ZnS_xSe_{1-x} 에피층의 엑시톤 동력학 연구

Dynamics of exciton luminescence from epitaxial ZnS_xSe_{1-x}

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We have reported the steady-state and time-resolved PL studies of the ZnS_xSe_{1-x} epilayers on GaAs substrate grown by molecular beam epitaxy with various sulfur compositions around the lattice matching composition ($0 < x < 0.12$). We have investigated the PL decay dynamics of ZnS_xSe_{1-x} epilayers, and found that the decay time of the ZnS_xSe_{1-x} epilayer with sulfur composition closely lattice-matched with the substrate is longer than that of any other lattice-mismatched one. This is interpreted as indicating that the crystalline defects induced by lattice mismatch with the substrate mainly act as nonradiative recombination centers and consequently reduce the PL lifetimes of the epilayers. These studies suggest that the lattice mismatch has a strong correlation with PL lifetimes of the ZnS_xSe_{1-x} epilayers.

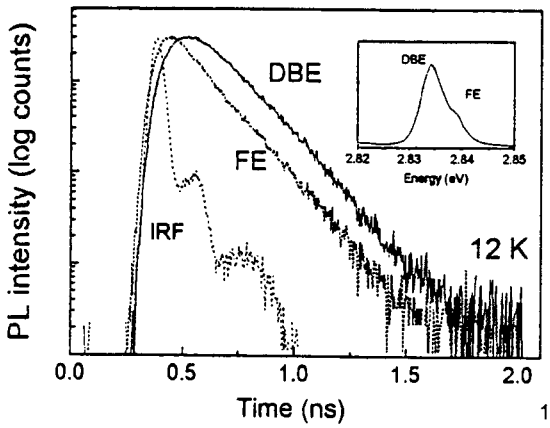

Fig. 1. PL decay profiles for DBE and FE emissions observed in the ZnS_xSe_{1-x} epilayers (x = 0.062) at 12 K. These profiles consist of single exponential rise and decay. Risetimes are around 90 ps, 30 ps and decay times are about 140 ps, 130 ps at DBE and FE emissions, respectively. IRF represents the instrumental response function. The inset shows the PL spectrum at 12 K. *(left)*

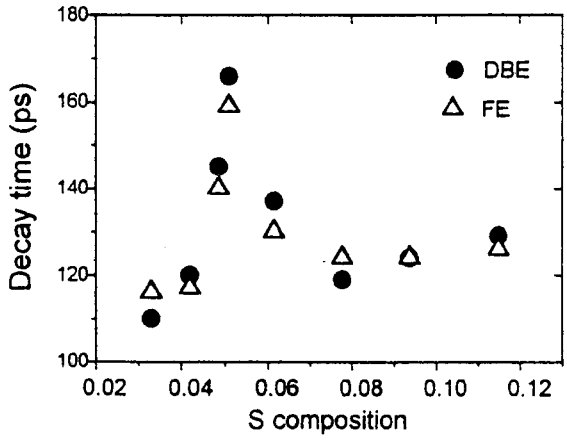

Fig. 2. Sulfur composition dependence of decay times for DBE and FE emissions in the ZnS_xSe_{1-x} epilayers on GaAs substrate at 12 K. *(right)*