Stress induced magnetic domain structure in chemically disordered FePt thin films

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FePt alloy films tend to grow in a chemically disordered crystalline phase with a relatively low magnetocrystalline anisotropy and an in-plane compressive stress which, due to the positive magnetostriction coefficient of the alloy, induces an easy magnetization axis normal to the film plane. Even when this anisotropy is lower than the demagnetization energy (the ratio between these two quantities defines the quality factor, Q) it is possible to observe a magnetic domain structure in the form of stripes. However, due to the competition between dipolar, exchange, anisotropy and domain wall energies, the striped domain structure is only observed above a critical film thickness, $d_{cr} \sim 30$ nm for our samples. This critical thickness depends on Q, so that a change in the domain structure could be observed if this parameter is varied. In order to study these effects we have sputter-deposited a set of FePt films on oxidized Si (100) substrates with thicknesses between 9 and 94 nm. Due to the different thermal expansion of FePt and Si a reduction in Q is expected when the temperature is lowered. From M vs. H loops measured at different temperatures in the range 80 K - 300 K, we have effectively observed a change in the coercive field which can be associated to a transition from stripe-like to planar domains. The transition temperature range is broad, indicating a gradual transition between the two magnetic configurations, but changes systematically with film thickness, consistent with an interfacial induced strain. We have also performed Ferromagnetic Resonance experiments below room temperature in order to study the possible effects of stress on the dynamic response. Contrary to the clearly observed transition in the coercive field, the resonance field shows a monotonous change which reflects the continuous variation of the anisotropy field.