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Polaron effect on absorption coefficient in $Al_xGa_{1-x}As$/ GaAs modulation doped single quantum well

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Abstract. The barriers of a single quantum well fabricated using $Al_{0.3}Ga_{0.7}As$/GaAs heterojunctions is doped by donors which get ionized at finite temperature. The ionized electrons flow into the well region which enhance the carrier density in the well. The strong electron-electron interaction gives rise to Hartree and exchange-correlation potential due to many-body effects. The effective mass equation including confining potential, the Hartree potential and the exchange-correlation potential are solved iteratively using the Fourier series method for different dopant densities. The energies and envelope functions are perturbed by the electron-phonon interaction in the Frohlich form. The calculated dipole matrix elements and the relaxation rates are used to calculate absorption coefficients. The absorption coefficients are enhanced by the increased dipole matrix elements due to electron-phonon interaction. The absorption coefficients are also enhanced when the strength of doping is increased.

Keywords: Quantum well, electron-phonon interaction

[Full Paper]