5 Å. As a consequence, as shown in Fig. 1, the resonance frequencies f_r of the films continuously increased from 2.0 to almost 4.0 GHz. Furthermore, the large ❍i above 100 for all films was achieved due to the large and increasing 4 πMs as d was increased. The combination of these properties makes the [FeCoSi (d)/native-oxide]$_{50}$ films potential candidates for high frequency magnetic devices.

REFERENCES

[1] J. L. Snoek, Physica 14, 207 (1948).

EQ05

Researching Arsenic Absorbability of Magnetic Nanoparticles Fe_3O_4 Coated with Oleic and Alginic Coatings

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Arsenic species are toxic compounds which present widely in water source in many countries, especially in Vietnam. Environmental health problems related to industrial waste streams and related drinking water contaminations can commonly occur. Removing or decreasing arsenic contaminations level effectively (according to WHO standars) is current facing many difficulties in technologies. This work focused on synthesizing magnetic nanoparticles with sodium oleate and alginate coatings in order to investigating whether or not effectiveness of arsenic removal can be increased by oleate and alginate coated magnetic nanoparticles. Magnetite nanoparticles were synthesized by co-precipitation method from $FeCl_2$ and $FeCl_3$ solution, coated by sodium oleate and alginate. Phase structure of these particles was determined by XRD, morphology were observed by TEM, SEM, and magnetic behaviors of these superparamagnetic nanoparticles were analyzed by hysteresis loop of VSM. Removal process were proceed with alter magnetic field by separation technique. Detection of arsenic was investigated using various types of electrodes, electrolytes.