

Technical specifications for Scanning Electron Microscope (SEM)

Sl.no.	Features	Specifications
1.	Resolution	3nm @ 30KV with tungsten filament in High Vacuum mode and 4.0 nm or better@30KV in Variable pressure or low vacuum mode. The definition of resolution and the method used to determine the same should be specified. Resolution claimed must be supported by printed literature.
2.	Magnification	Up to 3,00,000X or better. Minimum magnification should be specified.
3.	Accelerating voltage	Variable up to 30 kV or better.
4.	Probe current	Suitable for all applications, and should be up to 1μA or better.
5.	Electron gun	Thermionic emission type - Tungsten source
6.	Detectors	In-chamber SED (Everhart-Thornley). Dedicated and separate SE detector for low vacuum/ variable pressure mode. Back Scattered Electron Detector for using both in high vacuum and variable pressure. Detector should have capability of high sensitivity for low kV analysis. Specify built-in automatic/ manual control for contrast and brightness.
7.	Chamber	Large chamber with at least 6 or more accessory ports. Chamber design should allow changing of the specimens quickly. Chamber should be equipped with CCD camera or any suitable device to view the sample & stage inside the analysis chamber without interfering with EM detectors.
8.	Vacuum System	Fully automated microprocessor controlled vacuum system comprising of Turbo-Molecular Pump (TMP) (along with water chiller if water-cooled TMP) backed by Rotary pump (or) ion getter vacuum pumps, along with pneumatic valves. (Clarify if any in-built proper safety measures against failure of power supply, vacuum, water-flow, etc. are provided). This system should be compatible for gun and filament in order to protect both Gun/filament against air-exposure of specimen chamber during specimen loading/unloading. It should have capability to achieve low vacuum of 500 Pascal or better.

9.	Anti-Contamination	The SEM must be equipped with an oil free vacuum system (Turbo molecular pump & Ion pump) to avoid contamination.
10.	Specimen Stage	<p>PC controlled 5 axis motorized stage with motorized stage movements equivalent to or better</p> <p>X \geq 100 mm Y \geq 50 mm Z > 25 mm Tilt \geq -3 to 70° or more R = 360°</p> <p>Control of stage movement should be controllable through both computer and manual with joystick/track ball.</p>
11.	Multi-specimen Holder	To hold many specimens (\geq 5), Sample holders for cross sectional view– 1 Number (optional); Stubs-20 Numbers.
12.	Energy Dispersive X-ray Detector	<p>Latest Integrated Field Effect Transistor technology based-Peltier Cooled Silicon Drift Detector with 30 mm² crystal area or higher detector area and with a resolution of 129 eV or better Mn Kα @ 100,000 cps.</p> <p>At the installation site, the detector should also show \leq70 eV at F-Kα and 60 eV \leqC-Kα at 100,000 cps, as per established ISO norms. The detector should have a Super Ultra-Thin Window/ Silicon nitride window for better light element performance and capability to detect from beryllium(Be) to Uranium (U).</p> <p>Supplied EDS server & analysis software should have capability to do Qualitative & Quantitative Analysis, Peak and Auto ID routine, Spectral Match Analysis, Database management and reporting, Elemental Mapping, Point Analysis, Line Scanning, Real time Phase mapping, Phase to Element and Element to Phase maps with specimen drift correction. Pile up correction and background noise reduction, simultaneous imaging and analysis should be possible. All these capabilities should be applicable for polished flat specimens, fractured samples and nanostructured particulate systems.</p> <p>User interactive qualitative and standard less/ standards based quantification with K, L, M, N line database. Real time elemental mapping with auto elemental identification, quantification based on ZAF, PhiZAF.</p> <p>Should have quantification algorithm for uneven surfaces and under tilted conditions</p>

		<p>Pile up correction and background noise reduction, simultaneous imaging and analysis should be possible.</p> <p>Thin film analysis software with nanometer scale resolution in both space and depth capabilities should be quoted.</p> <p>The supplier should arrange for seamless interfacing, software, installation and commission for EDS</p> <p>Data acquisition facility in the form of ASCII values of the EDS spectra.</p>
Sample preparation accessories		
13.	Sputter Coater	<p>Sputter coating unit for Carbon and Gold deposition should be provided.</p> <p>Coater with touch screen and digital display for adjusting all coating parameters like coating time, current etc. It should display all coating parameters.</p> <p>Coater should have capability for carbon coating too.</p> <p>Along with the coater, 2 Nos. of extra Gold-Palladium targets and 2 meter of carbon fiber/rod should be provided.</p> <p>The power requirements and gas requirements of sputter coater must be mentioned in the bid/offer.</p>
14.	Critical Point dryer	<p>CPD with digital display and temperature monitoring and control with thermal cut-out protection provision</p> <ul style="list-style-type: none"> - Chamber dimensions should be minimum of 30mm x 40mm size - Standard Specimen holders - Boat holders for tissues and liquids - Holders for microscope coverslips - Required CO₂ gas cylinder and required liquid CO₂ delivery tubes should be provided - O ring and L gasket set (including window and door bonded seals) - Spare bursting disc and retaining copper (Cu) washer - Steel bar for tightening/untightening the door - Flat wrench (for removing the window retaining ring) - Comprehensive manual - Pressure test certificate
15.	STEM detector	<p>STEM detector for Dark Field and Bright Field imaging.</p> <p>100 numbers of 3mm -TEM grids required.</p>
16.	Accessories	<p>50 numbers of additional filament coupons needs to be provided.</p> <p>Specimen preparation kit - Necessary specimen kit for sample preparation with sufficient no of stubs etc. should be provided.</p> <p>Minimum 10 number of singles stubs and 2 number of multiple</p>

		<p>sample holders should be provided.</p> <p>System should be supplied with necessary tools for filament replacement and sample preparation.</p> <p>Necessary power backup support with minimum 10 kVA UPS with 2 hours backup under full load should be provided.</p> <p>Atleast 60 meters of carbon coated double adhesive tapes should be provided.</p> <p>Silver paste-50 grams should be provided.</p>
Other Requirements		
17.	User Interface	<p>High definition display system with 23'' LED or higher TFT monitor(s) for SEM image processing.</p> <p>One Color Laser Printer with photocopy/scanning facility with minimum speed of 20 pages per minute and 600 DPI should be provided.</p> <p>Control panel integrated to keyboard with control and adjustment knobs for frequently used SEM parameters (focus, magnification, etc.)</p>
18.	Computer	<p>Intel i7 processor, 2 TB HDD, 16 GB RAM, 2 GB graphics card, three year warranty including parts and labor.</p> <p>Windows 10 operating system to operate SEM and all attachments.</p> <p>All the computers for SEM and EDS must be imported /factory fitted and tested with pre-loaded softwares for operating these systems.</p>
19.	Software	<p>Pre-loaded licensed software for total system control, including EHT, lens supplies, scanning conditions, imaging, chamber pressure control, and image.</p> <p>Complete software for image analysis with dedicated particle size analysis (like particle size, size distribution Histogram, shape, etc), 3D imaging, super position of images etc.</p> <p>Image file in JPEG, TIFF and BMP formats.</p>

		<p>Software for controlling and analyzing the detectors chosen along with the SEM should be provided.</p> <p>Image from different detectors could be viewed simultaneously in a split-up view area of the monitor.</p>
20.	Future Upgradability	<p>The specimen chamber should be large and compatible to accommodate other detectors such as CRYO Transfer, WDS and Cathode luminescence detector (all these must be field installable) without any additional interfacing accessories at later stage.</p> <p>The system should have facility to integrate with co-relative microscopy at later date</p>
21.	Calibration standards	<p>Standard samples to check system calibration i.e., magnification etc. should be supplied along with the system.</p> <p>Faraday cup for probe current measurement, Cobalt standard for EDAX and Golden carbon Standard for SEM should be provided.</p>
22.	Spares and undertaking for spares	<p>An undertaking that the vendor will supply all the spares and services for the equipment for at least 10 years from the date of commissioning.</p>
23.	Pre-installation requirements	<p>Pre-installation requirements such as room size, tolerable limits of EM field and vibration (mechanical), required power rating, utility requirements are to be stated clearly, and to be verified/surveyed by the supplier at the installation site.</p>
24.	Environmental requirements	<p>Necessary environmental requirements, i.e., temperature, humidity etc during the operation of SEM/EDS system should be specified clearly.</p>
25.	Training and Support	<p>On-site training for 10 working days must be provided by factory trained engineer at the buyer's site free of cost.</p> <p>Additional training of 5 days after 3 months of installation should be provided.</p> <p>Service response time must be within 72 hours.</p> <p>The SEM must have provision for on-line diagnosis of faults.</p> <p>Remote diagnostics with internet connectivity (online support) with the manufacturer to solve hardware and software issues at site (IIFPT, Thanjavur, Tamil Nadu) should be provided.</p>
26.	Required Documents along with technical specifications	<p>The supplier must have sold at least 3 SEM within India in last 10 years.</p> <p>The supplier must provide a comprehensive list of users of quoted SEM model in India.</p> <p>They should also submit the name(s) of the service engineer(s)</p>

		employed by them who is/are competent to service the equipment being quoted with their locations in India.
27.	Compliance Statement	<p>The supplier must submit technical brochures and proper application notes and manuals adequately explaining and confirming the availability of the features in the model of the equipment being quoted.</p> <p>The supplier must submit a table indicating the compliance of the features of the model of the equipment being quoted with those given in the indent.</p> <p>Features not matching – must be clearly indicated.</p> <p>Additional features and features in the quoted equipment which are better than those in the indent – may be clearly explained.</p>

Indentor

External Expert member

HOD

CMNSP