Hole density of (Ga,Mn)As across its Curie temperature studied via pulsed high magnetic field

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(Ga,Mn)As is the most widely studied III-V ferromagnetic semiconductor, and its ferromagnism comes from the p-d exchange interaction between manganese magnetic ions and holes.The hole concentration is conventionally determined via Hall measurement at extremely low temperature and high magnetic fields.In order to further clarify the origin of magnetism in ferromagnetic semiconductors, we carried out Hall measurements of (Ga,Mn)As samples at various temperatures (below, at and above the Curie temperature T_C) in a pulsed high magnetic field (up to 40T).
Magnetoresistance and Hall resistance measurements were performed simultaneously on (Ga,Mn)As samples.With the Hall resistivity given by$R_{xy} = R^o_{xy} + R^a_{xy} = \frac{B}{ped} + M\frac{R_a(R_{xx})}{d}$,we fit the anomalous Hall resistance R^a_{xy} on the assumption that the magnetization M follows the Brillouin function and $R_a = \alpha R^n_{xx}$.Subtract R^a_{xy} from the Hall resistance R_{xy} and we obtain the ordinary Hall resistanceR^o_{xy},from which the carriers concentration can be further determined.The hole density measured in this way is almost in accordance with that determined by the conventional method at low temperature.Initial results suggest that the hole density in (Ga,Mn) determined across it Curie temperature at pulsed high magnetic field might allow for a further clarification of the origin of magnetism in ferromagnetic semiconductors.