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 numerous 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
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Contract No.
NO0014-83-K-0052

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Funding History
January 1, 1983 to December 31, 1983 - $378,550
January 1, 1984 to December 31, 1984 - $370,370
January 1, 1985 to December 31, 1985 - $399,520

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Thesis
**Publications during entire granting period**


Doping Reaction of PH3 and B2H6 with Si(100), M. L. Yu, D. J. Vitkavage and B. S. Meyerson, *J. Appl. Phys.* 59 (1986). Partially supported by IBM.


Ion Beam Studies of Surfaces by Multiphoton Resonance Ionization of Sputtered Neutrals, N. Winograd, Symposium on Atomic and Surface Physics (SASP), Maria Alm, Austria, 1984, page 268.

Characterization of CO Binding Sites on Rh(111) and Rh(331) Surfaces by XPS and LEED: Comparison to EELS Results, L. A. DeLouise, E. White and N. Winograd, Surface Sci. 147, 252 (1984).


Ion Beam Techniques, N. Winograd, New Directions in Chemical Analysis, B. L. Shapiro, Ed., Texas A&M University Press, College Station, Texas, 1985, page 263.


Technical reports during entire granting period

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