

Sensitive Elements of Magnetic Field Sensors Formation as Spin-Valve Type Multilayer Structures Based On Co and Cu

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Multilayer spin-valve structures with spin-dependent electron scattering based on Co and Cu are widely used in modern micro-instrument engineering and sensor techniques as sensing elements for high density recording systems. In this work we study the magnetoresistive properties of model film systems based on Co and Cu in the form of sandwich structures, received under the scheme magnetic/nonmagnetic/magnetic layer, which is the basis of simple spin valves and modified spin valves, in which as upper or lower magnetic layer used multilayer Co/Cu with different number of fragments.

The experiments have been performed under high vacuum condition (the base pressure was 10^{-4} Pa) and samples have been prepared by method of thermal evaporation. The layer thickness during the deposition process was controlled by the quartz resonator method. Results of the study magnetic properties of film samples in the form of spin-valves Co/Cu/Co/S(substrate) fixed magnetic layer thickness of 20 nm Co (bottom) and Co 5 nm (upper) shows, that for such systems value magnetoresistance (MR) at room temperature in the range of 0,1-0,2 %. The annealing to temperatures 700 K and 900 K simple and modified spin-valve based on Co and Cu leads to a slight increase in the values of MR and significant changes in the forms of dependency MR. These changes can be explained by the processes of mixing layers as a result of thermal diffusion, which may in turn lead to the formation of granular state of magnetic Co solid solution in the matrix.

Analyzing the experimental data we can conclude that multilayer film system in the form of spin-valve Co(5)/Cu(8)/Co(20)/S advisable to modify using as the upper magnetic layer multilayer based on Co and Cu. This modification will increase the value of MR, increases performance and somewhat improves temperature stability of the system. These characteristics can be useful in the manufacture of electronic components spintronics working in digital mode and the manufacture of magnetic memory elements, switches and so on.

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