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Evidences of the structural phase transition of equiatomic CoPt film

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Various physical properties of Co-Pt alloy films were investigated at low and room temperatures. The samples were thin films deposited on Si(100) substrates at 70-80 ℃ by ultra high-vacuum cosputtering. Both equiatomic CoPt and Pt-rich $CoPt_3$ alloy films were prepared. The thickness of the films were 200Å with a Pt buffer layer of 200Å thick. The deposition rate was 0.75 Å/s.

The saturated polar Kerr rotation angles of CoPt and $CoPt_3$ alloy films showed different temperature dependence. The $CoPt_3$ film shows a significant temperature dependence in which the polar Kerr rotation angle increases as temperature is lowered, confirming the increased magnetic alignment at low temperature. However, the equiatomic CoPt film shows very little temperature dependence. This result is quite contrary to our expectation; the equiatomic CoPt film should show the same temperature dependence as that of $CoPt_3$ film.

Synchrotron-radiation photoemission spectroscopy (SR-PES) was used to confirm the correlation between magneto-optical properties and the change in electronic structure of these films. The SR-PES spectra also showed the similar temperature dependences to those of the polar Kerr rotation angle measurements. For the equiatomic CoPt film a peak around 4.3 eV of the Pt 5 *d* levels hybridized with the Co 3*d* electrons decreases, and a structure near the Fermi level increases prominently upon cooling, while the spectra do not change significantly for $CoPt_3$.

Since the experimental results exhibited a rather large electronic structure change upon cooling, we perform the electronic structure calculations for various crystal structures and investigate the total energy to find a new structural phase of the equiatomic CoPt film using linearized-muffin-tin-orbitals methods within the so-called *"LDA+U"* scheme. From the results of calculations a structural phase transition of the CoPt films from the $L1_0$ to $B19$ phase upon cooling was suggested by the theoretical calculations.