

THE DEPENDENCE OF THE MAGNETORESISTANCE OF AlMn
ALLOYS ON MAGNETIC FIELD AND IMPURITY CONCENTRATION

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The investigation of the resistivity of alloys with a high Kondo temperature (T_K) in a strong magnetic fields may give useful information about the nature of the magnetic resonance. These investigations are hampered by the fact that at low temperatures relative change in the magnetoresistance is proportional to H^2/T_K^2 which is very small for available fields. Such an alloy is AlMn with $T_K \approx 600\text{K}$. We have measured several AlMn alloys with concentrations 0.55-5at%Mn in the temperature interval 1.5-20K. The samples were situated in a special cryostat within a gap of the superconducting magnet with a maximum field of 3.5T.

Fig.1 shows that the results of the measurements on alloys with $c > 1\text{at}\% \text{Mn}$ are very different from those for lower concentrations. Low concentration alloys were discussed elsewhere¹⁾. We note only that 0.55at%Mn alloy (lowest curve in Fig.1) shows a positive magnetoresistance proportional to T^2 and independent of temperature (open circles denote measurements at 4.2 and closed ones at 1.5K) qualitatively in agreement with the theoretical calculations^{2,3)}. The dotted line above this curve shows the results for an Al0.7at%Mn alloy used for comparison¹⁾. By subtracting these results from those for Al0.55at%Mn we obtained (negative) magnetoresistivity for single Mn impurities in Al.

At higher concentrations ($c > 1\text{at}\% \text{Mn}$) the interactions between impurities set in. Figure 1. shows that these alloys also show H^2 dependence but magnetoresistance decreases with increasing magnetic field. This behaviour is typical for an alloy with localized magnetic moments and arises from freezing out of the spin-flip processes⁴⁾. Furthermore the magnetoresistance is strongly dependent on temperature (note the difference between the open and closed circles) indicating rather low $T_K \approx 4\text{K}$. In addition the

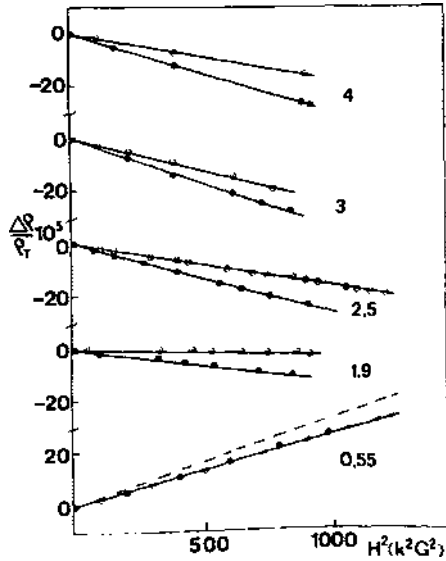


Fig.1. A relative change in the magnetoresistance for several $AlMn_2$ alloys (concentrations in at% marked on right) vs H^2

change of magnetoresistivity with H^2 is strongly concentration dependent and varies as c^3 indicating that the Mn triplets are causing such behaviour.

Recent magnetic susceptibility measurements⁵⁾ on the same system have also found (at higher Mn concentrations) the triplets with $T_K \approx 3K$ in a good agreement with our results.

References:

- 1) A.Hamzić and E.Babić, Sol.St.Comm.(1976)in press
- 2) P.Nozieres, J.Low Temp.Phys.17(1974)31
- 3) J.Souletie, AIP Conf.Proc.(1976)in press
- 4) M.T.Beal-Monod and R.A.Weiner, Phys.Rev.170(1968)552
- 5) J.R.Cooper and M.Miljak, J.Phys.F.Met.Phys.(1976)in press