Exciton Determination of Strain Parameters in InSb/$Al_xIn_{1-x}Sb$ Quantum Wells.

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A major obstacle in growing thin films of one semiconductor on another is the lattice mismatch between materials. The lattice parameter mismatch between epilayer and substrate introduces strain. Since the epilayer is typically much thinner than the substrate, the strain can be accommodated elastically. Such strained layers offer advantages in semiconductor devices as well as interesting new physics. The strain can have strong effects on the electrical and optical properties of the epilayer.

We studied strain-related material parameters in the strained and nonparabolic InSb /AlInSb quantum well system. The strain present in the InSb wells alters the spectrum from that for unstrained systems by introducing a shift in both the heavy and light hole band gaps. With a change of Al concentration in the barrier layers, the strain in the quantum well system can be tuned continuously. Using optical techniques, we were able to trace the strain-induced shifts of the exciton energies. The different strain dependence of the light-and heavy-hole band edges allows us to determine deformation potential parameters. Our samples were nominally undoped InSb/AlInSb quantum wells, with Al concentration ranging from 5 to 15% were grown by molecular beam epitaxy (MBE) on GaAs substrates. We use Fourier transform infrared (FTIR) spectroscopy to probe the excitonic states in the quantum well.