AD-A172 422 HIGH AND LOW ENERGY PARTICLE BEAMS INTERACTIONS WITH SOLIDS(U) PENNSYLVANIA STATE UNIV UNIVERSITY PARK DEPT OF CHEMISTRY N WINOGRAD 1986 N00014-83-K-0052 1/1

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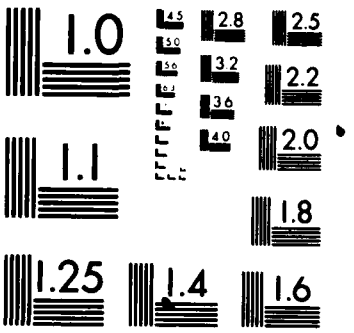

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OFFICE OF NAVAL RESEARCH

FINAL REPORT

for

"High and Low Energy Particle Beams Interactions with Solids"

Contract N00014-83-K-0052

Task No. NR SRO-152

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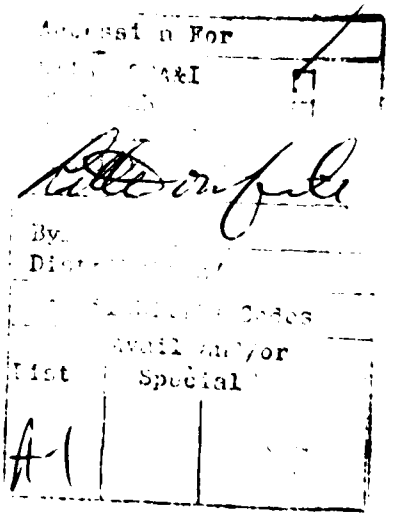
The major goal of our research has been to establish a center for the preparation and surface characterization of advanced materials related to the construction of high speed electronic devices. The focal point of the experimental side of our center has been a molecular beam epitaxial (MBE) growth facility directly attached to a sophisticated surface analysis system. The growth facility has been initially set-up to study the chemical aspects of interface formation during the fabrication of multi-layer systems. The analysis chamber incorporates a number of novel approaches to characterizing the chemistry of these interfaces with unprecedented detail. These include LEED, XPS, angle-resolved SIMS and He atom diffraction. On the theoretical side, our goal has been to establish extensive computational hardware and software for the modeling of the interaction of energetic particles with solids. This project has involved the development of interaction potentials which accurately predict forces between atoms in materials with directional bonding such as GaAs and Si.

At the conclusion of our project, we have been able to accomplish most of the above goals. The MBE facility is now operational and we are growing GaAs films of high quality. Both the theoretical program and advances in surface characterization techniques have proceeded rapidly as evidenced by the numberous technical reports. We have just begun experiments aimed to characterizing the formation of interfaces and Schottky barriers. In a recent study, for example, we have observed surface reconstructions on the As stabilized GaAs(001) surface during deposition of Al. These reconstructions suggest that the Al initially forms two dimensional

clusters along preferred azimuthal directions. Such unusual interface states will be of interest to probe further with our apparatus as the full power of the surface analytical chamber is brought on-line.

The specific research accomplishments are summarized in the list of noted technical reports.



Title of Project
"High and Low Energy Particle Beams Interactions with Solids"

NR-Number
NR SRO-152

Contract No.
N00014-83-K-0052

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Funding History
January 1, 1983 to December 31, 1983 - $378,550
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Thesis
Lisa A. DeLouise, Ph.D. Thesis, entitled, "A Multitechnique Characterization of the Reaction of Small Gass Molecules on Rhodium Single Crystal Surfaces" 1984.

Roger J. Bleiler, Ph.D. Thesis, entitled, "An Angle-Resolved Secondary Ion Mass Spectrometry Investigation of Adsorbate Structure on Single Crystal Metal Surfaces" 1984.

Fred M. Kimock, Ph.D. Thesis, entitled, "Solids Analysis Using Energetic Ion Bombardment and Multiphoton Resonance Ionization" 1985.

Mark Kaminsky, Ph.D. Thesis, entitled, "Investigation of the Reaction Intermediates and Catalyst Composition that are Relevant for CO Hydrogenation" 1985.

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Technical reports during entire granting period

The above listed reprints were each sent through as a technical report.

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