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The Effect of B Content on the Structure and Magnetic Properties of Fe-Pt-B Alloy Films

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Structural analysis by using TEM and XRD, and direct magnetic measurements by VSM have been used to determine the magnetic structures of platinum + iron alloys in the neighborhood of the composition FePt3. It is found that the magnetic structure is sensitively dependent on the precise chemical order, in particular on the number of nearest-neighbor iron atoms. Bulk alloys of the stoichiometric composition, where the chemical order is perfect, have simple antiferromagnetic structures with the Neel temperatures below 200 K. Our objective in the present work is to control the magnetic properties of $FePt_3$ films by adding B content: addition of B leads to a ferromagnetic structure at room temperature. After suitable thermal treatments, our results showed the room temperature ferromagnetic behavior of the $L1_2$ phase is associated with the presence of additional B content of 6%. The $[B(x\ nm)/Fe(0.17\ nm)/Pt(0.2\ nm)]_N$ were deposited on an epitaxial Pt/MgO(001) buffer grown on Si(100) substrate by UHV-(molecular beam epitaxy (MBE) deposition. The B thickness (x)is ranging from 0 to 0.05 nm. The perpendicular magnetic anisotropy was found in the films having at least 8 (N=8) repetitions of B(0.03 nm)/Fe(0.17 nm)/Pt(0.2 nm), after subsequent annealing. One possible explanation for the origin of the magnetic property change from the antiferro- (or ferri-magnetic) properties to ferromagnetic properties could be related to the improvement of L12 phase stability by adding small amount of ternary element B.