



	<b>Experiment title:</b> Interface structures in GaSb/InAs superlattices	<b>Experiment number:</b> SI629
<b>Beamline:</b> ID32	<b>Date of experiment:</b> from: 06-sept-00                      to: 15-sept-00	<b>Date of report:</b> 28-feb-01
<b>Shifts:</b> 12	<b>Local contact(s):</b> Tian-Lin LEE	<i>Received at ESRF:</i>
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Report:

Two samples were prepared by Dr AD Johnson (DERA, Malvern), each containing a single, epitaxial GaSb/InAs interface. Careful timing of the vapour source shutters was used to influence the atomic structure of the interface. Each sample was grown on a GaSb(001) substrate. In each case a 5000 Å capping layer was grown to improve the crystal quality

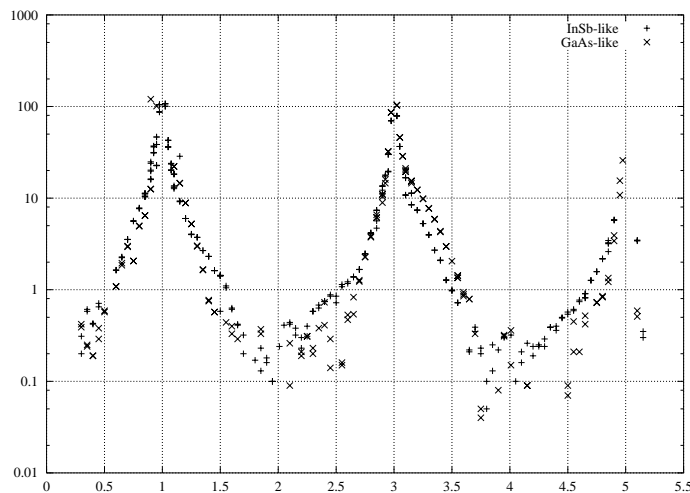
**Sample 1** The heterojunction was made *GaAs*-like by depositing 1 monolayer Ga onto GaSb then soaking with As before opening the In shutter for 3 monolayers.

**Sample 2** The heterojunction was made *InSb*-like by soaking GaSb with Sb then depositing 1 monolayer of In before opening the As shutter. A total of 3 monolayers of InAs was grown.

The samples were grown approximately one week before being mounted on the ID32 diffractometer and measured in air. The samples are believed to be resistant to oxidation on this timescale.

The aim of the experiment was to determine the atomic structures of the two interfaces and to relate the differences in structure to the observed improvement in device performance when GaSb/InAs superlattices are grown with InSb-like interfaces.

In order to determine the structure of the interfaces a total of four crystal truncation rods (Bragg rods) were measured from each sample. Simulations based on expected differences between the two structures indicated that the (0,1), (1,0), (1,1) and (2,0) rods show distinct features and that all other rods are similar to one of these four. (All rods are indexed in the LEED/surface unit cell in which  $a_1 = a_2 = \sqrt{2}a_0$ .)



**Figure 1**

Figure 1 is a comparison of a typical rod, the (0,1) rod, from the two samples. The rods all exhibit small, but significant, differences related to the structural differences between the two interfaces. In particular, the shoulder of the Bragg peaks is consistently more asymmetric for the GaAs-like interface.

The data were difficult to measure due to a high background signal. This was probably caused by air scattering and by some degradation of the wafer surface. Nevertheless reasonable data sets were obtained.

Initial analysis suggests that

- The structures of the two interfaces are substantially similar. The differences relate to different bond lengths at the interface itself rather than a completely different structure.
- There is significant roughness of the surface.

Analysis is underway to determine the structures and the precise differences that account for the different opt-electronic properties.