

# 2000 Laboratory Report to SNEAP for the Surface Modification and Characterization Research Center at Oak Ridge National Laboratory

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## **Introduction:**

The Surface Modification and Characterization Research Center is a unique facility for the alteration and characterization of the near-surface properties of materials. It is operated by the Solid State Division at Oak Ridge National Laboratory and is available to scientists from university, industry, government, and other laboratories for basic and applied materials research. The facility is a User Facility with an average of about 92 users a year.

## **Facility:**

The Center features four ion accelerators, a 2.5 MV Van de Graaff, a 200 kV Extrion Implanter, a 500 kV Eaton Implanter, and a 1.7 MV Tandetron. They provide a wide range of implantation and ion scattering capabilities. These accelerators are integrated with computer-monitored beam lines, experimental chambers, and data acquisition electronics. Additional capabilities include annealing, thin-film evaporation, optical microscopy, and nanoindentation hardness. Surface analytical equipment, including Auger electron spectroscopy and low-energy electron diffraction is available on one experimental chamber.

## **Report:**

To improve performance and reduce downtime of the accelerators, a new lab wide vacuum system was designed and implemented in phases. This oil free system uses turbomolecular drag pumps with a mechanical scroll on the forelines and for roughing. All three systems have a ballast tank, a manifold for the foreline, and a controller that mediates between the rough and the foreline manifolds. The first phase was completed in December 1996 and was reported on at the last SNEAP meeting. It now has ~602 hours on the scroll pump timer. The second phase was completed in December 1997 and now has ~560 hours. A third phase, which isolates the tandem source area from the rest of the lab, was installed in October 1998, it now has ~1075 hours. The first year pump has lower hours because the ballast is larger. The scroll pump requires a rebuild after approximately 6000 hours. At ~500 hours of operation a year, it will be 12 years before a rebuild is needed. This past June the Tandem accelerator was upgraded with a solid state driver, replacing the RF tubes. O'Brien Scientific of Derry, New Hampshire (603-664-3530) installed this upgrade for about \$35 K. With the cost of labor and replacing the RF tubes the pay back will be in about 10 years. Also, no more terminal voltage sag nor down time to replace the tubes. No problems to report on the new installation. The Alphasource now has ~13050 hours, with no major problems to report. The SNICS source had no major problems to report.

One major upgrade was done on the Extrion this past year. A new optical telemetry system (Control Net, Group 3) was installed. Not all controls have been switched to the new system yet. One major problem occurred, the magnet waveguide developed a vacuum leak caused by the beam sputtering the chamber walls. Vacuum Technology Inc. (VTI) made a new magnet chamber for ~\$7000 which is a lot lower in price than the last chamber purchased. A temporary fix with a spot weld was implemented and is still in place.

The Van de Graaff operated some this past summer. Most users prefer to use the tandem accelerator to do material analysis. A new electron suppression tube from HVEE is ready to be installed in the near future.

The Eaton had one major upgrade, the installation of an automatic extraction aperture exchange for enhanced low energy operation.

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