

**Mn을 치환한  $\text{Bi}_2\text{Se}_3$ 와  $\text{Sb}_2\text{Se}_3$ 의 자성과 수송특성연구**  
**(Magnetic and Transport Properties of Mn-doped  $\text{Bi}_2\text{Se}_3$  and  $\text{Sb}_2\text{Se}_3$ )**

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Currently diluted magnetic semiconductors (DMSs), which are prepared by substituting transition metals into nonmagnetic semiconductors, have attracted the worldwide scientific interests because of their unique electronic and magnetic properties. Group  $\text{V}_2\text{-VI}_3$  compounds are known as good materials for room-temperature thermoelectric and thermomagnetic refrigeration and power generation. It was reported that Fe-doped  $\text{Bi}_2\text{Te}_3$  and V-doped  $\text{Sb}_2\text{Te}_3$  had ferromagnetic (FM) ordering at 12 and 22 K, respectively.<sup>1,2</sup> Also, we observed that Mn-doped  $\text{Bi}_2\text{Te}_3$  and  $\text{Sb}_2\text{Te}_3$  had ferromagnetic ordering at  $T_c = 10$  and 17 K, respectively.<sup>3</sup>

In this talk we will report on the single crystal growth, thermoelectric, and magnetic properties of Mn-doped  $\text{Bi}_2\text{Se}_3$  and  $\text{Sb}_2\text{Se}_3$  single crystals prepared by the temperature gradient solidification method. The composition and crystal structure were determined using electron probe micro analysis (EPMA) and powder X-ray diffraction (XRD) studies. The lattice constants of several percent Mn-doped  $\text{Bi}_2\text{Se}_3$  and  $\text{Sb}_2\text{Se}_3$  were slightly smaller than those of the un-doped sample due to the smaller Mn atomic radius (1.40 Å) than those of Bi (1.60 Å) and Sb (1.45 Å). Mn-doped  $\text{Bi}_2\text{Se}_3$  and  $\text{Sb}_2\text{Se}_3$  showed spin-glass and paramagnetic properties, respectively. Transport properties such as electrical resistivities, mobilities and thermopower will be discussed.

<sup>1</sup>V.A. Kulbachinskii, A. Yu. Kaminskii, K. Kindo, Y. Marumi, K. Suga, P. Lostak, P. Svanda, *Physica B* **311**, 292 (2002)

<sup>2</sup>J.S. Dyck, P. Hájek, P. Lošťák, and C. Uher, *Phys. Rev. B* **65**, 115212 (2002)

<sup>3</sup>J. Choi, S. Choi, J. Choi, Y. Park, H. M. Park, H. W. Lee, B. C. Woo, and S. Cho, *phys[1]. stat. sol.(b)* **241**, 1541 (2004)

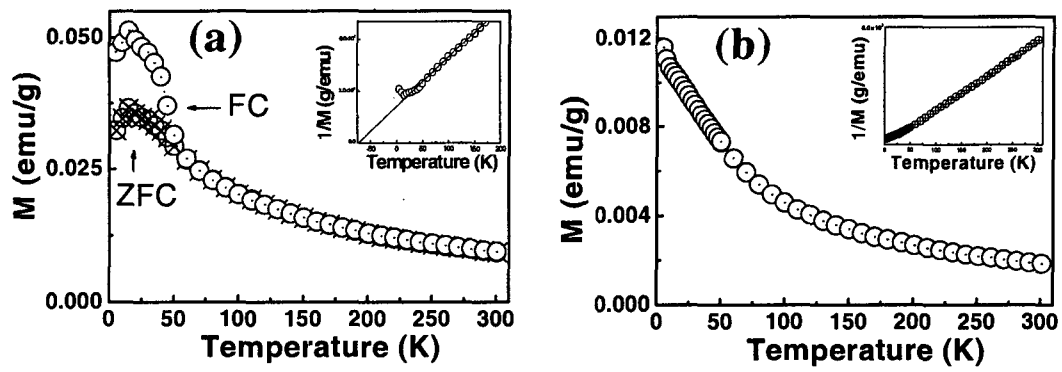


Figure 1. Temperature dependent magnetization of (a) Mn-doped  $\text{Bi}_2\text{Se}_3$  and (b) Mn-doped  $\text{Sb}_2\text{Se}_3$  single crystals.