Low-Temperature Magnetoresistance in Magnesium and Aluminum Containing Small Concentrations of Manganese or Iron

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Abstract

Magnetoresistance measurements in magnetic fileds up to 21 kOe have been made on Mg-Mn, Mg-Cd, Mg-Al, Al-Mn, and Al-Fe alloys in the temperature region of liquid helium. Magnesium alloys containing more than 0.1–at.%Mn which exhibit a resistance maximum and minimum in zero filed, show a negative magnetoresistance, whereas the more dilute samples (0.001–0.1 at.%Mn) show a positive magnetoresistance, the magnitude of which decreases with decreasing temperature. The magnesium alloys containing non-transition element impurities, as well as the aluminum alloys containing transition metal impurities, are found to obey Kohler's rule. From an analysis of these data it is found that the magnetoresistivity of a dilute alloy of magnesium containing manganese, can be considered as the sum of a normal positive magnetoresistivity (obeying Kohler's rule) and an anomalous term which is negative in sign, does not obey Kohler's rule and is presumably due to a magnetic scattering of the conduction electrons. Using values of thes *s-d* exchange integral and the Coulomb scattering integral derived from an analysis of the zero-field resistivity permits an explanation of the magnetoresistivity based on Kasuya's theory, at temperatures near the Néel point.

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