

MnP 박막의 에피성장과 자기적 특성 및 전기적 특성연구
(Epitaxial MnP thin films: epitaxial growth, magnetic and electrical properties)

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For the past many decades, MnP has been widely studied because of its unique magnetic properties. It is known that a single crystalline of MnP has antiferromagnetic (AFM) and ferromagnetic (FM) ordering below $T_N=47$ K and $T_C=291.5$ K, respectively.[1] Also, it has a strong magnetic anisotropy. The crystal structure of MnP is an orthorhombic with the lattice constants $a=5.916$ Å, $b=5.260$ Å, and $c=3.173$ Å which is distorted from the NiAs-type structure.[2] We have grown the epitaxial MnP thin films using solid-source MBE (molecular beam epitaxy). The base pressure of growth chamber was an order of 10^{-10} Torr. The growth temperature of MnP was 500 Å and the growth rate of Mn was 0.25 Å/s under phosphorus ambience. We have grown 500 Å MnP on un-doped GaAs(100) substrate. In order to characterize the crystal structure of MnP, we performed in-situ RHEED (reflection high energy electron diffraction) and θ - 2θ XRD (X-ray diffraction) studies. From the measurements of SQUID (superconducting quantum interference device, Quantum Design), MnP thin film shows FM ordering at around 291.5 K. We have observed a slight magnetic properties change below 100 K in M-T and M-H data, however, which is different from the reported 0 K AFM data. We have observed a metallic resistivity with negative magnetoresistance in MnP thin film using by PPMS (physical property measurement system, Quantum Design).

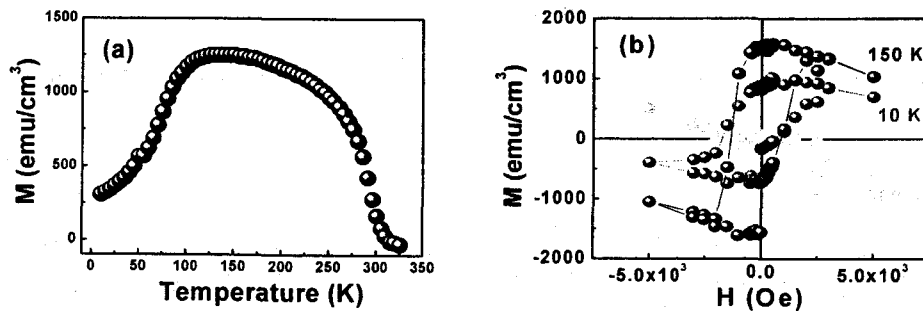


Figure 1. (a) Magnetization (M) as a function of temperature(T) in 500 Oe and (b) M-H (magnetic field) curves at 10, 150 and 300 K.

[1] T. Komatsubara, T. Suzuki, and E. Hirahara, J. Appl. Phys. **40**, 1037 (1969)

[2] J. Okabayashi, K. Tanaka, M. Hashimoto, A. Fujimori, K. Ono, M. Okusawa, and T. Komatsubara, Phys. Rev. B. **69**, 132411 (2004)