AD-A195 677 METAL CONTACTS ON SEMICONDUCTORS(U) UNIVERSITY COLL CARDIFF (WALES) R H WILLIAMS 31 OCT 86 DAJA45-84-C-0028 1/1

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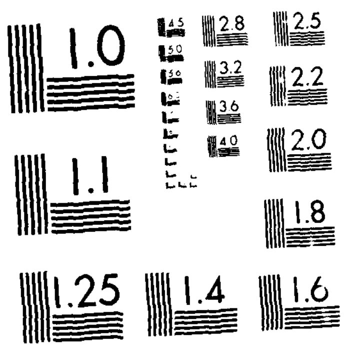
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1.25
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METAL CONTACTS ON SEMICONDUCTORS

Principal Investigator:	Professor R.H. Williams
Contractor:	University College, Cardiff
Contact No.	DAJA 45-84-C-0028
5th Periodic Report:	1st May 1986 - 31st October 1986

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FIFTH INTERIM REPORT

Dr Alistair McLean, the post-doctoral research assistant on the grant left the contract in October 1985. The contract was then re-scheduled and Mr D Zahn joined us from the University of Aachen, commencing duties as a research assistant on 1st March 1986. Mr Zahn has a strong background in the use of Raman spectroscopy to study metal-semiconductor interfaces. Excellent facilities for Raman spectroscopy are available in Cardiff and Mr Zahn will use these, together with our surface science techniques and conventional transport methods, to probe the physics of interfaces.

Substantial progress has been made on the programme during the past few months. We have studied the microscopic interactions for several selected metals with both clean and oxidised surfaces of GaAs and InP, and in a series of parallel studies we have established Schottky barrier heights by transport techniques. Data for metals on GaAs will be published shortly. Broadly speaking the data is in agreement with those published by others for metals on cleaved (110) GaAs surfaces but with important differences. One such is the case of Mn. This element strongly interacts with the clean GaAs surface and yields reproducible and well behaved Schottky barriers. Mn also leads to a strong reduction of the surface oxide but leads to barrier heights which display a large spread. The oxide layer thus has an influence and detailed aspects of this are now being considered. Improved models for determining barrier heights when recombination-generation currents are strong have also been developed.

Studies have also been carried out for several metals on InP cleaved surfaces. Some time ago we showed that some reactive metals, such as Ga, lead to high barriers on N-InP. This is in contrast to our earlier findings for three reactive metals. Recently the Stanford group have also found that Cr is an exception. We have carried out studie of Cr on InP and confirmed that it does indeed yield Schottky barrier heights larger than 0.4 eV. We have also studied the detailed interactions of Mn and V with InP surfaces. Photoemission show that these are highly reactive and both photoemission and I-V studies yield low barrier heights. Detailed analysis of this data is underway and will be published shortly.

A major problem in the study of metal-semiconductor interfaces is the inability of surface science techniques to probe buried interfaces. Thus it is difficult to monitor the formation of Schottky barriers in the intermediate range of metal coverages, between a few Å and a few hundred Å. Recently it has been shown that Raman spectroscopy is a powerful tool for this purpose and it is intended to use the technique to probe metal - GaAs and metal - InP interfaces further. An ultra high vacuum chamber is now being assembled so that Raman studies can be carried out on clean surfaces and on surfaces with controlled metal coverages. The chamber will also contain surface science techniques. Of particular interest will be the question of whether or not photoemission techniques, which are low coverage methods, measure the correct Schottky barrier heights.

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