Anomalous Hall Effect in $Ge_{1-x-y}Pb_xMn_yTe$ Composite System

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GeTe-based semimagnetic semiconductors are a subject of intensive research in the recent years due to the occurrence of the carrier mediated ferromagnetism with Curie temperatures T_C up to 190 K [1].

The aim of this study was to investigate the structural, electrical and magnetotransport properties of bulk $Ge_{1-x-y}Pb_xMn_yTe$ crystals with average chemical content varying in the range of $0.155 < x < 0.311$ and $0.019 < y < 0.136$. XRD and SEM characterization showed that all the samples are composites consisting of GeMnTe and PbMnTe phases.

Two magnetic phase transitions were found in the studied system, the first at T < 20 K and the second around 90 K. The high temperature magnetic transition was identified as a freezing of magnetic moments. Even in the spin-glass-like state well-defined hysteresis loops were observed. All studied crystals were p-type semiconductors with high carrier concentrations, $n > 10^{19}$ cm^{-3}. The magnetotransport measurements done below the higher transition temperature, 90 K, showed negative magnetoresistance and a pronounced hysteretic anomalous Hall effect (AHE). Detailed AHE analyzes were performed in order to explain the physical mechanisms responsible for the observed magnetotransport phenomena.

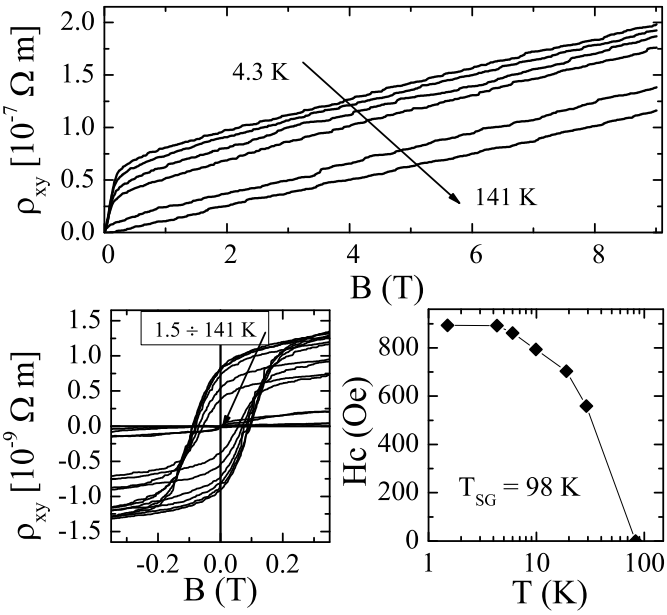

Figure 1: Anomalous Hall effect obtained for $Ge_{0.743}Pb_{0.183}Mn_{0.074}Te$ crystal.

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