

ZnTe-ZnSe Strained-layer Superlattices

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ZnTe-ZnSe strained-layer superlattices have been fabricated on GaAs (001) substrates by hot wall epitaxy. This superlattice system with a large lattice mismatch (7 %) is of much interest because of its direct and wide band gap, type-II band structure, and the possibility to obtain bipolar conductivity through modulation doping.

The results of RHEED show that high-quality ZnTe and ZnSe films have been grown on GaAs. Low- and high-angle [004] x-ray diffraction has been performed and sharp satellite peaks due to the superlattice periodicity were observed. This periodicity was also confirmed by the diffraction patterns and lattice images in TEM analysis, together with the zone-folding effects of Raman scattering. [440] x-ray diffraction was proposed to study the lattice strain, giving results that coincide with those of TEM and Raman scattering. The critical thickness of coherent growth in ZnTe-ZnSe superlattices is estimated to be about 10Å.

Interband exciton emissions of the superlattices have been observed for the first time, indicating accurate period and smooth interfaces. Separately confined electrons and holes make such observation difficult in type-II superlattices. Effective band gap of the superlattices has been also clarified by transmission spectra, which were obtained successfully through partial removal of the GaAs substrates, using a chemical etching technique. Pico-second spectroscopy was carried out to examine the band structure. Valence band discontinuity in the superlattices, which is the key point of band calculation, is determined to be around 0.50eV.

P-type dopants, such as Sb, As, Li and P were added to the ZnTe films and ZnTe-ZnSe superlattices. Hall effect measurements show that the carrier concentrations $p = 5 \times 10^{15} \text{ cm}^{-3}$ (mobility : $80 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$) have been obtained in Li, P co-doped samples.