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Control of the magnetization orientation in L10 FePt films by means of annealing in a magnetic field near the Curie temperature

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Abstract

© 2015, Pleiades Publishing, Ltd. Films of the L10 Fe50Pt50 phase with a thickness of 20 nm in the multilayer Fe(2 nm)/Fe50Pt50(20 nm)/Pt(2 nm) magnetic structure have been prepared by magnetron sputtering. The multilayer structures have been annealed at 700°C for 30 min and then at 430–600°C for 1 h either in an external magnetic field of ~3500 Oe, which is applied perpendicular to the film plane (the A mode), or without an external magnetic field (the B mode). X-ray diffraction and Mössbauer studies have revealed that the annealing of FePt films in the composition of the multilayer magnetic structure in an external magnetic field at the temperature TC = 478°C (TC is the Curie temperature for FePt films) leads to the formation of the L10 structure with the magnetic moments oriented along the normal to the film surface. In this case, the atomic force microscopy images have demonstrated changes in the grain sizes. When the annealing temperature is close to the Curie temperature TC for FePt films, the thermal perturbation is comparable in magnitude to the magnetization exchange energy; consequently, the external magnetic field of ~3500 Oe, which is applied perpendicular to the film surface, effectively contributes to the formation of the L10 structure. The annealing of FePt structures in an external magnetic field makes it possible to form the L10 (001) texture in these materials and to orient magnetic moments in the direction of the field.

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