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MAGNETIC PROPERTIES OF THE ALLOY $MnAu_2$ IN INTENSE PULSED MAGNETIC FIELDS UNDER HIGH HYDROSTATIC PRESSURE

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Magnetization curves were obtained for the alloy $MnAu_2$, which has a helicoidal magnetic structure, in fields up to 80 kOe under high pressures, up to 14 kbars, at room temperature. The threshold magnetic field for transition to the ferromagnetic state H_c was plotted against pressure; it was found that the threshold field decreases to zero at ~15 kbars. The results were used to calculate the energies of exchange interaction n_1 and n_2 along the c axis of the tetragonal unit cell according to current theory with regard to the alloy $MnAu_2$. It was shown that the model of competing interaction does not correspond to the nature of the helicoidal ordering of magnetic moments in $MnAu_2$, since n_1 and n_2 do not manifest the dependence on pressure which follows from this model. Proceeding from the difference in relative volume change on transition from antiferromagnetic states to the ferromagnetic state under the influence of a magnetic field ($\Delta V/V = -5 \cdot 10^{-4}$) and under hydrostatic pressure ($\Delta V/V = -21 \cdot 10^{-4}$), a hypothesis is advanced regarding the difference in transition mechanisms for the two cases.

The intermetallic alloy $MnAu_2$ has an antiferromagnetic helicoidal structure, the angle of the helicoid being ~51° at room temperature and atmospheric pressure. In a magnetic field of ~10 kOe this alloy goes over to the ferromagnetic state.

The effect of hydrostatic pressure on the magnetization of $MnAu_2$ was first investigated in [1]. It was found that hydrostatic pressure shifts the beginning of the rise in the magnetization curve downfield. A detailed investigation of the magnetic properties at high pressures was carried out in [2]. It was shown there that the threshold magnetic field in the alloy $MnAu_2$ at 12 kbars should be equal to zero. In a recent paper [3] it is stated that the pressure of transition to the ferromagnetic state is 15 kbars. All earlier measurements of the magnetization of the given alloy under hydrostatic pressure were made in steady-state magnetic fields, except for a recently published study [4] in which the magnetic field reached 80 kOe, but the pressure was quite low, amounting to only 3.3 kbars. From these measurements one can hardly draw any definite conclusion as to the effect of hydrostatic pressure on the saturation magnetization of $MnAu_2$.

It was of interest to supplement the earlier work by studying the magnetic properties of the alloy $MnAu_2$ under high pressures in intense pulsed magnetic fields; a special method was developed for this.

1. EXPERIMENTAL PROCEDURE

Pressures up to 14 kbars were produced in an independent cell made of 40Kh ferromagnetic steel. The cell is described in [5] (inner diameter 5 mm, outer diameter 20 mm, and working volume 0.6 cm^3). It was placed in a solenoid in which a pulsed magnetic field was produced by discharging a 3600-μF capacitor bank. It was found experimentally that a magnetic-field pulse having a forward front of 0.63 msec duration permeates the cell completely.