TT-P019

MBE growth of ferromagnetically ordered Mn film on GaAs substrate

Younghun Hwang, Jeongyong Choi, Sunglae Cho*

Department of Physics, University of Ulsan

We report that the thermal strain due to the thermal expansion difference between a Mn film and a semiconductor substrate is strong enough to overcome the thermal energy for a paramagnetic (PM) state and also to break antiferromagnetic (AF) magnetic symmetry, inducing ferromagnetic (FM) ordering at high temperatures. An Mn film on GaAs (100) showed FM ordering up to 9000 Å with a (T_C) of over 750 K, and a net magnetic moment of 0.33 μ_B/Mn, instead of AF (T_N=95 K) and PM orderings in bulk. We expect similar phenomena in other Mn based AF alloys such as FeMn, NiMn, IrMn, PtMn, and RhMn. We also predict that epitaxial Mn clusters on a GaAs matrix in a GaMnAs diluted magnetic semiconductor or GaAs/Mn digital alloys, typically grown at 250℃, might show FM ordering above room temperature with the same reason.

TT-P020

Eptatial Relationship for the Fe/MgO/InXGa1-XAs Heterostructure.

Kyung Ho Kim, Hyung Jun Kim*, Il Jea Shin, and Suk Hee Han

Center for Spintronics Research, KIST

Thin MgO layer inserted between ferromagnetic metal and semiconductor is important challenge for the semiconductor spintronics application because efficient spin injections can be achieved by spin dependent tunneling barrier. We in-situ grew Fe(8 nm)/MgO(3 nm) layers on (2X4) reconstructed GaAs, $In_{53}Ga_{47}As$, and InAs by molecular beam epitaxy. Crystal structure has been investigated by cross-sectional high resolution transmission electron microscopy (HRTEM). From the TEM analysis, we determinded that Fe and MgO films grew on $In_XGa_{1-X}As$ substrates with crystallographic relationship of Fe(001)[110] // MgO(001)[100] // $In_XGa_{1-X}As$ (001)[100] in spite of large lattice mismatch between MgO and $In_XGa_{1-X}As$ about 25~30 %. And we observed morphologies of Fe change from 2 dimensional to 3 dimensional layer when lattice mismatches of MgO-$In_XGa_{1-X}As$ are increased. This means interface strain at the MgO layer affects growth of Fe layers.

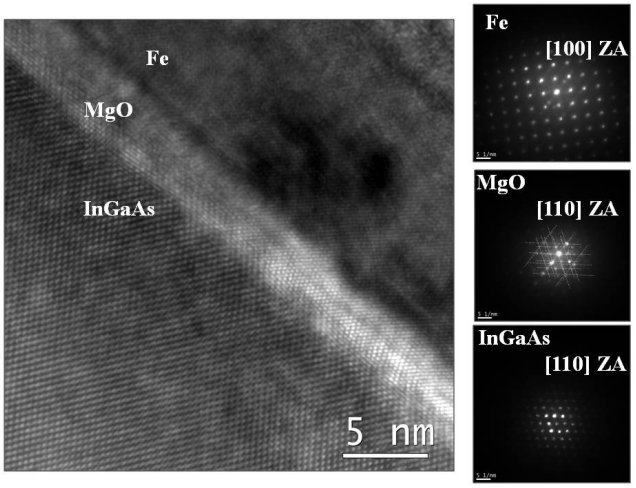

Fig. 1 A cross-sectional HR-TEM image of the Fe / MgO / In53Ga47As heterostructure and electron diffraction patterns.

* Correspondence E-mail : mbeqd@kist.re.kr