AD-A193 673 METAL CONTACTS ON SEMICONDUCTORS(U) UNIVERSITY COLL CARDIFF (WALES) R H WILLIAMS 31 OCT 85 DAJA45-84-C-0028 1/1

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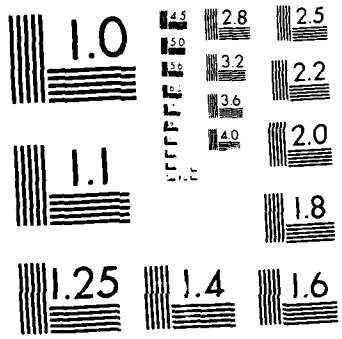
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METAL CONTACTS ON SEMICONDUCTORS

Principal Investigator: Professor R.H. Williams

Contractor: University College Cardiff

Contract Number; DAJA 45-84-C-0028

3rd Periodic Report: 1st May 1985 - 31st October 1985

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THIRD INTERIM REPORT - ALASTAIR McLEAN

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[1] 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 Φ_{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 Φ_{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 Φ_{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.

1 Rhoderick E H, Metal-Semiconductor Contacts, Clarendon Press, Oxford, 1978.

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