

# Growth and characterisation of InSb Films on GaAs

## Substrate grown using molecular beam epitaxy

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### Abstract

InSb thin films were grown using molecular beam epitaxy, characterized by using SEM, TEM and XRD measurements. These results indicate that the InSb buffer layer grown at low temperature plays an important role in the growth of InSb films on GaAs substrates.

Epitaxial InSb thin films on GaAs substrates are studied with low temperature (LT) InSb buffer layers having different thicknesses. The LT InSb buffer layers are critical to improve the quality of the InSb epitaxial films, and reduce the threading dislocation density therein. The LT InSb buffer layers are adapted to improve the quality of InSb thin films under appropriate growth conditions. Using transmission electron microscopy (TEM), we confirmed attenuation of threading dislocations by the buffer layer. Surface roughness was analyzed by Scanning electron microscopy (SEM). Furthermore, strain relaxation and mosaicity were investigated by X-ray diffraction (XRD) measurements. The measurements indicated that the lattice mismatch between InSb and GaAs generated the formation of plane defects in the InSb epilayer near the InSb/GaAs heterointerface. Structural properties of the InSb/GaAs heterostructures were strongly affected by the growth temperature.

These results indicate that the InSb buffer layer grown at low temperature, by eliminating the defects due to the lattice mismatch, plays an important role in the growth of InSb films on GaAs substrates. The films grown were n type and the highest electron mobility obtained was  $5.7E+4 \text{ cm}^2\text{v}^{-1}\text{s}^{-1}$  at room temperature.

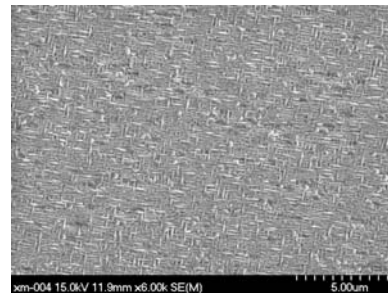


Fig.1 Surface morphology of InSb films grown on GaAs substrate at 420 °C

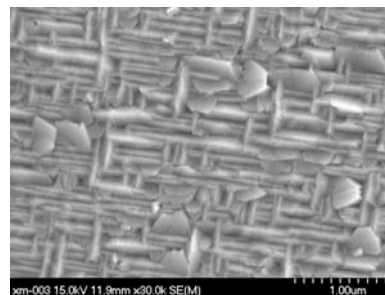


Fig.2 Surface morphology of InSb films grown on GaAs substrate at 430 °C

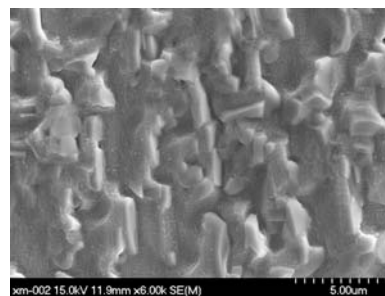


Fig.3 Surface morphology of InSb films grown on GaAs substrate at 440 °C

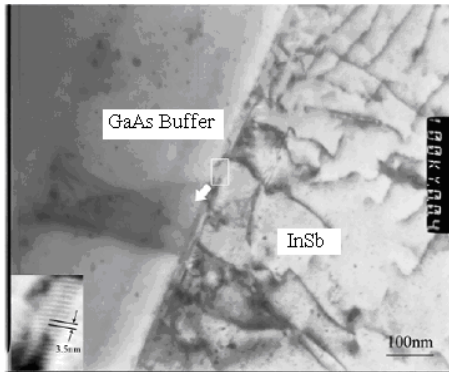


Fig.4 TEM image of the InSb/GaAs heterostructure grown on GaAs substrate at 420°C

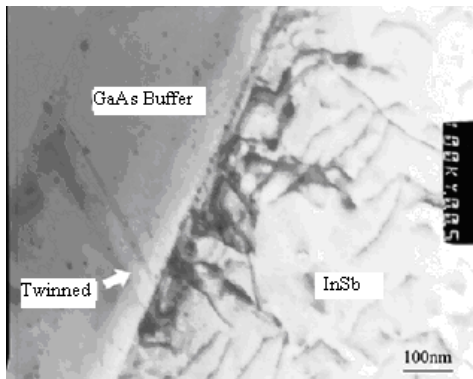


Fig.5 TEM image of the InSb/GaAs heterostructure grown on GaAs substrate at 440°C