

MnGe(As,P)₂ and FeMn thin films: MBE growth and unique magnetic properties

Sunglae Cho

Department of Physics, University of Ulsan, Ulsan 680-749

We have grown ferromagnetic semiconductors, MnGe(As,P)₂, on GaAs(100) substrate using molecular beam epitaxy (MBE). The crystal structure is chalcopyrites, which are “genealogically” related to the more familiar tetrahedrally-coordinated zinc-blende materials. They exhibited ferromagnetism with $T_C = 300\text{K}$ and a magnetic moment per Mn at 5K of $> 2.58 \mu_B$. In this talk we will present the structural and magnetic properties in of MnGe(As,P)₂ thin films.

It has been well known that Fe_{1-x}Mn_x alloys have three different crystal structures of γ , α , and ϵ . The ϵ -Fe_{1-x}Mn_x phase is hexagonal. The α -Fe_{1-x}Mn_x ($x \leq 0.2$) has bcc crystal structure with the lattice constants of $a = 2.87 \sim 2.90 \text{ \AA}$ and is ferromagnetic material with $T_C > 300 \text{ K}$. The fcc γ -Fe_{1-x}Mn_x ($0.1 \leq x \leq 0.6$) with $a = 3.61 \sim 3$ has antiferromagnetic ordering at $T_N = 540 \text{ K}$, which is used as pinning layer in various spin devices. Here we report on the structural and magnetic properties of Fe_{1-x}Mn_x thin films grown on GaAs(100) substrate. The crystal structure of epitaxial Fe₅₀Mn₅₀ is similar to that of α -Mn. Interestingly, they show ferrimagnetic ordering below 750 K. The magnetic moment per Fe atom is over $3 \mu_B$.