

## SURFACE ANALYSIS SYSTEM

### I. SCOPE OF WORK:

- A. The work shall consist of providing all materials, labor, supervision, tools, equipment, training, and incidentals necessary to furnish, install (set-up), and render operational a surface analysis system for the Center for Materials Research at Norfolk State University, 2401 Corprew Avenue, Norfolk, Virginia 23504.
- B. The system shall consist of the following:
1. Surface Analysis Chamber
  2. Vacuum System
  3. Chamber Roughing Chamber
  4. Load-Lock Chamber
  5. Bake-out
  6. Sample Holders
  7. Sample Introduction (Sample Transfer Mechanism)
  8. Hot-Cold Manipulation Stage
  9. Ion Gun (for sample cleaning)
  10. Differentially Pumped Fine Focus Ion Source
  11. Electron Source (for Auger Electron Spectroscopy (AES))
  12. LEED Optics
  13. Energy Analyzer
  14. Data Acquisition Software
  15. Frame and Electronics Rack
  16. System Assembly
  17. Calibration and Checkout
  18. Training
  19. Warranty
- C. The surface analysis system shall be supplied, warrantied, and supported by the Contractor in an effort to ensure service responsibility.
- D. The Contractor shall plan and coordinate the performance of the work with the Agency's Representative to minimize disruption of Agency personnel and to complete work in an orderly and expeditious manner. The Contractor shall notify the Agency's Representative, Dr. Edward S. Gillman at (757) 683-2632, at least three working days before beginning each phase of work.
- E. Work shall be performed by competent technicians who are employees of the Contractor and familiar with the specific equipment. They shall be fully supervised by a competent full-time job foreman. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work.
- F. The Contractor shall perform the described work in accordance with the manufacturer's recommendations and these Specifications.
- G. All work that may require a Virginia Contractor's License will be provided/arranged by the Agency. The Contractor shall notify the Agency should any work be identified that requires a licensed contractor.
- H. The Agency will provide AC power, as required, with appropriate breakers/disconnects up to

a common point at the equipment, with surge protection meeting UL1449, with a let through voltage of 330V.

- I. The Agency will also provide chilled water for cooling, as required.
- J. All materials, equipment, and installation work shall meet these specifications, the Virginia OSHA Standards, the Virginia Uniform Statewide Building Codes, and shall be Year 2000 compliant.

**II. BIDDER INSTRUCTIONS:**

- A. The following specifications are intended to define the level of quality and performance of the requested work and not to be restrictive by manufacturer, brand, method of configuring a system, and method of accomplishing required functions, unless otherwise indicated.
- B. Bidders shall:
  - 1. Annotate and return these specification pages (not scanned or regenerated pages) to show compliance even if offering the referenced equipment.
  - 2. Provide pertinent technical data documenting compliance/equivalence with dimensions, quality, features, functions, and performance, even if offering the referenced equipment.
- C. The Commonwealth reserves the right to obtain technical data, request clarification/demo, and set time limits for response, when deemed necessary. Failure by the Bidder to provide the follow-up documentation will be cause to declare the bid non-responsive.
- D. The offered equipment shall be suitable for the purpose intended and shall meet or exceed the specified dimensions, quality, features, functions, and performance (with terms such as “fast,” “easy,” “miniature,” “minimum working distance,” and “precision” defined as a consensus of opinion among those trained in surface analysis system operation, unless further defined; with “greater than/less than or equal to” having the scientific meaning; and with “plus or minus” indicating a range):

**III. SPECIFICATIONS:**

**Response Format:** Bidders should organize their responses in the same order as that in which the requirements and specifications are presented in the IFB. Use a separate sheet(s) for additional information.

|    | Referenced Description  | Describe Product Bid (Include Manufacturer & Model Number) |
|----|---|--|
| A. | Surface Analysis Chamber:   | _____  |
| 1. | with a Mu-metal spherical analysis chamber to include ports for an electron spectrometer, | _____  |
| 2. | with rear-view Low Energy Electron Diffraction (LEED),                                    | _____  |
|    |   | _____  |
|    |   | _____  |

- 3. with a depth-profiling ion gun,
- 4. with gas manifold view-port,
- 5. with a vacuum gauge,
- 6. with a manipulator,
- 7. with a sample transfer device,
- 8. with a flood gun,
- 9. with ultraviolet (UV) source,
- 10. with Secondary Ion Mass Spectrometry (SIMS),
- 11. with ellipsometer,
- 12. with an X-ray source,
- 13. with an ion pump,

- 14. with magnetic field measured at less than 10 milligauss of stray field above the earth's magnetic field measured at the base plate, with a conceptual drawing included in this attachment,

**B. Vacuum System:**

- 1. for the surface analysis chamber,
- 2. with pumping for the surface analysis chamber any combination of ion, cryo, and Ti-sublimation pumping, with the Agency's Representative approval of the final configuration prior to manufacturing,
- 3. with the ultimate pressure less than or equal to  $1 \times 10^{-10}$  Torricelli (Torr), with gauging and interlocks for the electronics supplied,
- 4. with gate valve isolation for the ion pump from the analysis chamber included,

**C. Chamber Roughing:**

- 1. with chamber roughing a combination of molecular drag and fore pump if chamber roughing is to be used for sample preparation,
- 2. with components oxygen compatible if used for pumping of the sample preparation chamber,
- 3. with a vent valve included,

**D. Load-Lock Chamber:**

- 1. with combined sample preparation/fast entry air load-lock incorporating gate valves for isolation from a surface analysis chamber and separate ion pump,
- 2. with ports to accept the ion gun for sample

- cleaning, with a variable leak valve, with view-ports,
  - 3. with the sample temperature to reach greater than or equal to 650 degrees C in 2 to 3 Torr of oxygen,
  - 4. with a power supply for the heater,
  - 5. with a temperature controller,
  - 6. with ion and convectron gauging,
  - 7. with appropriate thermal shielding,
  - 8. with pumping oxygen compatible,
- E. Bake-out:
- 1. with upper and lower bake-out to 200 degrees C,
  - 2. with power supply, interlocks, and temperature controller,
- F. Sample Holders:
- 1. with at least three sample holders,
  - 2. with at least one of the sample holders oxygen compatible,
  - 3. with compatibility between the sample holder, sample transfer mechanism, and the hot-cold manipulation stage,
- G. Sample Introduction (Sample Transfer Mechanism):
- 1. with the sample transfer mechanism for transporting the sample from the load-lock to the surface analysis chamber,
  - 2. with the transport mechanism compatible with the sample holder, load-lock, and manipulation stages,
- H. Hot-Cold Manipulation Stage:
- 1. with a precision manipulator, with heating and cooling, as required, with primary rotation about the manipulator axis, and a tilt axis 90 degrees to the primary axis of rotation,
  - 2. with the manipulator compatible with the sample holder and sample transfer mechanism,
  - 3. with a temperature controller and power supply(s) included,

- 4. with this stage providing:
  - a. x and y travel greater than or equal to 12.5 mm,
  - b. z travel greater than or equal to 100 mm,
  - c. primary rotation of 360 degrees,
  - d. tilt of plus or minus 10 degrees,
  - e. heating of greater than or equal to 800 degrees C,
  - f. cooling of less than or equal to 160 degrees C,

**I. Ion Gun (for sample cleaning):**

- 1. with a computer controllable ion source for noble and reactive gases with an energy range of 0.1 to 5.0 keV,
- 2. with a power supply(s),
- 3. with mounting kit,
- 4. with Ultra-high Vacuum (UHV) leak valve,
- 5. with instruction manuals on the 2.75 knife edged circular flange (CF) flange,
- 6. with the ion source providing ion current greater than or equal to 10 microA at 5 keV,

**J. Differentially Pumped Fine Focus Ion Source:**

- 1. computer controlled for noble and reactive gases,
- 2. with an energy range of 0.2 to 5.0 keV,
- 3. with a power supply(s),
- 4. with raster control,
- 5. with a mounting kit,
- 6. with a leak valve and instruction manuals on the 2.75 CF flange,
- 7. with the ion source providing:
  - a. maximum current density of greater than or equal to 4 mA/cm<sup>2</sup>
  - b. ion current greater than or equal to 0.8 microA at 5 keV and 125 micrometer

spot,

c. ion current greater than or equal to 8 microA at 5 keV and 1000 micrometer spot,

d. raster size of greater than or equal to 2.5 mm x 2.5 mm at minimum working distance,

**K. Electron Source (for Auger-electron Spectroscopy (AES)):**

1. computer controllable electron gun for AES,
2. with power supply,
3. with deflection electronics,
4. with mounting kit and cabling,
5. with electronics capable of the following:
  - a. beam diameter of less than or equal to 100 micrometers at 5 keV and 10 microA beam current,
  - b. stability of better than plus or minus 0.3 percent,

**L. LEED Optics:**

1. retractable four-mesh type,
2. with miniature electron gun,
3. with power supply(s),
4. with shutter,
5. with cables and mounting kit,
6. on an 8.00 CF flange,
7. with retraction compatible with Mu-metal chamber,

**M. Energy Analyzer:**

1. hemispherical type with optics for:
  - a. X-ray Photoelectron Spectroscopy (XPS),
  - b. Ultraviolet Photoelectron Spectroscopy (UPS),
  - c. (AES),
  - d. Instrument Support Structure (ISS),
  - e. Scanning Auger Microscopy (SAM),
2. with mounting kit,
3. with connecting cables,

- 4. with instruction manuals, \_\_\_\_\_
- 5. with the analyzer meeting the following: \_\_\_\_\_
  - a. AES of 25,000 cycles per second (cps) for CU LMM line with a signal-to-noise ratio of 100 when excited from the electron source of: \_\_\_\_\_
    - 1) 5 keV, \_\_\_\_\_
    - 2) 10 nA, \_\_\_\_\_
    - 3) biased at plus 90 V, \_\_\_\_\_
    - 4) dE/E equal to 3, \_\_\_\_\_
  - b. ISS of 200,000 cps for Ag elastic peak when excited with He<sup>+</sup> from the fine focus ion source of: \_\_\_\_\_
    - 1) 2 keV, \_\_\_\_\_
    - 2) 1 microA, \_\_\_\_\_
    - 3) biased at plus 90 V, \_\_\_\_\_
    - 4) dE/E equal to 3, \_\_\_\_\_
- N. Data Acquisition Software: \_\_\_\_\_
  - 1. for the following: \_\_\_\_\_
    - a. data collection, \_\_\_\_\_
    - b. display, \_\_\_\_\_
    - c. data processing, \_\_\_\_\_
    - d. quantitative analysis and interface of all system components, \_\_\_\_\_
- O. Frame and Electronics Rack: \_\_\_\_\_
  - 1. made from steel tubing, \_\_\_\_\_
  - 2. with a stainless steel top to support the surface analysis and sample entry chambers, \_\_\_\_\_
  - 3. with rack(s) supplied as necessary for the electronics, \_\_\_\_\_
- P. System Assembly: \_\_\_\_\_
  - 1. with system assembly, calibration, and check-out, \_\_\_\_\_
  - 2. with items normally required such as flanges, gaskets, valves, wiring, connectors, and any other miscellaneous items provided for a completely operational system, \_\_\_\_\_

- IV. **DOCUMENTATION:** The Contractor shall provide a complete hardware and software manual including operation, maintenance, and preventative maintenance manuals including assembly and wiring diagrams, electrical and electronic schematics, mechanical diagrams, component views, and parts lists on all products offered. This manual shall include a copy of all warranties.
- V. **TRAINING:** The Contractor shall provide "hands on" equipment operation training at the installation location. This training shall occur not later than the week following the date the system becomes fully operational and shall cover all operational, maintenance, and preventative maintenance procedures. The Agency representative will provide a location and any routine training aids required (overhead projectors, slide projectors, and/or VHS video playback equipment). The Contractor shall provide training manuals for up to 3 individuals at this session.
- VI. **WARRANTY & MAINTENANCE:** The Contractor shall provide a warranty for the entire work against defective materials, workmanship, and performance, excluding vandalism, for one year from the date of acceptance of the installation. The Contractor shall also provide cost figures for the 2nd year complete maintenance including preventative maintenance. The Contractor hereby agrees to furnish, without cost to the Commonwealth of Virginia, all labor, materials, and transportation both ways for replacement of all parts and materials that are found defective or requiring update, including any system software provided, during the warranty period and any subsequent contracted maintenance period. Warranty response shall be made within 2 hours on Agency working days. Warranty repairs shall be made within seven calendar days after notification. Repair parts shall be readily available for at least 7 years following the date of acceptance.