Detection of NRR Centers in InGaAs/AlGaAs HEMTs: Two-Wavelength Excited Photoluminescence Studies

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The *pseudomorphic* (*p*-) InGaAs/AlGaAs high electron mobility transistors (HEMTs) provide superior saturation velocity and large quantum confinement of electrons than a lattice-matched GaAs/AlGaAs structure. As the presence of point defects in a crystal forms below-gap states which act as non-radiative recombination (NRR) centers and degrades the efficiency of the devices, quantitative characterization of these states and optimization of growth conditions for eliminating them are becoming important for further improvement of device performance.

In this work, a purely optical, non-contacting technique of two-wavelength excited photoluminescence (PL) has been applied for detecting NRR centers in a *p*-$In_{0.40}Ga_{0.60}As/Al_{0.24}Ga_{0.76}As$ HEMT grown by metal organic vapor phase epitaxy. Under an above-gap excitation (AGE) light of 1.37 eV, we have observed the PL intensity change according to a temporally chopped below-gap excitation (BGE) light of 0.80 eV. The AGE-density, BGE-density and the temperature dependence were examined and attributed to trap-filling effect of NRR centers, which can be utilized for the quantitative determination of NRR parameters.

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