Electrodeposited, High Moment FeCoNi Alloys for Magnetic Recording Heads

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In advanced disk drives, magnetic media with high coercivities are needed to allow recording at high linear densities. To provide the magnetic field necessary to switch the magnetization in these media, soft magnetic materials with magnetic moment much higher than Permalloy are required.

Electrodeposited FeCoNi alloys in the optimum compositional range have been shown to provide high moment (> 21 kG) with low coercivities (~ 1 Oe). In addition, these materials exhibit low values of magnetostriction (4×10^{-6}) and advantageous anisotropies (~ 25 Oe). Investigations on high purity FeCoNi alloys allowed us to determine the conditions yielding optimum soft magnetic properties and high moment. Such characteristics are obtained when the competitive growth of BCC and FCC phases of FeCoNi is induced, producing smallest grain size and minimum internal stresses.

Focus of our most recent research is the optimization of the micromagnetic structure of these films by growth on suitable underlayers. The figure below shows magnetic force microscopy images of two FeCoNi films with identical composition grown respectively on copper (left) and $Ni_{80}Fe_{20}$ (right). It is clearly shown that a Permalloy underlayer decreases the amplitude of the magnetization ripple structure by narrowing the easy axis dispersion. This behavior is attributed to microstructural effects and to exchange interactions at the interface.

Future work includes the study of the magnetic properties, domain structure and high frequency response of small elements of FeCoNi, simulating magnetic head writers in advanced recording systems.

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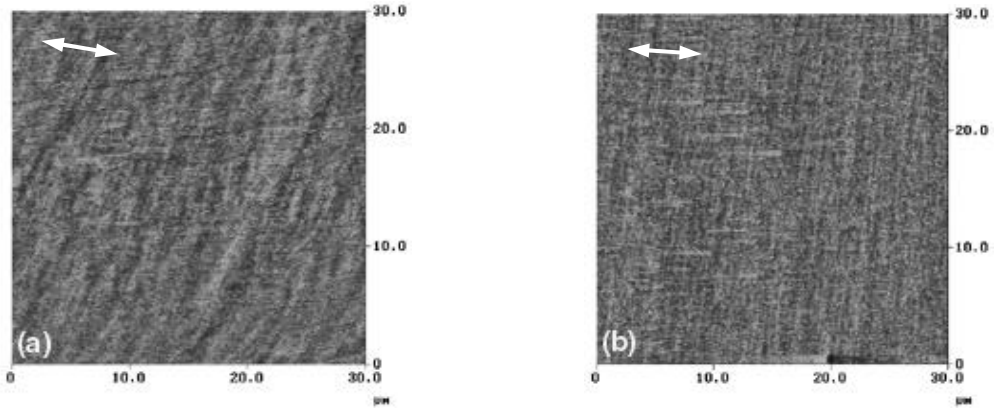

Cu underlayer **NiFe underlayer**

MFM images of FeCoNi 400 nm thick on different underlayers. The ripple structure observed corresponds to inhomogeneities in the magnetization configuration, which are more relevant when FeCoNi is grown on Cu underlayers.