Nanocomposites and nanomaterials

Magnetic properties three-layers film systems based on Co and Gd or Dy

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The relevance of the study of magnetic properties based on R-T metals is associated with finding new combinations of metals to create modern information recording media with stable performance characteristics at the specified temperature range. Thus, this paper is devoted to inverstigation of magnetic properties of three-layers film systems Co / X / Co / S (X = Gd or Dy), such as coercitive force (H_c), remanent magnetization (M_r) and saturation magnetization (M_s), when the thickness of the layer of rare earth metals is changed.

Samples were obtained by electron beam method on warmed substrate ($T_s \cong 460$ K) in the working volume of the vacuum chamber (residual gas pressure of the atmosphere $P \cong 10^{-4}$ Pa). Heat treatment was carried by scheme «heating to $T_a = 800$ K $\rightarrow$ exposure for 15 min. $\rightarrow$ cooling to room temperature». The study of the magnetic properties were carried at room temperature in a parallel geometry measurement (lines of induction magnetic field were directed parallel to the sample surface) using a vibrating magnetometer VSM Lake Shore 7400.

The inverstigation of the magnetic properties of film systems Co(5) / Dy(x) / Co (20)/ S ($d_{Dy} = 1 \div 20$ nm) in freshly condensed state showed that an increase of the effective thickness of the Dy increases value of H_c and thus it has oscillating character. The minimum value recorded for the sample Co(5) / Dy(1) / Co(20) / S is $H_c = 12$ E, and the maximum $H_c = 38$ E for sample Co(5) / Dy(20) / Co(20) / S. For film samples Co(5) / Gd(x) / Co (20)/ S ($d_{Gd} = 1 \div 20$ nm) observed a similar dependence H_c. The minimum value H_c for sample Co(5) / Gd(5) / Co(20) / S is $H_c = 14$ E, and the maximum $H_c = 32$ E for sample Co(5) / Gd(10) / Co(20) / S.

After heat treatment values of H_c decreases by an average of 42 % for film system Co / Dy / Co / S and increases by 10-20 % for film system Co / Gd / Co / S. This result can be explained by changes in the structural and phase state.

For saturation magnetization and remanent magnetization reversible character is being observed when the effective thickness of the Dy and Gd layers increase the values of M_r and M_s decrease.