METAL CONTACTS ON SEMICONDUCTORS

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After some preliminary measurements of the transport properties of GaAs Schottky diodes, fabricated on air-cleaved and chemically etched surfaces, it became obvious that the basic assumptions underlying the 'standard' methods for analysing I-V and C-V curves required some detailed re-examination. Measurements of the Schottky barrier height using the conventional I-V and C-V techniques, ($\phi_{SB}$)$_{IV}$ and ($\phi_{SB}$)$_{CV}$ respectively, often give different results. It has been found that if the I-V curves are analysed using models that are based upon thermionic emission over the barrier alone and ignore the effect of the parallel conduction path through localised states in the depletion region then the Schottky barrier height is overestimated. By correctly taking into account the effects of recombination and trapping of majority carriers at localised states that have energies within the band gap of the semiconductor a more accurate value for $\phi_{SB}$ is obtained. A large body of I-V curves taken from CdTe Schottky diodes, measured by I M Dharmadasa, has been reanalysed and it had been found that the agreement between ($\phi_{SB}$)$_{IV}$ and ($\phi_{SB}$)$_{CV}$ is considerably better. This has allowed us to be more confident and state with a higher precision the value of $\phi_{SB}$ for a range of diodes.

However to fully test our approach we hope to look at diodes fabricated on UHV cleaved GaAs surfaces. In addition it is hoped to extend this work by using the photoresponse technique for measuring $\phi_{SB}$.

In addition to the macroscopic transport measurements the microscopic aspects of Schottky barrier formation of clean cleaved GaAs (110) surfaces using Al, Mn and Ag have been examined using soft X-ray photoemission at the
synchrotron radiation source. Barrier formation on oxidised GaAs (110) surfaces has also been examined using Al and Ag. In the former case Al leads to significant surface changes in the surface oxide layer and significant Ga outdiffusion through the Al overlayer over considerable distances. The deposition of Al and Mn on GaAs has been studied for submonolayer coverages and is interesting in the light of the current theories of Schottky barrier formation.

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