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Influence of order-disorder structural transition on the properties of Co_xAl_{1-x} (x=0.50, 0.54 and 0.62) alloy films

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The influence of the order-disorder structural transition on the magnetic, optical, magneto-optical, and transport properties of equiatomic and Co-rich β-phase Co_xAl_{1-x} (x=0.50, 0.54 and 0.62) alloy films has been investigated.

The ordered and disordered Co_xAl_{1-x} alloy films of 100 - 150 nm thick were prepared by flash evaporation on the heated and cooled substrates, respectively. The magnetic properties were investigated by using a vibrating sample magnetometer and by ferromagnetic resonance. The transport properties have been measured in 2 - 300 K temperature range. The optical properties were studied by ellipsometry in the 0.5 - 5.0 eV energy range. The magneto-optical properties (equatorial Kerr effect : EKE) were measured in the 1.05 - 0.5 eV energy range at a 66° angle of incidence.

The order-disorder transition of the Co-Al alloy films causes an increase in the magnetic moment, and a significant (at least, twice at 3 eV for the $Co_{0.62}Al_{0.38}$ alloy film) growth of the EKE value and an apparent change in shape of the spectrum are also observed. We attribute the increased magneto-optical response and magnetization, and additional optical absorption in the infrared region of the disordered Co_xAl_{1-x} alloy films to the bcc Co precipitates (antistructure Co atom clusters). All the experimental data are discussed by using the results of the first-principles calculations of the electronic structure of the CoAl compound, and in the framework of the structural defect approach.