

Properties of DC plated 2.4 Tesla CoFe alloys

C. Bonhôte, J. Lam, and M. Last

HITACHI Global Storage Technologies
San Jose, CA

CoFe alloys, which exhibit the highest magnetic saturation (~ 2.45 Tesla) of the iron-group metal alloys¹, have been successfully electrodeposited, as shown in a previous study².

The same bath was used in this study to electroplate CoFe thin films with alloy compositions ranging from 40wt% Fe up to 65% Fe. Plating conditions such as plating current density, bath temperature and bath composition were varied to obtain a large range of alloy compositions. In this paper, the magnetic properties (i.e. saturation magnetization, easy-axis coercivity and magnetostriction coefficient) and the internal stress of CoFe films are represented in Figure 1 and Figure 2 as a function of the alloy composition. The CoFe alloys were thermally annealed.

In addition, microstructural and compositional characteristics of the CoFe films were investigated using electron microprobe, X-Ray diffraction and TEM. In the latter, EDX analysis was performed to determine the alloy composition gradient, both in full film (open area) and within a narrow trench, as shown in Figure 3. The resulting magnetic property gradient was investigated using a Vibrating Sample Magnetometer.

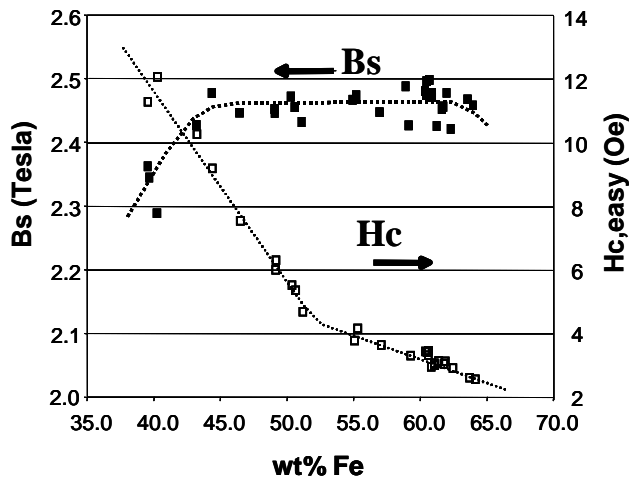


Figure 1. Saturation magnetization B_s and easy-axis coercivity $H_{c,e}$ of electrodeposited CoFe films as a function of iron content

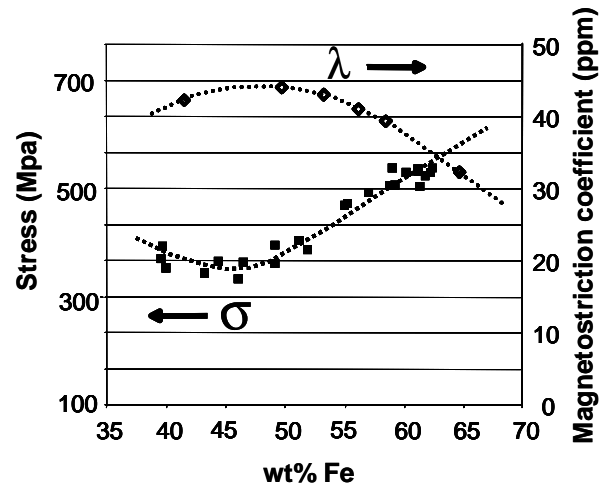


Figure 2. Internal stress σ and magnetostriction coefficient λ of electrodeposited CoFe films as a function of iron content

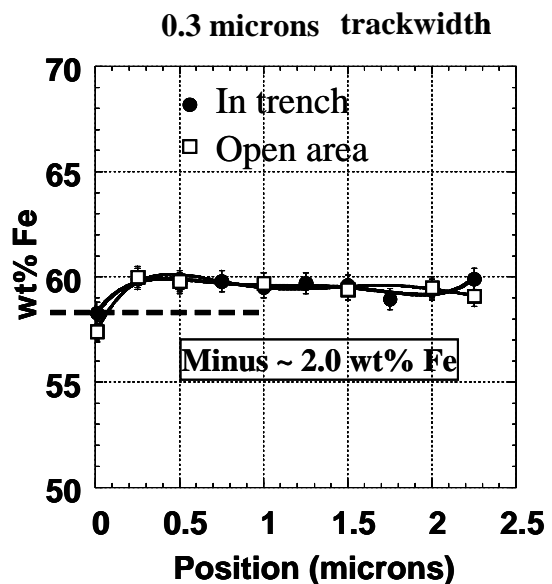


Figure 3. TEM-EDX analysis of the Fe composition gradient in a full film (open area) and in a narrow trench (0.3 micron wide) for a $Co_{40}Fe_{60}$ electrodeposited alloy.

References

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