Static and dynamic properties of FCC FePt ferromagnetic films

Alejandro Butera
Centro Atómico Bariloche (CNEA) e Instituto Balseiro (U. N. Cuyo),
8400 Bariloche, Río Negro, Argentina.

We have studied the static and dynamic properties of FePt thin films as a function of film thickness in the range 10 nm ≤ t ≤ 100 nm. These films, that are ferromagnetic at room temperature, have been deposited by magnetron sputtering on oxidized Si (100) substrates. As deposited films are polycrystalline and grow in a disordered FCC phase with a moderate texture along the [111] direction.

All magnetic properties are considerably different for thinner (t ≤ 30 nm) than for thicker (t ≥ 60 nm) films. In the thinner films the in-plane magnetic hysteresis loops are almost square with a large remanent magnetization and a relatively small coercivity. Thicker films, on the contrary, reverse magnetization in a two step process and have larger coercivities. Isothermal remanent magnetization, DC demagnetization and magnetic viscosity measurements also show a different behavior in the two thickness ranges. Magnetic force microscopy revealed that thicker films have a stripe-like domain structure with a period of 200 nm. This domain structure is not observed in the thinner samples.

The dynamic response of the films was studied by ferromagnetic resonance measurements at 9.5 Ghz (X-band) and 34 GHz (Q-band). In the thinner films we have observed a single resonance line which is related to the uniform precession of the magnetization vector. Thicker films show an additional resonance line when the magnetic field is applied close to the film normal.

All the above results are consistent with the presence of a perpendicular anisotropy field that favors a small out of plane component of the magnetization. In the case of thicker films it is energetically favorable to form domains with a perpendicular magnetization component of varying sign.