Surface Science Lab (SSL) of JLab

Outline

♥: Brief introduction to our Surface Science Lab (SSL)

♥: Summary of some examples of the on-going surface related R&D activities at JLab that have been supported by the SSL in terms of using its equipment (one viewgraph)

Surface Science Lab (SSL)

Thomas Jefferson National Accelerator Facility

A.T. Wu, Proceedings of the 11th workshop on SRF, Germany, 2003, ThP13

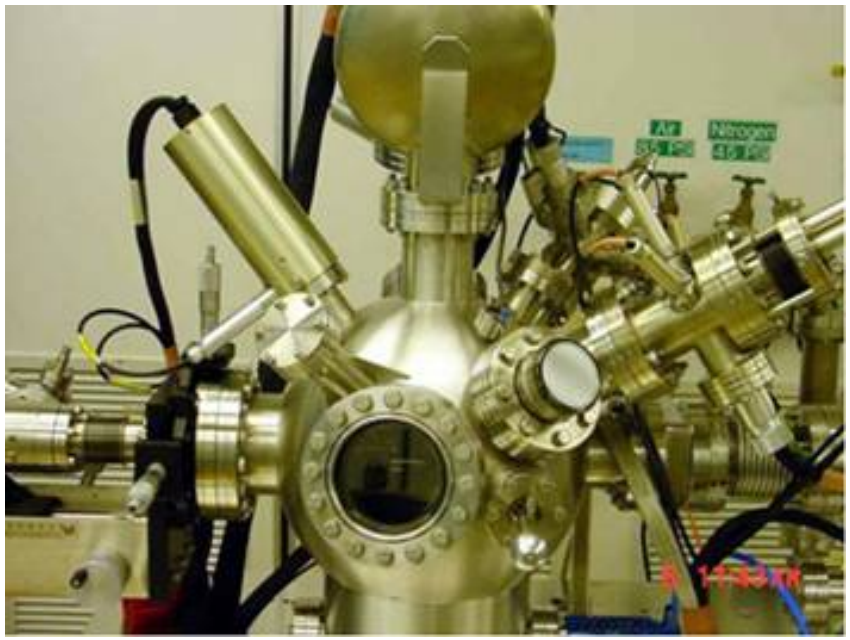
Available Instruments

- Scanning Auger Microscope
- Secondary Ion Mass Spectrometry
- Scanning electron microscope
- Energy dispersive X-ray analysis system
- Scanning field emission microscope
- Transmission electron microscope and scanning transmission electron microscope
- High precision three D profilometer
- Metallographic optical microscope

A fully equipped sample preparation room

Scanning Auger Microscope (SAM)

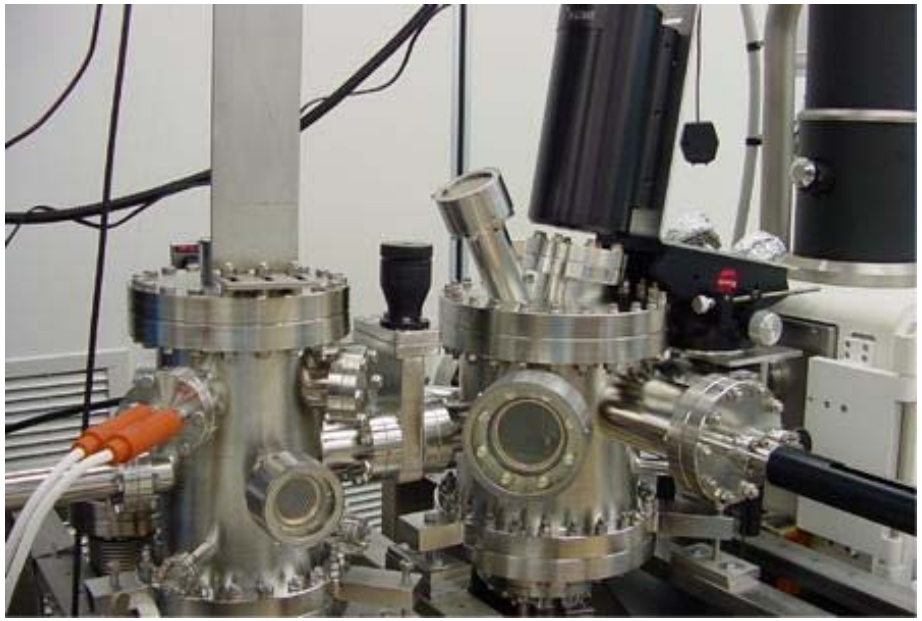
- Surface composition determination (0.3% accuracy except H and He).
- Depth profile
- Surface composition mapping
- In-situ heat treatment (35 k ~ 1000 oC)
- Scanning Electron Microscope
- Can be extended to include X-ray Photoelectron Spectroscope
- Surface work function



Multilabs

Scanning Field Emission Microscope (SFEM)

- Large scanning size d=25mm
- Spatial resolution 2.5 mm
- Routine operation electric field up to 140 MV/m
- In-situ heat treatment chamber
- Coupled with SEM and EDX



The only one available in USA

Secondary Ion Mass Spectrometry (SIMS)

- Surface composition analysis (ppm or ppb)
- Can detect all elements and their isotopes including hydrogen
- Depth profile

Transmission Electron Microscope (TEM) System

- Accelerating voltage 100 kV
- Magnification up to 800,000 X
- Point to point resolution 0.3 nm
- Lattice resolution 0.14 nm

3-D Profilometer

- Vertical resolution of 0.2 nm with a guaranteed repeatability of 0.75 nm.
- Scanning area of 80X200 mm^2.
- Three-dimensional plots

Sample Preparation Room

- **Best equipped in our area**
- **TEM sample preparation, cross-section, surface topography, polishing, cutting, dimpling etc. Recently a new ion milling system from Gatan has been purchased and commissioned.**

Typical Examples of R&D Activities

- Thin film group
- Integrated Process, Procedure & Performance Improvement (IP3I) Program led by C.Reece
- EP group
- Single and large crystal Nb cavities led by P. Kneisel
- Study of the low temperature baking effect using SIMS and SFEM
- Developing a new approach to study the surface oxide layer structure employing SIMS
- Effect of acid agitation technique on the surface smoothness during BCP