

## **CORRIGENDUM- 6**

**Tender Ref:** ICSR/2022/IOE/008/HRVPSEM

**Tender Name:** Variable Pressure High Resolution Scanning Electron Microscope with Energy Dispersive and Wavelength Dispersive Spectroscopy for study of conducting, non-conducting and biological samples

**Reason for Corrigendum:** Amendment in Technical Specification and Extension Of Bid Submission Date

### **EXTENSION OF BID SUBMISSION DATE:**

The due date for the submission of bids has been extended to 11/08/2022 @ 3 PM. The bid opening is 12/08/2022 @ 3 PM.

## Amendment in Technical Specification

### Technical Specifications for Variable Pressure High Resolution Scanning Electron Microscope with Energy Dispersive and Wavelength Dispersive Spectroscopy for study of conducting, non-conducting and biological samples

Sr. no	Features	Specification	Comply/ Not Comply	Catalogue Page No.
1	Resolution	<p>0.6 nm or better at 15 kV in SE mode in high vacuum (see vacuum specifications below)</p> <p>0.8 nm or better @ 1 kV in high vacuum</p> <p>1 nm or better at 15 kV in low vacuum SE mode at 30 Pa or more</p> <p>1.4 nm or better @ 3 kV in low vacuum SE mode at 30 Pa or more)</p> <p>0.6 nm or better in STEM mode at 15 kV in high vacuum</p> <p>All above resolutions on standard gold on carbon samples to be achieved without application of external sample/stage bias</p> <p>The methodology for obtaining the resolution should be as per ISO/TS 24597 standard. The resolution quoted should be the average value and not the best value.</p>		
2	Vacuum	<p>The FEG SEM should be freely and simply be switched between the following vacuum modes.</p> <p style="margin-left: 40px;">i. High-vacuum mode (<math>&lt; 1 \times 10^{-4}</math> Pa)</p> <p style="margin-left: 40px;">ii. Low-vacuum mode (upto 300 Pa or higher)</p> <p>Features of the OIL FREE vacuum system which include turbo-molecular, scroll, rotary, PVP, ion getter or other suitable pumps with seamless transition between the different vacuum modes.</p>		
3	Electron Gun / Column	<p>High Stability Schottky Field Emission Electron Source with automated filament cutoff safety device</p> <p>Beam acceleration or deceleration upto 4 kV or higher in column for achieving high resolution images at low kVs.</p>		
4	Magnification	<p>Lower mag. <math>\times 30</math> or less</p> <p>Higher Mag. <math>\times 2,000,000</math> or more</p>		

5	High Tension	Lower limit: 200V, Higher limit: 20 kV or 30 kV and any chosen intermediate value. All the kV settings should be varied through software		
6	Chamber	a) Chamber should have at least 12 accessory ports, c) Infrared chamber scope (IRCCD) for real time view c) Integrated plasma cleaner, d) Navigation camera for easy sample identification, sample exchange should be within 5 minutes b) Air lock chamber for quick sample transfer with a gate valve of 80 mm diameter or more		
7	Stage	5 axis motorized Eucentric stage with X and Y of 100 mm or more and Z-axis = 40 mm or more, Tilt = -4° to +70° or better. Manual Joystick as well as software control for stage movement.		
8	Sample holder	a) SEM should be able to handle at least 50 mm diameter and weight upto 0.5 kg in untitled position b) Multiple sample holder that houses at least 10 stubs to be provided. The sample holder should accommodate samples of varying sizes in the range 1 mm to 10 mm or larger		
9	Electron Optics, Lenses	The system must have combination of electromagnetic and electrostatic lens (compound lens) assembly for high resolution imaging of biological, non-conducting and magnetic materials. The lenses should be thermally stabilized.		
10	Lens correction	Manual and Auto focus / astigmatism / wobbling features Local charge compensation and cleaning to reduce charging of non-conducting samples and suitable SE and BSE detectors for imaging while using charge compensation		
11	Probe Current	Adjustable range from Minimum: 3 pA or less and maximum of 20 nA or higher, Noise < 1%, Drift < 0.2%/hour; In built specimen current meter and option for continuous current adjustment		
12	Scanning	Varying scan speeds of 25ns to 1 ms or more Spot mode: electron beam spot location to be defined freely in X and Y Freely adjustable line scan, 360° Scan rotation at all scan rates and automatic tilt correction when the stage is tilted		

13	Imaging detectors / image processing	<ul style="list-style-type: none"> <li>• High-vacuum mode: conventional Everhart-Thornley detector with variable grid bias.</li> <li>• In-lens or In-column SE detector or equivalent for HR imaging in high and low vacuum</li> <li>• In column detector for energy selective back scatter electrons</li> <li>• Low-vacuum mode: large-field, high resolution state of the art gaseous/variable pressure SE detector for operation upto 500 Pa.</li> <li>• Retractable 5 or more segmented solid state backscattered electron detector which is optimized for low-kV (1 keV-6 keV) operation for compositional and crystallographic contrast imaging</li> <li>• Pneumatic retractable multi-mode annular STEM- detector for bright field, dark field, oriented dark field and high angle annular dark field transmission imaging along with suitable STEM sample holder</li> <li>• A CCD camera should be included as standard, and 4 quadrant displays for simultaneous imaging using SE and BSE</li> <li>• Simultaneous Imaging of SE, BSE and other detector images in multiple quadrants of the screen</li> <li>• Cathodoluminescence (CL) imaging detector compatible for operation at low vacuum upto 300 Pa</li> <li>• File type: TIFF (8-, 16-, 24-bit), JPEG or BMP</li> <li>• Single-frame or 4-view image display</li> <li>• 256-frame average for integration, line integration and averaging, interlaced scanning)</li> <li>• drift compensated frame integration mode</li> <li>• Digital image improvement and noise reduction filter</li> </ul>		
14	User Interface	<p>Computer controlled user friendly interface for the smooth routine operation of microscope</p> <p>The software should have function like auto-focusing, drift correction, dynamic focus, auto- contrast/brightness/wobble .</p>		
15	Computer hardware and software	At least 2 State of the art computer systems with suitable processors and communication ports (one each for SEM and EDS) with 64 bit Windows		

		<p>10 PRO or similar operating system and at least 24 inch LED monitors. 3 GHz or better processor; at least 32 GB RAM; 10 TB HDD.</p> <p>Software for automatic large area mapping and stitching</p> <p>Software for advanced image analysis, segmentation and image coloring</p> <p>Module to organize and align images for correlative analysis from optical and SEM tools</p>		
16	EDS Detector	<p>EDS detector should be fully compatible with the SEM and provide suitable hardware and software for complete integration with the microscope</p> <p>Motorised and Peltier cooled silicon drift detector (SDD) with pulse processor, Active detector area 60 mm<sup>2</sup> or larger, energy resolution of 125 eV or better at Mn K alpha with e-beam excitation. The detector should detect Al and Si L alpha lines. Detection of elements down to Beryllium and quantification from Boron onwards. Robust EDS detector window made up of Silicon nitride or similar tough material compatible for operation at low vacuum upto 300 Pa or more. Polymer windows are not acceptable.</p>		
17	Software for EDS analysis	<p>Software for qualitative and quantitative spectrum analysis at the same region of interest. Accurate peak identification, background subtraction and automatic peak evaluation</p> <p>Deconvolution of spectra for separate element contributions</p> <p>Quantification software must have options for ZAF corrections</p> <p>Quantification of elements from Boron in point, Line Scan, area Mapping.</p> <p>Real time elemental mapping with auto elemental identification, quantification based on ZAF correction algorithms. Quantification of phases / oxides/ compounds and minerals.</p> <p>Spectral imaging with up to 4096 × 4096 pixel resolution, online deconvolution and pseudo color mapping. Storing of spectrums at each point during mapping for online and offline analysis.</p>		

		<p>Display of quantitative results as atomic and weight percentage. Color-coded concentration distributions (element maps, phase maps) for any number of elements within an arbitrary field of view.</p> <p>Easy Project Management work flow for data saving and data export 2 licenses for offline analysis of EDS data.</p> <p>Raw data to be exported in atomic%, weight% and intensity profiles (Excel or CSV format).</p> <p>Export of results to MS Word, Excel and pdf report generation.</p>		
18	Calibration standard samples	<ul style="list-style-type: none"> <li>• 1 No. of standard sample for calibration of SEM images (Gold on Carbon and Tin on carbon) and suitable ultra-high resolution sample for STEM and in-lens detectors.</li> <li>• 1 No. of EDS calibration sample</li> <li>• Suitable baking Kit and it's spares (Halogen bulb) for the standard samples</li> </ul>		
19	Hardware and software tools for correlative microscopy	<p>Suitable Hardware and software for doing correlative microscopy</p> <p>Motorized Upright Microscope with correlative microscopy workflow with FESEM</p> <p>Fully Motorized Upright Microscope stand with Apochromatically corrected beam path, Integrated Light Intensity manager for Bright field, Dark Field and Polarised light Applications .</p> <ul style="list-style-type: none"> <li>- Dedicated TFT/LCD display for control of motorized components and contrast manager.</li> <li>- Light control should be motorized by light manager/TFT/Software</li> <li>- 6 Position motorized reflector turret</li> <li>- 6 Position or more Motorized Objective Nose piece</li> <li>- Trinocular tube/Binocular Phototube</li> <li>- Focusable 10X eyepieces with Field Of View 23 mm or better</li> <li>- 100W Halogen light source or equivalent LED for reflected light illumination</li> </ul> <p>Motorized Z drive with step size of 25nm or better along with motorized XY Scanning stage along with accessories for correlative microscopy</p>		

		<ul style="list-style-type: none"> <li>- Correlative holders and accessories to correlate Light microscopy image with SEM.</li> <li>- Adapter plate with SEM interface for mounting of specimen holders with SEM adapter</li> </ul> <p>High N.A, High light transmission efficient objectives</p> <ul style="list-style-type: none"> <li>- Epiplan 5x/0.13</li> <li>- Epiplan 10x/0.25</li> <li>- Epiplan-Neofluar 20x/0.50</li> <li>- Epiplan-Neofluar 50x/0.80</li> <li>- Epiplan-Neofluar 100x/0.90</li> <li>- Microscopy camera incl. Driver software</li> </ul> <p>Number of Pixels: 2464 (H) x 2056 (V) = 5.07 Mega pixel color or more</p> <p>Sensor type: Global Shutter CMOS</p> <p>Pixel size: 3.45 <math>\mu\text{m}</math> x 3.45 <math>\mu\text{m}</math> or better</p> <p>Chip size: 8.5 mm x 7.1 mm, equivalent to 2/3" (diagonal 11.1 mm) or more</p> <p>Image acquisition and processing for light microscopy with modules for panorama, measurement, and extended focus use</p> <p>Interactive control of stage movement from the workspace</p> <ul style="list-style-type: none"> <li>- Advanced 2D alignment functionality</li> <li>- Measurements capability</li> <li>- Export of merged project view as image (single and multi-channel)</li> <li>- Export to suitable file format for use in SEM</li> </ul>		
20	Essential Consumables	a) The quote should provide consumables (FEG tip, apertures, vacuum pump related spare parts and any other essential spare parts/consumables for smooth operation for 5 years)		
21	Essential Accessories	a) A tabletop Carbon evaporator and Chromium, Gold-Palladium sputter coater with oil free vacuum pump(s) (to reach vacuum of $10^{-5}$ mbar or more), touch screen based coating control of parameters, stage for loading multiple samples (upto 6) of		

		<p>diameter 10 mm or more. Interchangeable plug-in heads for mounting Carbon / Chromium, Gold-Palladium targets</p> <p>b) Vibration and noise free chiller</p> <p>b) Compressor for pneumatic systems of the microscope</p> <p>c) Suitable vibration isolation system, EMI active cancellation system to achieve the required specifications for the instrument</p> <p>d) Suitable UPS for 1 hour of back up</p>		
22	Power supply	All equipment including accessories should operate with 220 V, 50 Hz power supply		
23	Warranty	<p>Comprehensive warranty (from the date of full installation) with AMC for 5 years along with free software upgrades for the entire system including all the 3<sup>rd</sup> party attachments and accessories</p> <p>The service engineers must undertake periodic inspections (every 3-6 months) to ensure that the SEM provides high quality imaging and spectroscopy results</p>		
24	Documentation	Vendor should specify the model number of the FESEM and those of the attachments and submit the brochure that supports all the quoted specifications		
25	Operation & maintenance manuals	Online user guidance: Soft copy of the operation & maintenance manuals should be provided along with all the detector operation principle and techniques behind it.		
26	Availability of spares parts	The vendor has to guarantee that all the spares parts for the offered FESEM model and 3 <sup>rd</sup> party attachments will be available for at least next 10 years		
27	Installation & training	Onsite installation, demonstration of all specifications quoted. training for 5 persons in the operation of the entire system including attachments at the installation site		
28	Service Support and operation	<p>The OEMs should have trained engineers preferably in Chennai for service and repair and attend to the issue within 48 hours of the notification of the service complaint.</p> <p>Provide the list of service engineers. Provision for remote diagnostics with OEM factory should be available, Provide a trained operator for a period of 5 years</p>		



29	Pre-installation requirement (civil& electrical EMI and gas, etc.)	Should be mentioned along with offer. Free survey of vibration and EMI at site and provide the results of the survey and the necessary modifications if required for achieving best results		
30	Cooling stage	<ul style="list-style-type: none"> <li>• A Peltier cooled stage for study of beam sensitive samples Temperature range of -50°C to + 50°C Self-contained cooling - no additional external cooling water needed Temperature accuracy +/- 1.5°C, Minimal image drift Cooling and heating rates of up to 30°C per minute or more Keypad control - with simultaneous display of actual and target temperature</li> </ul> <p>Should provide suitable SEM chamber feedthrough. Comprehensive AMC and warranty for 5 years. Quote for required consumables if any for smooth operation for 2 years.</p>		
31	Additional Detectors (Optional)	<ul style="list-style-type: none"> <li>• State of the art Cathodoluminescence (CL) detector with spatial resolution &lt; 10 nm, angular resolution of 1° or better and wavelength resolution of 0.2 nm or better. Simultaneously capture angle- and wavelength-resolved CL data. Automatic alignment of optics for reproducible results over short and long term.</li> </ul> <p>Acquisition capabilities should include: Angle-resolved (ARCL), Angle-and wavelength-resolved (WARCL), Wavelength-filtered and -resolved spectroscopy, Wavelength-filtered and unfiltered CL mapping, ARCL and wavelength spectrum imaging (hyperspectral imaging). CL collection optics consisting of retractable, diamond turned paraboloidal / semi-ellipsoidal mirror with direct optical coupling to the monochromator for high collection sensitivity. Additional mirror thin enough to enable working at low working distances ~1mm should be quoted.</p>		

		<p>Highly sensitive detectors covering the Wavelength ranges from 185 nm – 1100 nm.</p> <ul style="list-style-type: none"> <li>- Should include a high sensitivity photomultiplier tube and suitable blazed grating (preferably 1200 lines/mm, 500 nm).</li> <li>- And back-illuminated UV-enhanced CCD with anti-etaloning technology</li> </ul> <p>The wavelength resolution should be better than 0.2 nm in visible range. System electronics for control of monochromator and detector for viewing / recording of wavelength resolved spectrum as well as high resolution panchromatic and monochromatic CL images simultaneously with other imaging signals like SE and BSE.</p> <p>Detection system and grating turret with 3 nos. diffraction gratings A cooled housing for the photomultiplier tube in order to provide more than 10 times reduction in detector dark noise, required for CL mapping applications. Necessary water recirculatory to be supplied.</p> <p>Spectrum / image acquisition and processing software:</p> <ul style="list-style-type: none"> <li>• The software should be capable of digital acquisition, display and storing of monochromatic as well as panchromatic images, superimposition of various monochromatic images and pseudo coloring of images,</li> </ul> <p>image annotation for text entry on any part of the image and should have various measurement functions. Image and spectra processing, curve fitting, and spectra processing like multiple display, image stitching, normalization, peak fitting etc., software to be provided.</p> <p>System should have auto-alignment feature. The alignment routine must be capable of locating the sample at the focal point of the collection optic delivering optimized collection</p> <ul style="list-style-type: none"> <li>• efficiency and repeatable results using a laser-injection optimization. Hyperspectral imaging at 6000 or more spectra per second should be possible with CCD or any other detector.</li> <li>• Comprehensive warranty for 5 years</li> </ul>		
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32	Consumables for sample preparation and handling (Optional)	<ul style="list-style-type: none"> <li>• Provide sample preparation tools (100 numbers each of Al stubs of 12.7 mm and 25.4 mm diameter), SEM Pin Stub Mount Gripper Tweezers, 30° angle 4 Numbers), Tweezer Style Mount Gripper for Grooved 25mm stubs, 45° angle 4 Nos)</li> <li>• 100 Number of suitable stubs for sample mounting on cooling stage</li> <li>• Consumables i.e., 2 rolls each of 6 mm wide carbon tape, copper tape and 2 nos. conducting Silver paint and thinner of 25 ml.</li> </ul>		
33	Buyback offer:	<ul style="list-style-type: none"> <li>• Provide an offer for buy-back of the existing ThermoFisher-FEI Quanta 400 model FESEM (installed in 2009) (not working)</li> <li>• Provide an offer for buy-back of the Energy Dispersive Spectroscopy (model XFlash 6110, make Bruker installed in 2017) (not working)</li> <li>• Provide an offer for buy-back of the existing sputter coater (Model Polaron SC7640, Quorum Technologies make installed in 2009) (working)</li> </ul>		

**NOTE / Pre-Qualification criteria:**

S.No.	Description	Comply / Not Comply
1	A) Equipment offered must be a model from the current serial production range of the manufacturer. Customized or One of Manufactured Model will not be accepted. Offer should be supported with printed catalogue / depiction on company website.	
2	B) The local vendor/OEM must have supplied at least 5 of the quoted model to IITs, IISERs, IISc and other Govt. of India organizations. Please attach the purchase order copies of supplies in last 3 years with contact details (Name, Phone, email address) of users.	
3	C) The company or companies (for combined quotations) should be original equipment manufacturers (OEMs) of the quoted systems. Please attach exclusive authorization certificate(s) specific for this tender with quote without which bid will be rejected.	