MBE Growth and Investigate Optical Properties of Mg-Doped GaAs Epitaxial Layer

Hyun Young Choi¹, Su Min Jeon¹, Min Young Cho¹, Ghun Sik Kim¹, Do Yeob Kim¹, Min Su Kim¹, Dong Kyun Jeong¹, Byeong Guk Choi¹, Jin Soo Kim², Jong Su Kim³, Jeong-Sik Son⁴, Gi-Seog Eom⁵, Jae-Young Leem¹*

¹Department of Nano Systems Engineering, Inje University
²Division of Advanced Materials Engineering, Chonbuk National University
³Department of Physics, Yeungnam University
⁴Department of Visual Optics, Kyungwoon University
⁵Division of General Education, Uiduk University

To investigate the optical properties of Mg doped GaAs grown by molecular beam epitaxy (MBE) with various growth temperatures, photoluminescence (PL) measurements were carried out. As changing the growth temperature, the carrier concentration are changed from $6.6 \times 10^{16}$ to $1.5 \times 10^{18}$ cm$^{-3}$. In sample which carrier concentration is $2.3 \times 10^{17}$ cm$^{-3}$, we observe four dominant PL emissions emitted from free-to bound transitions (e-A), exciton bound to neutral acceptor (A$^0$X), and two kinds of acceptor associated emission (g, g-g). Temperature dependence of PL measurements were carried out from 45 to 160 K to study the each peak behavior with changing temperature. The A$^0$X peak position follows GaAs Varshni model with increasing temperature. In g and A$^0$X peaks, an increase in the PL intensity with the increase of temperature is observed in the temperature range from 45 to 50 K and this phenomenon is known as “negative thermal quenching (NTQ)”. The NTQ in g peak is observed.