T-P19

Optical studies of Transition Metal (Mn and Fe) doped ZnO bulk crystals

Y. H. Shin[1], Y. H. Park[1], S. J. Noh[1], H. S. Kim[1], Yongmin Kim[1]*, Y. K. Lee[2], K. S. An[2]

[1]Department of Applied Physics, Dankook University, Seoul 140-714, Korea.
[2]Department of Thin Film Materials Laboratory, Korea Research Institute of Chemical Technology, 100 Jang-Dong, Yuseong-gu, Daejeon, 305-600. Korea.

Transition metal doped wide-gap semiconductors such as GaN or ZnO are of prominent candidate for future spintronics applications. In this study, we report optical properties of ZnO:Mn and ZnO:Fe bulk crystals by photoluminescence measurements and Raman scattering spectra. First, we recorded PL spectra as a function of temperature (5.0 K ~ 300 K). At high temperature above 60 K, free-carrier like transition dominates whereas bound exciton transitions dominate at low temperature. We calculated activation energy (E_a) of ZnO:Fe and ZnO:Fe bulk crystals by Arrhenius function. The activation energy of $D^oX(1)$ and $D^oX(2)$ for ZnO:Mn bulk crystal is 10.67 meV and 15.64 meV respectively, in comparison to the relatively small activation energy of D^oX for ZnO:Mn bulk crystal (6.6 meV). Observed Raman spectra of $Zn_{1-x}T_xO$ (T=Mn, Fe) single crystals are similar to difference references. In the measured Raman spectra, conventionally well known A1 and E2 related peaks appear. We will discuss detailed temperature-dependence of photoluminescence transitions and room temperature Raman spectra of different transition metal doped samples. This work was supported by Seoul Development Institute(SDI) as a project of 'Cluster for Advanced Information Display with enhanced Human Sensibility Ergonomics'(2005)