S-2

Ferromagnetism and Magnetotransport of GaMnN

K.H.Kim[1], K.J.Lee[1], D.J.Kim[1], C.S. Kim[2], C.G. Kim[3], S.H.Yoo[3], H.C.Lee[4], H.J.Kim[1], and Y.E. Ihm[1]

[1]*Department of Materials Engineering, Chungnam National University, Taejon, 305-764, Korea*

[2] *Korea Research Institute of Standard and Science, Taejon, 305-606 Korea*

[3]*Korea Research Institute of Chemical Technology, Taejon, 305-600, Korea*

[4]*Korea Basic Science Institute, Taejon, 305-333, Korea*

III-V magnetic semiconductors initiated by GaMnAs growth at low temperatures via molecular beam epitaxy (MBE) has been a hot issue recently for their possible application to spntronics. GaMnN may be one of the candidates for room temperature operating ferromagnetic semiconductors as proposed by a theoretical calculation. However, since GaN was grown at very high temperatures above ~750 °C even with MBE, it is expected that the incorporation of Mn into GaN will be limited.

We report a successful growth of GaMnN thin films on GaAs(100) and sapphire(0001) substrates at lower temperatures using a new single GaN precursor of a solid type $Et_2Ga(N_3)NH_2CH_3$. The substrate temperature was varied in the range of 450 ~ 650 °C. The growth pressures was varied in $1x10^{-7}$ ~ $1x10^{-6}$ torr. The growth surface was monitored in-situ by the reflection high-energy electron diffraction. Average RMS surface roughness measured by atomic force microscope was about 4nm.

GaMnN layers were grown with varying Mn flux. Structural properties of the layers were examined by x-ray diffraction, double crystal x-ray diffraction, and tunneling electron microscope. Magnetic properties of GaMnN were investigated by superconducting quantum interference device (SQUID) and Hall effect measurement.

We report the XRD measurement results for GaMnN layers grown with varying the Mn flux

and discuss the second phase segregation issues. The magnetization and magnetic transport properties in the layers with and without second phases are discussed. For the layer showing no second phase peaks in XRD, the magnetization versus magnetic field (M-H) curves at 300K showed a clear magnetic hysteresis loop. While this strongly indicates the ferromagnetic nature of the GaMnN film, no magnetoresistance property was confirmed. We also discuss the electro-magnetic transport measured by Hall measurement.