Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Influence of magnetic annealing and interdiffusion on the exchange bias of CoFe/IrMn[1] WALDEMAR MACEDO, LUIS FERNANDEZ-OUTON, MARIO ARAUJO FILHO, RAPHAEL ARAUJO, JOSE ARDISSON, Centro de Desenvolvimento da Tecnologia Nuclear - CDTN — Magnetic annealing is broadly used to set exchange bias (EB). The EB field depends on the magnetic field and the temperature at which the F/AF exchange interaction is set. Atomic interdiffusion is also expected to have strong influence on EB. For systems containing IrMn, different results have been reported regarding the effect of setting EB between 200 and 400 °C. We study the effect of atomic interdiffusion on the exchange bias of polycrystalline IrMn/(^{57}Fe+CoFe) multilayers due to the magnetic annealing between 225 and 500 °C. The samples have been prepared by magnetron sputtering, and ^{57}Fe probe layers (10 Å thick) were grown at the F/AF interface, and 1 nm and 2 nm above it, inside the CoFe layer. Depth-resolved ^{57}Fe conversion electron Mössbauer spectroscopy (CEMS) was used to quantify atomic interdiffusion, and vibrating sample magnetometry was used to monitor the variation of exchange bias and magnetisation. We found that interface sharpness is only affected above ∼350 °C. Three different stages for the setting of exchange bias can be inferred from our results. At temperatures < 350 °C, no interdiffusion is observed and the F/AF exchange coupling establishes partial spin alignment of interfacial and bulk AF spins. At intermediate setting temperatures (350-450 °C) interfacial spin order is dominant over chemical intermixing effects, and both exchange field and coercivity increase up to 450 °C. Above 450 °C, severe chemical intermixing reduces significantly (∼50%) the F/AF coupling.

[1]Work supported by CAPES/PNPD, FAPEMIG, and CNPq

Waldemar Macedo
Centro de Desenvolvimento da Tecnologia Nuclear - CDTN

Date submitted: 13 Nov 2012 Electronic form version 1.4