Magnetoresistances and Hall effects of $Ge_{1-x}V_x$ and $Ge_{1-x}Co_x$

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In general, substituting transition metals into semiconductor modifies crystal and electronic structures of host semiconductor, generating unique magnetic and electric properties. It was reported that Mn-doped Ge had ferromagnetic ordering.[1] In this presentation, we will report on the unique transport properties of Co and V-doped Ge. We have grown $Ge_{1-x}V_x$ and $Ge_{1-x}Co_x$ single crystals using the vertical temperature gradient solidification method. The XRD patterns of the Ge, $Ge_{1-x}V_x$ and $Ge_{1-x}Co_x$ showed the diamond crystal structures without detectable secondary phases. We measured transport properties such as resistivity, Hall effect and magnetoresistance(MR) using the PPMS (Quantum Design, Inc). As shown in Fig. 1(a), electrical resistivities were rapidly increased with decreasing temperatures below 50 K and the resistivity variations of $Ge_{1-x}V_x$ and $Ge_{1-x}Co_x$ were larger than that of pure Ge. MR of $Ge_{1-x}V_x$ and $Ge_{1-x}Co_x$ are three and two times larger than that of the pure Ge at 77 K in 5T magnetic fields, respectively. The carrier mobilities were decreased with decreasing temperature below 70 K because of the increased ionic scattering between charge carriers and ionised impurities.

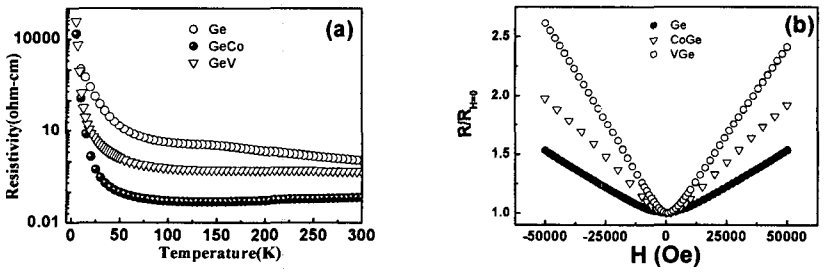

Fig.1. (a) Temperature dependent of resistivity and (b) magnetic field dependent of resistance at 77 K of Ge, $Ge_{1-x}Co_x$ and $Ge_{1-x}V_x$

References

[1] Sunglae Cho *et al.*, Phys. Rev. B **66**, 033303 (2002).