

**REQUEST FOR PROPOSALS (RFP)**  
**Surface Analysis System including X-ray photoelectron spectroscopy (XPS), ultraviolet photoelectron spectroscopy (UPS), and scanning Auger electron spectroscopy (AES)**  
**For**  
**Portland State University**  
**(RFP No. 21689)**

**ADDENDUM Number 1**

REQUEST FOR PROPOSAL: ADDENDUM Number 1

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TITLE: Surface Analysis System including X-ray photoelectron spectroscopy (XPS), ultraviolet photoelectron spectroscopy (UPS), and scanning Auger electron spectroscopy (AES)

DATE RFP ISSUED: July 3, 2013

DATE ADDENDUM 1 ISSUED: July 11, 2013

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**PURPOSE OF THIS ADDENDUM 1:**

The purpose of this Addendum 1 is to respond to those questions or requests for clarification/change (or protest) submitted by potential Proposers pursuant to Section 1, Paragraph 3 of the RFP. The questions or requests for clarification/change (or protest) are in italics. PSU's response is underlined.

**1. VENDOR QUESTION:**

*Mandatory Requirement #5: The need to include SXI as a mandatory requirement would prevent us from making an offer as we do not provide this capability on our instrument. This technology is specific to a particular manufacturer and limits the information that can be obtained. This technology depends upon a high Z difference in the elements to provide a contrast mechanism for the images. Alternative methods are available that allow differentiation and images of the same element in different chemical states to be provided enhancing the information that can be obtained.*

**PSU's RESPONSE:**

Please see #11 below, Revised Mandatory Requirement Table and Revised Mandatory Specifications Table.

**2. VENDOR QUESTION:**

*Mandatory Specification #5: The requirement for a micro-focused monochromator would preclude us from making an offer. The requirement for a micro-focused monochromator limits the sensitivity and energy resolution that can be achieved with the spectrometer. Modifying the specification to allow all types of X-ray monochromators would ensure that improved sensitivity and energy resolution can be provided to the University thereby ensuring that the best possible performance can be offered.*

**PSU's RESPONSE:**

Please see #11 below, Revised Mandatory Requirement Table and Revised Mandatory Specifications Table.

**3. VENDOR QUESTION:**

*Mandatory Specification #10: This specification is the same as Mandatory Requirement #5 and would preclude us from making an offer as we do not provide the SXI capability. We offer an alternative imaging capability with better spatial resolution (3um vs. the requested 10um) but it does not use a scanning monochromator to generate the images.*

**PSU's RESPONSE:**

Please see #11 below, Revised Mandatory Requirement Table and Revised Mandatory Specifications Table.

**4. VENDOR QUESTION:**

*Mandatory Specification #15: The requirement to provide a dual beam charge neutralization system would preclude us from making an offer. We provide an electron beam only neutralization system that offers superior performance (energy resolution and sensitivity) on insulating samples and eliminates potential damage due to the ion beam as well as maintaining a lower vacuum level during analysis. Our system is fully automated and requires no adjustments. Eliminating the requirement for an auxiliary ion beam would allow us to make an offer.*

**PSU's RESPONSE:**

Please see #11 below, Revised Mandatory Requirement Table and Revised Mandatory Specifications Table.

**5. VENDOR QUESTION:**

*Mandatory Specification #16: The requirement for a dual beam charge neutralization system ensures that the optimum performance on insulating materials (such as PET) cannot be achieved. Our electron beam only neutralization scheme guarantees a performance of better than 0.68eV on the O-C=O (289eV) peak of PET.*

**PSU's RESPONSE:**

Please see #11 below, Revised Mandatory Requirement Table and Revised Mandatory Specifications Table.

**6. VENDOR QUESTION:**

*Mandatory Specification #20: This is the same as Mandatory Requirement #5, and Mandatory Specification #10. The inclusion of Scanning X-ray induced secondary electron imaging would preclude us from making an offer. It also limits the spatial resolution that the instrument can achieve, thereby limiting the University with an instrument that cannot offer the best overall performance.*

**PSU's RESPONSE:**

Please see #11 below, Revised Mandatory Requirement Table and Revised Mandatory Specifications Table.

**7. VENDOR QUESTION:**

*Mandatory Specification #20: This is the same as Mandatory Requirement #5, and Mandatory Specification #10. The inclusion of Scanning X-ray induced secondary electron imaging would preclude*

us from making an offer. It also limits the spatial resolution that the instrument can achieve, thereby limiting the University with an instrument that cannot offer the best overall performance.

**PSU's RESPONSE:**

Please see #11 below, Revised Mandatory Requirement Table and Revised Mandatory Specifications Table.

**8. VENDOR QUESTION:**

*Mandatory Requirements #5: Vendor requests that this requirement be revised as follows: The ability to align accurately and precisely on sample features of interest, using a variety of methods X-ray induced electron imaging contrast methods such as XPS peak or background signal images. Must include the ability to acquire digital images of sample mounts for sample navigation.*

**PSU's RESPONSE:**

Please see #11 below, Revised Mandatory Requirement Table and Revised Mandatory Specifications Table.

**9. VENDOR QUESTION:**

*Mandatory Specification #10: Vendor requests that this requirement be revised as follows: X-ray induced photoelectron or secondary electron imaging with a minimum spatial resolution of 10µm or less.*

**PSU's RESPONSE:**

Please see #11 below, Revised Mandatory Requirement Table and Revised Mandatory Specifications Table.

**10. VENDOR QUESTION:**

*Mandatory Specification #20: Vendor requests that this requirement be revised as follows: Precise, accurate and repeatable definition of the analysis position via secondary electron imaging capability, live optical viewing or other instrument capability. (Please state methodology which would be used).*

**PSU's RESPONSE:**

Please see #11 below, Revised Mandatory Requirement Table and Revised Mandatory Specifications Table.

**11. PSU's RESPONSE:** Section 2: Scope of Work, A. Mandatory Requirement Table, and B. Mandatory Specifications Table, are both hereby deleted in their entirety and replaced with the following Revised Mandatory Requirement Table and Revised Mandatory Specifications Table:

**A. Mandatory Requirements Table**

All Surface Analysis System hardware and/or software shall meet the mandatory requirements listed in the table below. Proposer's shall include the Mandatory Requirement table below with their Proposal and describe all deviances from the listed Mandatory Requirement. Proposer must indicate "Y" for "Yes" and "N" for "No" for each Mandatory Requirement listed in the table below.

<b>Mandatory Requirements</b>	<b>Proposer must indicate "Y" for "Yes" and "N" for "No" for each Mandatory Requirement</b>
1. The ability to provide quantitative and qualitative elemental and chemical state information from the surfaces of solid materials including: metals, semiconductors, polymers, glass, ceramics, and powders.	
2. The ability to perform routine large area XPS measurements.	
3. The ability to perform complete XPS spectrum analysis and mapping experiments from selected micron-scale areas. Complete XPS experiments include the ability to provide survey spectra, narrow region spectra from elements of interest, and sputter depth profiling if required.	
4. The minimum analysis area for selected area measurements: including elemental survey spectra, chemical state spectroscopy, and chemical state depth profiling should be 20 µm in diameter or less.	
5. The ability to align accurately and precisely on sample features of interest. Must include the ability to acquire digital images of sample mounts for sample navigation.	
6. Sputter depth profiling to explore composition below the surface of a material and characterize multi-layer thin film structures with a monatomic Ar and special (either C60 or Ar cluster will meet this requirement) ion beam source.	
7. Sputter depth profiling should be available in both the large and selected area analysis modes.	
8. In the selected area mode, multi-point sputter depth profiling should be available to obtain depth profiles on and off of a selected sample feature or material defect.	
9. The ability to provide Compucentric rotation during the sputter portion of a sputter depth profile to reduce sputtering artifacts that may degrade the quality of the depth profile.	
10. The ability to perform angle resolved XPS (ARXPS) measurements.	
11. Robust charge neutralization capability for the analysis of insulating materials to facilitate ease-of-use and automated analysis.	
12. Robust auto-Z height alignment of samples, for all x-ray spot sizes, to facilitate ease-of-use and automated analysis.	
13. Intuitive easy-to-use software packages for instrument operation and data reduction.	
14. The data reduction package should be available in a stand-alone format for off-line data processing.	
15. The ability to provide UPS analysis: energy resolution 0.12eV @ 1M cps or better.	
16. The ability to perform scanning Auger spectroscopy and imaging: spatial resolution 100nm or better @ 600k cps signal noise ratio 700:1 or better.	

## B. Mandatory Specifications Table

All Surface Analysis System hardware and/or software shall meet the mandatory specifications listed in the table below. Proposer's shall include the Mandatory Specification table below with their Proposal and describe all deviances from the listed Mandatory Specification. Proposer must indicate "Y" for "Yes" and "N" for "No" for each Mandatory Specification listed in the table below.

Mandatory Specifications	Proposer must indicate "Y" for "Yes" and "N" for "No" for each Mandatory Specification
1. Oil-free roughing pump and turbo pumped sample-introduction chamber with a cold cathode ion gauge for the rapid introduction of samples into the main analysis chamber.	
2. A UHV analysis chamber with ports that allow for the addition of x-ray sources, ion sources, new detectors and sample preparation chambers to meet current and future needs. The system should be capable of achieving an ultimate base pressure $\leq 7 \times 10^{-10}$ mbar. The analysis chamber must be made from mu-metal. The sample heating and cooling stages are required.	
3. The energy analyzer should be a 180° hemispherical analyzer with an electrostatic input lens to avoid the problems associated with ferromagnetic materials.	
4. The energy analyzer detector should provide both the spectroscopy and chemical state spectral mapping analysis modes with a maximum count rate in pulse count mode $> 20,000,000$ cps.	
5. A monochromated Al K $\alpha$ x-ray source. The spot size of the monochromated x-ray beam must be user definable.	
6. The ultimate XPS energy resolution of $\leq 0.50$ eV FWHM for the Ag 3d $_{5/2}$ peak.	
7. XPS sensitivity as demonstrated using the Ag 3d $_{5/2}$ peak performance is required to ensure a viable selected area and large area XPS capability.	
8. XPS elemental survey spectra and chemical state spectroscopy with a minimum spatial resolution of 20 $\mu$ m or less.	
9. XPS chemical state mapping with a minimum spatial resolution of 10 $\mu$ m or less.	
10. X-ray induced photoelectron or secondary electron imaging with a minimum spatial resolution of 10 $\mu$ m or less.	
11. The system should be capable of performing ARXPS measurements at multiple angles automatically under eucentric tilt software control and maintain the original analysis position as the angle is changed.	
12. Ultra-violet light x-ray source for valance band spectroscopy and work function measurements.	
13. Sample stage movement must allow analysis of samples of different sizes up to 50 mm in diameter and up to 7 mm thick.	
14. Sample stage must have the ability to be cooled down to -120°C, and heated up to 500°C with temperature regulation control.	

<b>Mandatory Specifications</b>	<b>Proposer must indicate "Y" for "Yes" and "N" for "No for each Mandatory Specification</b>
15. The instrument should be equipped with a robust dual beam charge neutralization system that uses low energy electrons and low energy ions for charge neutralization.	
16. Dual beam charge neutralization should be software-controlled and one setting should work for nearly all sample types with no operator intervention (tuning). Dual beam charge neutralization must be demonstrated on the O-C=O 289 eV C 1s peak, from clean PET, to be $\leq 0.85$ eV FWHM.	
17. Compucentric rotation shall be provided.	
18. Capable to perform both special ion sputtering for polymer application to maintain the chemical state of polymer samples and monoatomic Ar sputtering.	
19. A user adjustable, including adjustable range at least from 1 to 10 kV, scanning electron gun for performing Auger Electron Spectroscopy shall have a minimum probe size of 100 nm.	
20. X-ray photoelectron or secondary electron imaging capabilities for the precise, accurate, and repeatable definition of the analysis position between image and spectrum, shall be included with the system.	
21. A set of security features protecting the integrity of the vacuum system, in vacuum components, and electronics in case of power failure.	
22. Free software updates shall be included for 3 years from the date of acceptance. This requirement shall not apply to software updates that require new hardware updates.	
23. The system must have the ability to be controlled remotely via an internal network or the internet.	
24. The system must have the ability to load multi samples including single sample holders and multisample holders. Both standard and Heating/Cooling sample holder kits should be included if they are different. Both standard and heating/cooling stage sample holder kits should include at least two small sample holders with a recessed slot and two holders without a recessed slot, plus one small holder with Farady cup, one large sample holder capable to load a sample with at least 50mm in diameter.	
25. The system should meet the stated specifications when installed in our facility. The system must include water chiller. The system should include high vacuum bakeout accessories if they are required for vacuum bakeout. PSU recommends the manufacturer survey the site to make sure it will conform to their instrument needs. All PSU site surveys shall be conducted by the manufacturer five months prior to delivery of the system, and at no cost to PSU. In the event the PSU site fails to meet the manufacturers recommended environmental conditions, the manufacturer shall notify PSU within 10 days of completion of the PSU site survey with a detailed list of the deficiencies. PSU shall be responsible for any changes necessary to meet the manufacturer recommended environmental conditions.	

<b>Mandatory Specifications</b>	<b>Proposer must indicate "Y" for "Yes" and "N" for "No for each Mandatory Specification</b>
26. A state of the art computer system to manage, process, and print the acquired data. Control and software computers must meet the following minimum specs: Intel Core i7 processor, >=4G RAM, 1TB Hard drive, two monitors (each monitor should be larger than 19").	
27. Instrument control software and post-data processing software must be included. The software should be full version including all XPS, UPS, AES acquisition and data processing functions the vendor has developed for the proposed system. The post-data processing software must include spectrum analysis, modification, profile processing, overlay/comparison, non-linear least squares fitting, target factor analysis plus image processing: smooth, edge detection, filtering, image arithmetic.	
28. At least one (1) online instrument software control and data acquisition and processing software license, twenty (20) offline post data processing software licenses must be included in the proposal.	

12. Section 2: Scope of Work, Equipment Needed, this paragraph is deleted in its entirety and replaced with the following: Currently the Center of Electron Microscopy and Nanofabrication (CEMN) at Portland State University has an urgent need for the purchase of a surface analysis system including X-ray photoelectron spectroscopy (XPS), ultraviolet photoelectron spectroscopy (UPS), scanning Auger electron spectroscopy (AES), collectively the "Surface Analysis System". The proposed Surface Analysis System must be able to perform surface analysis on conducting and insulating solid materials used for a broad range of materials applications. The completed Surface Analysis System must be delivered within eight (8) months following the vendor's receipt of PSU's Purchase Order.
13. Section 2: Scope of Work, C. Additional Mandatory Requirements #5, Timeline Guarantee/Liquidated Damages, is hereby deleted in its entirety and replaced with the following: Vendor must have the ability to deliver the complete Surface Analysis System, including all items stated in the vendor's proposal, within eight (8) months after vendor's receipt of PSU's purchase order. Vendor agrees that failure to deliver the complete Surface Analysis System, including all items stated in the vendor's proposal, within eight (8) months after vendor's receipt of PSU's purchase order shall result in a 10% reduction in the total cost of the Surface Analysis System. Proposers shall include a timeline as part of the solicitation response.

NOTICE: PSU assumes no liability for inadvertent errors or mistakes in this document. PSU has answered all vendor questions to the best of our ability with the information we have readily available at the time of issuance of this document.