INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

MATERIALS MANAGEMENT DIVISION

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Technical Specifications for the Field Emission Scanning Electron Microscope (FESEM) with EDS and EBSD

Sr No	Specifications		Compliance (Yes/No)	Remark if Any
1	Resolution	0.7 nm or better at 20 kV		
		1.3 nm or better at 1 kV		
2	Accelerating voltage	Variable from 10V or lower to 30kV or higher must be preprinted on parent company brochure and website.		
3	Probe current	In Adjustable range from a few pA to 300 nA or better		
		Probe current setting must be fully automatic without change of aperture and column tuning The aperture angle control, automatically optimizes the aperture angle of the objective lens across the entire current range.		
4	Magnification	Magnification: - ×10 to 35,00,000 or better Automatic correction of magnification is provided		
5	Electron gun	It should be In -Lens Schottky type gun High brightness. The In-lens Schottky Plus electron gun efficient focusing of generated electrons, enabling probe currents ranging from a pA to nA, even at low accelerating voltages. As high-resolution observation, high-speed elemental mapping, EBSD analysis can be easily performed without the need for objective aperture switching. Emitter warranty should be three years for trouble free operations or Emitter operationally fails during warranty period replacement should at site free of cost.		
6	Electron optics	High Resolution imaging at low KV		
		The Condenser lens system should consist of dual condenser lens to allow changes in beam current		

		continuously.		
		The Objective lens should consist of both Electrostatic and Electromagnetic Lenses with beam acceleration and deceleration within the lens to reduce aberration and improve probe diameter.		
		The system should have beam deceleration or stage biasing technology for High resolution analysis.		
		Energy filtration technology – user get energy selection range		
		All parts including apertures should be operated through computer-controlled software		
7	Specimen stage	5 axes motorized fully Eucentric stage with motorized stage movements: X=100mm or higher -fully motorized Y=100mm or higher -fully motorized Z=50 mm or higher -fully motorized Rotation: 360° – fully motorized Tilt: -4° to +70° – fully motorized must be preprinted on parent company brochure and website.		
8	Specimen chamber	Chamber should be capable to upgrade all future possible detectors like, STEM, WDS, CLD, etc		
		At least 8 ports or more should be available for future expansion		
9	Specimen size	Specimen chamber should be capable to accommodate large specimen size of 150mm diameter or more.		
10	Specimen exchange & vacuum system	Suitable vacuum systems having Sputter ion getter Pump, Turbo Molecular Pump and Rotary Pump must be provided.		
		All necessary gauges and valves must be included		
		Pump down time should be 5 minutes or less.		
11	Sample holder	Multisampling specimen holder with 8 position or more should be provided.		
		Pin / regular stubs 1 inch – 10 Numbers		

		Conductive carbon adhesive tapes -2 Nos		
12	Auto functions	Gun alignment, Focus, Stigmation, Brightness, Contrast and Beam alignment should be automatic, aperture angle control,		
13	detectors	1) SE Detector – Chamber Mounted Ever -Heart Thornley Detector		
		2) BSE Detector -Chamber Mounted BSE detector		
		3) In Lense SE detector		
		4) In lense BSE detector		
		5) Beam deceleration or equivalent		
		6) EDS Detector		
14	Computer & image acquisition and display	Compatible computers with latest configuration (core i7), keyboard, mouse, LCD monitor, Windows licensed Operating system and one colour laser printer should be offered.		
		24-inch or better LCD/ LED Screen		
		Image Size: 9 K X 7 K pixel or better		
		Image depth: up to 16 bits or better		
		Image format: BMP, TIFF, JPEG, JPEG2000, GIF, PNG etc.		
		Software should be capable of automatic generation of report in MS-office.		
		Image acquisition system should be compatible with Windows		
15	Features	FESEM and EDS have following features a) LDF – Lower depth of focus b) Automatic Observation and Analysis Function, as SEM observation can be automated by simply setting the analysis conditions and selecting the areas to measure, from Single screen multi location SEM image. c) Tilt Magnification correction. d) Seamless Transition from Optical to SEM		

		imaging, As the magnification is changed the image automatically switches between the optical to SEM image. e) Data automatically saved for each project, and reports are automatically created according to templates f) Energy Filtration technology can allow the In Lense SE and In Lens BSE image from single detector.		
16	Spares and consumables	Supplier must have support for quoted model at least for minimum 10 years.		
17	Sputter coater	Sputter coater with Pt target **Pressure** ~4 Pa **Chamber Size** 86mm (d) x 100mm (h); hard g **Target Size*** Au: 49.5mm (d) x 0.05 mm (t) **Target Electrode** 20mm (d) **Sample Stage Size** 70mm (d) **Sample Stage Height** Adjustable to Target (10mm – 50mm) **Sputter Time** 0.5min/1min/2min (Fixed)		
18	Power supply	Equipment and power supply connector should be compatible with Indian electrical main supply of 220V ,50Hz. If Indian plugs are not supplied, suitable converters must be provided. The electronics system of the FESEM should be highly reliable.		
19	UPS	Suitable advanced online UPS for FESEM, EDS, EBSD and chiller with one-hour maintenance-free battery back-up.		
20	Pre-installation	The system and all its electronics should be rugged, sturdy and suitable for Mumbai climate. Compliance certificate must be diligently prepared. Any false information will lead to disqualification of the bidder. Before installation of the FESEM, the site would be tested and certified by the supplier in respect of stray magnetic field, ground vibration, and quality of air (humidity), water and electricity.		
21	Water chiller	Recirculating water chiller for lens and peripheral		

		cooling must be supplied.		
22	Safety devices	Safety devices against power/vacuum/water/air/gas failures to be provided.		
23	Warranty	Three-year Warranty for the equipment and its accessories		
24	Installation and training	Bidders must conduct site survey after placement of PO at no additional cost and all operation related requirements should also be submitted along with technical bid.		
		After installation one week of training must be provided on site free of cost.		
25	EDS	The EDS system should be very latest, state-of-art system which should seamlessly get integrated with the proposed FESEM system. The EDS detector should be SDD type, having detector area of 30mm2 area or more, to offer very high-count rate for Elemental Analysis and Mapping applications. Detector window should made by robust Silicon Nitride or equivalent robust material, with honeycomb grid structure supporting grid, to increase low energy X ray transmissivity for better light element analysis apart from analysis of heavy elements. The Energy resolution should be 127eV or better at Mn-Kα which is to be guaranteed at site. C-kα : < 50eV at count rate of 100,000cps, F-kα : < 65eV at count rate of 100,000cps The EDS detector should be able to handle high input count rate at least 1.6M icps or more The detector should be optimized for low energy X-ray transmission for light element analysis apart from heavy elements. EDS must be plasma cleaner compatible Detection Range of detector should be Be to Am.		

		Also, the detector must have capability to detect Al Lα line (73eV). The EDS should be able to do Quantitative and Qualitative analysis. The EDS software must have features like, Mapping, Point ID, Line Scan, Multipoint, Phase map, Drift correction, Reporting, etc.		
26	EBSD	The EBSD system should work on the same computer platform as that of EDS system, the EBSD camera system should be CMOS based with up to 6,700 indexed points per second or more with indexing success rate of 99% or better. The system should have the assessment of accuracy of Indexing. The EBSD should be optimized for low – kV data application while working with SEM. The camera should have motorized insertion and retraction mechanism. Position accuracy is to be 0.1mm or better. Optimized phosphor screen for high speed and high sensitivity collection. The camera should have hexagonal scanning grid for minimizing grain shape artifacts, to provide constant point-to-point distance between all adjacent measurements and to allow optimum measurement density of an area and precise grain boundary reconstructions. The camera must facilitate imaging of the sample. The camera should have imaging detectors to facilitate Orientation contrast, Topographic contrast and atomic number contrast imaging. The system software should include following features: (i) Data Acquisition Software (ii) Phase Reflector File Creation Software (iii) Pole Figure Software (iv) Mapping Software (v) ODF Software (vi) Imaging and Beam Control Software (vii) Stage Control Software (viii) Phase Identification Software. EBSD data processing software should provide Triplet Indexing and Confidence Indexing. EBSD software should have feature like dynamic camera optimization. The software should also have feature to improve S/N		

		level by averaging each pixel with its surrounding neighbouring pixels. Should have software module, which will create the queue of desired Region of Interests (ROI) for EBSD analysis and will do the EBSD analysis as per the queue without any manual intervention. One Pre-tilt Sample holder and a suitable holder for transmission EBSD experiments should be provided.		
27	Vibratory polisher	Flat working surface produces flat and even polishing, Motor oscillates at 7200 rpm; maximizes contact with polishing cloth for highly effective polishing, High quality polish makes it ideal for Electron Back-Scatter Diffraction (EBSD), 32 mm sample holder Adjustable amplitude to adjust for sample size, number of samples, and material.		
28	Qualification Criteria	1. The vendor should have supplied minimum 30 FESEM units in reputed Indian Institutes (e.g. IITs), Universities or research laboratories during the past decade. 2. The vendor should provide proof of after sales- service and availability of spares and accessories. 3. Only models launched after January 2024 that provide the latest technology should be quoted. 4. The vendor must provide the release note from the principal.		