

Chapter 8: Specification and Allied Technical Details (Item No. 2)

Revised Technical Specification after pre-bid meeting January 2017 for X-ray Photoelectron Spectroscopy (XPS) with XPS maps

The proposed system must be able to characterize conducting and insulating solid materials used for a broad range of material applications. The XPS system must be capable to provide quantitative elemental and chemical state information from the surfaces of solid materials including: powders, metals, semiconductors, polymers, glass, ceramics, thin films, coatings, catalyst, nanomaterials etc.

Details Technical Specifications:

Sl. No.	Requirements / parameters / parts	Specifications in detail
1.	General Requirement for:	<p>The proposed system must be able to characterize all kind of solid materials used for a broad range of material applications.</p> <p>To include:</p> <ol style="list-style-type: none">1. XPS - X-ray photoelectron Spectroscopy The chemical state, elemental composition of materials such as inorganic, organic, polymeric, nanocomposites etc,2. UPS - Ultraviolet Photoelectron Spectroscopy Valence band studies3. AES - Auger Electron Spectroscopy Inter- and intrastate transitions of electrons to yield information about the chemical composition of a surface
2.	Complete System	<ol style="list-style-type: none">1. The ability to perform large area XPS measurements.2. The ability to perform complete XPS measurements from selected areas which include the ability to provide survey spectra, narrow region spectra from elements of interest, and sputter depth profiling if required.3. The ability to perform small area XPS measurements without damaging the nature of the surface of the sample.4. The ability to obtain optical images and XPS maps for locating sample features of interest with a suitable mechanism.5. Sputter depth profiling should be available in both the large and selected area analysis mode.6. In the selected area mode, multipoint sputter depth profiling should be available to simultaneously obtain depth profiles on and off of a selected sample features or material defect.7. The ability to perform angle dependent XPS measurements. In this the whole of the X ray spot is within the analysis area over the range of sample angles.

		<p>8. The ability to provide azimuthal rotation during the sputter portion of a sputter depth profile.</p> <p>9. Robust charge neutralization capability for the analysis of insulating materials to facilitate ease-of-use and automated analysis.</p> <p>10. Robust auto-Z height alignment of samples to facilitate ease-of-use and automated analysis.</p> <p>11. In-built easy-to-use software packages for instrument operation and data reduction.</p> <p>12. The data reduction package should be available in a stand-alone format for off-line data reduction.</p>
3.	Vacuum system	<p>A UHV Mu-metal chamber with ports that allow for the additional X-ray sources, ion sources and sample preparation chambers to meet current and future needs.</p> <p>Pre chamber and specimen chambers with proper heating and cooling. The vacuum status and temperature should be controlled with proper monitoring with digital display.</p> <p>The state of art turbo molecular pump (oil free preferred) with auto control fail safe operation to create vacuum in the range of 5×10^{-10} to 7×10^{-10} mbar or better.</p> <p>Vacuum pumping system consisting of turbo molecular and Ti Sublimation pump with software controlled vacuum management.</p>
4.	Detector	Multichannel detector assembly should provide high sensitivity and resolution in both the spectroscopy and mapping analysis mode.
5.	Analyser	<p>Electron Energy Analyzer with software package</p> <p>The energy analyzer should be 180° hemispherical analyzer with an electrostatic input lens to avoid the problems associated with magnetic immersion lenses.</p>
6.	Sample entry system and sample manipulator	<p>Assisted with turbo-molecular pump</p> <ol style="list-style-type: none"> 1. Sample holder kit 2. Facility to load multi samples at a time 3. Multistage for parking of the samples 4. Motorized XYZ-theta manipulator 5. Argon sputter ion gun in the sample preparation chamber
7.	Water chiller system	Proper power supply and control system for the X-ray source with proper cooling system (Water circulated) and source should be protected from all safety measures.
8.	Source for XPS	A mono-chromated scanning Al $K\alpha$ and dual anode Al/Mg $K\alpha$
9.	Source for UPS	Ultraviolet Photoelectron Spectroscopy: UV source (HeI and HeII) for Ultraviolet photoelectron spectroscopy.
10.	X -ray beam/spot size	The diameter of the monochromated scanning X-ray beam/spot must be adjustable from 20 μm or less up to 100 μm or more.

		<p>The monochromated scanning x-ray beam must have the ability to scan the X-ray beam, of any specified diameter, on the sample, to an area of 1 mm x 1 mm or better</p> <p>Fully automated 5-axis (X, Y, Z, rotation and tilt) euscentric specimen stage with bakeable motors on</p>																					
11.	Source for AES Auger Electron	Auger Electron spectroscopy: 5keV or better Auger electron source with one micron or less electron beam size with secondary electron detector for AES studies.																					
12.	Source for Depth profiling	Ion source (Argon) and Argon ion cluster with variable ion energy in the range 0.2keV to 1 keV or better along gas lines and high precision leak valve for gas inlet.																					
13.	Flood gun- charge neutraliser system	The instrument should be equipped with a robust dual/single beam charge neutralization system that uses low energy electrons (typically 1-2 eV) and low energy ions (typically 5-10 eV) for charge neutralization																					
14.	Heating and Cooling system	In situ heating and cooling stage (-100°C to 700°C or better) option and to maintain all 5 axes functionality.																					
15.	Camera	Microscope Specimen viewing with a high resolution color CCD Camera with digital zoom facility and proper light source illumination.																					
16.	XPS mapping	<p>XPS spectroscopy, XPS mapping/parallel XPS imaging and/or X-ray induced secondary electron imaging with a minimum spatial resolution of 10 µm or less</p> <p>The system should be capable of performing angle dependent XPS measurements at multiple angles automatically under software control and maintain the original analysis position as the angle is changed.</p> <p>X-ray induced secondary electron imaging capabilities for the precise definition of the analysis position should be provided</p>																					
17.	Sensitivity of selected area, size and resolution	<p>XPS sensitivity as demonstrated using Au (4f_{7/2}) and Ag 3d_{5/2} peak performance shown in the table below is required to ensure a viable selected area and large area XPS capability</p> <table border="1"> <thead> <tr> <th>Sensitivity Selected area analysis</th> <th>Size</th> <th>Resolution</th> </tr> </thead> <tbody> <tr> <td>≥ 3200 cps</td> <td>≤ 30µm</td> <td>≤ 0.60 eV</td> </tr> <tr> <td>≥ 45 kcps</td> <td>≤ 30 µm</td> <td>≤ 1.00 eV</td> </tr> <tr> <td>≥ 60 kcps</td> <td>≤ 30µm</td> <td>≤ 1.30 eV</td> </tr> <tr> <td colspan="3">Large area analysis</td> </tr> <tr> <td>≥ 250 kcps</td> <td>100 x 1400 µm</td> <td>≤ 0.60 eV</td> </tr> <tr> <td>≥ 2 Mcps</td> <td>Large area</td> <td>≤ 1.00 eV</td> </tr> </tbody> </table>	Sensitivity Selected area analysis	Size	Resolution	≥ 3200 cps	≤ 30µm	≤ 0.60 eV	≥ 45 kcps	≤ 30 µm	≤ 1.00 eV	≥ 60 kcps	≤ 30µm	≤ 1.30 eV	Large area analysis			≥ 250 kcps	100 x 1400 µm	≤ 0.60 eV	≥ 2 Mcps	Large area	≤ 1.00 eV
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18.	Remote access	<p>The system must have the ability to be controlled remotely via an internal network or the internet.</p> <p>Remote diagnostic facility for maintenance and control of the system.</p>																					

19.	Operational Software-Data Analyzer; Computer system and printer:	<p>Complete software (Windows based) for data acquisition and data processing including background subtraction, smoothing, peak identification, curve fitting, de-convolution of peaks for multiple chemical states etc.</p> <p>Should include the complete latest libraries.</p> <p>The software package should be given off line multi user license to at least ten numbers.</p> <p>Any up gradation in the software package should be made available with free of cost.</p> <p>Suitable high and latest configuration computer with ~27-inch FULL HD LED Backlit Monitor for running the system.</p> <p>Color LaserJet printer with high and latest configuration.</p>
20.	Consumable	Please provide a complete list of consumables with item-wise unit price for five years
21.	Training and Installation	Comprehensive training by experienced and qualified engineers on the operation, basic maintenance of the system (for both the hardware and software) and trouble-shooting must be provided on-site for a period of 20 days in two sessions.
22.	Instrument Warranty	Warranty for 5 years from the date of installation with all recommended spares.
23.	UPS (Uninterrupted Power supply)	<p><u>For Complete System:</u> 20 KW or suitable wattage on-line UPS with 3-phase input and single phase output with 3 hours battery back-up.</p> <p><u>For Chiller:</u> Suitable on-line UPS with 3 hours battery back-up</p> <p>Both the UPS shall have isolation transformers.</p>
24.	Manuals and circuit diagrams	Complete set of manuals in English language for operation, and servicing of the equipment. All circuit diagrams and block diagrams must be provided for the main unit, sub systems and accessories (including bought out items)

Other terms & conditions:

- 1) Service response time, turn-around time & up-time of the equipment should be clearly specified
- 2) List of users of the Instrument in last 5 years in India with contact address to be provided
- 3) Pre-installation requirements are to be stated clearly, and to be verified/surveyed by the supplier at the installation site.
- 4) The supplier must submit technical brochures and proper application notes adequately explaining and confirming the availability of the features in the model of the equipment

➤ **All necessary components / accessories required for installation and smooth running of the equipment to be quoted.**

- Bidder should ensure availability of spares for at least 10 (ten) years.
- Annual Maintenance Contract (AMC) for 5 (five) years after expiring of warranty period with 2 (two) preventive and 1 (one) break down visit minimum. The rates will be obtained but not included in the total cost for price comparison.
- Insurance coverage and liaising with insurance company for any matter will be the responsibility of the supplier up to the installation of the instrument.

(Please ensure to check and mention all the above parameters and requirements in the technical compliance statement)

Note: All other terms and conditions of tender document except the above Chapter 8, Item No. 2 will remain same. All prospective bidders may quote accordingly.