GALVANOMAGNETIC PROPERTIES OF Mn_5Ge_2 *FAR FROM THE COMPENSATION POINT*

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The temperature dependence of the transverse magnetoresistance of the ferrimagnet Mn_5Ge_2, which has a compensation point, was investigated. At temperatures far below the compensation point, a minimum is observed in the $\Delta R/R_\perp = f(t)$ curve.

IT was Belov's suggestion[1,2] that ferrimagnets that have a compensation point Θ_c ought to have anomalies in the curve of the temperature dependence of various physical properties, not only near Θ_c, but also at a considerable distance from it ($t = \Theta_n$). According to his ideas, this is due to a sharp change in the long-range magnetic order in the sublattice with the weakest exchange interaction at $t = \Theta_n$.

Experimental investigations, mainly on iron garnets, have confirmed this assumption.[3-7]

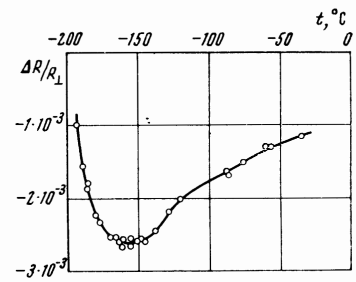
In this it was found that the character of the anomalies in the susceptibility of the paraprocess, coercive force, magnetoresistance, etc., recalls the behavior of these quantities near the ferromagnetic Curie point. Further theoretical basis for the observed phenomena is given in[8], where the assumption relative to the growth of intrinsic magnetization occurring at $t = \Theta_n$ is confirmed. Thus, it is clear that the study of uncompensated ferrimagnets with a compensation point will permit a judgment about the role of the different sublattices in ferrimagnetism and the phenomena associated with them.

In this connection there is an interest in finding low-temperature anomalies in ferrimagnets with another type of chemical bond and a different kind of electrical conductivity than in the iron garnets. With this in mind, we chose the intermetallic compound Mn_5Ge_2. The presence of a compensation point in this compound was established by Yasukochi et al.[9] As was shown in[10], this compound behaves like a metal as far as the temperature dependence of electrical conductivity is concerned. The magnetic and galvanomagnetic properties of Mn_5Ge_2 near Θ_c had been studied earlier.[10-13] The data was explained phenomenologically in[14].

One of the properties most sensitive to a change in intrinsic magnetization is the change in resistance in a magnetic field. Hence, to study the behavioral peculiarities of Mn_5Ge_2 at $t \ll \Theta_c$ we undertook measurements of the transverse magnetoresistance versus temperature.

The sample was prepared according to the method described in[9]. Its compensation point was $-122°C$. The resistance was measured with a dc potentiometer and a galvanometer of sensitivity 2×10^{-8} V/div in the temperature interval from -196 to $0°C$.

Over this entire temperature interval, it was found that the isotherms $\Delta R/R_\perp = f(H)$ were straight lines passing through the origin. This indicates that a paraprocess plays the basic role in the makeup of $\Delta R/R_\perp$ in Mn_5Ge_2. The temperature dependence of the transverse magnetoresistance in a field of 16 kOe is shown in the figure. Note the minimum at $-160°C$. It has a shape like that of the anomaly in $\Delta R/R_\perp = f(t)$ near the Curie point T_C. However, the minimum in this case is much more diffuse than at $t = T_C$ and extends over an interval of 15 to 20°. It should be noted that its occurrence cannot be related to any sudden change in the anisotropy constant near $t = -160°C$, since the shape of the magnetization curves near this temperature remains unchanged.



Temperature dependence of transverse magnetoresistance in a magnetic field of 16 kOe.

In summary, we can say that the peculiarities in the behavior of ferrite-garnets for $t \ll \Theta_c$ described in[1-8] are characteristic of a broad class of ferrimagnets with compensation points.

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