DEPARTMENT OF CECASE

NATIONAL INSTITUTE OF TECHNOLOGY: TIRUCHIRAPPALLI - 620 015

24.01.2014

Minutes of the pre-bid conference

Tender Notification No.: NITT/F.NO:SIF003/PLAN2013-14 dt: 19.12.2013

The pre-bid conference was held on 24.01.2014 at 9.00 AM in the conference hall of Chemical Engineering Department to discuss the specification published in the tender.

Based on the discussion, the committee recommends the following amendments to the specification.

Specification for Field Emission Scanning Electron Microscope:

Sl. No	Original tender specification		Amended specification
1.	Electron gun	Field emission electron source Schottky FEG	No change
2.	Resolution	0.8 nm or better at 15 kV and 1.5 nm or better at 1 kV The definition of resolution and the method used to determine the same should be specified. Resolution claimed must be supported by printed literature.	No change
3.	Acceleration voltage	≤ 0.1 to 30 kV continuously adjustable	No change
4.	Magnification	≤25X to 1,000,000X or more. Minimum and maximum magnification should be specified	No change
5.	Probe current	Suitable for all applications, and should be up to 200 nA or higher.	Suitable for all applications, and should be up to 200 nA or higher.
6.	Specimen stage	PC controlled fully eucentric 5 axis motorized stage movements equivalent to X ≥120 mm Y ≥100 mm Z ≥25 mm Tilt = ≥ -5° to ≥ 90° or higher, R = 360° endless Stage movement should be controllable through both computer and manually with joystick.	PC controlled fully eucentric 5 axis motorized stage movements equivalent to X ≥100 mm Y ≥80 mm Z ≥20 mm Tilt = ≥ -3° to ≥ 50° or higher, R = 360° and higher Stage movement should be controllable through both computer and manually with joystick/trackball.
7.	Multi Specimen holder	For loading many specimens (≥ 5)	Suitable for loading many specimens (≥ 5); 70 degrees pre-tilt holders-5 nos; Cross sectional sample holders – 1 No STEM holder-1 No.; Stubs-50 Nos.
8.	Removal of sample	Plasma Cleaner to be provided	No change

	contamination		
9.	Detectors	In-chamber SED (Everhart-Thornley). Four quadrant detectors for BSE. In lens/In column Secondary Electron Detector (SED) or equivalent. In-lens/In-column Backscattered Electron (BSE) Detector or equivalent. Angle Selective BSE/ Directional backscattered detector or Equivalent Technology. Pneumatically Retractable STEM with bright field and dark field detectors should have capability of high sensitivity for low kV analysis. Specify built-in automatic/ manual control for contrast and brightness. Option for viewing images from SE and BSE detectors simultaneously on the screen. STEM detector WDS detector FIB (optional), SIMS(Optional)	In-chamber SED (Everhart-Thornley). In lens/In column Secondary Electron Detector (SED) or equivalent. In-lens/In-column Backscattered Electron (BSE) Detector or equivalent. Angle Selective BSE/ Directional backscattered detector or Equivalent Technology. Pneumatically Retractable STEM with bright field and dark field detectors should have capability of high sensitivity for low kV analysis. Specify built-in automatic/ manual control for contrast and brightness. Option for viewing images from SE and BSE detectors simultaneously on the screen. WDS detector
10.	Camera	Camera (IR-CCD) or suitable device to view the samples and stage inside the chamber.	No change
11.	Non conductive samples/Magnetic samples	should have low vacuum or charge compensation facility for imaging Non-conductive samples without conductive coating. Low vacuum ≥ 150 Pa to be provided and variable pressure to be specified. Should be capable of imaging magnetic samples at higher magnifications similar to the non-magnetic samples (details are of magnification and resolution to be provided) System should possess a state of art hybrid lens or equivalent technology to image magnetic materials.	Should be capable of imaging non-conducting samples without conductive coatings. Should be capable of imaging magnetic samples at higher magnifications similar to the non-magnetic samples (details are of magnification and resolution to be provided) System should possess a state of art hybrid lens or equivalent technology to image magnetic materials.
12.	Cryo-Stage	It should be possible to study biological/ceramic/polymer samples.	Cryo-stage (optional)

		Temperature ≤ -60°C	
13.	Vacuum system	Fully automated microprocessor controlled vacuum system comprising of Ion-Pump (for Field-emission SEM), Turbo-Molecular Pump (TMP) (along with water chiller if water-cooled TMP) backed by oil-free rotary pump, 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.	No Change
14.	Scanning/Display	system - High definition dual display system with 23" LED (1920 X1080) pixel better for high quality image in real time under graphical user interface Color Laser printer	system - High definition dual display system with 23" LED (1920 X1080) pixel (or)better for high quality image in real time under graphical user interface; Color Laser printer
15.	Sample Exchange	Separate Air lock specimen exchange system for fast sample transfer without breaking vacuum 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.	Sl.No. 15 can be omitted if the sample exchange chamber loading time is less than five minutes.
16.	Sample preparation Accessory	Carbon and gold deposition sputtering unit, Along with the coater, 2 Nos. of extra Gold-Palladium targets and 2 meter of carbon fiber should be provided. Mag. calibration grid, STEM grid, Carbon tapes, Lacey carbon coated copper grids and Plasma cleaner to be provided. The power requirements and gas requirements of sputter coater must be mentioned in the bid/offer.	Carbon and gold deposition sputtering unit, Along with the coater, 2 Nos. of extra Gold-Palladium targets and 2 meter of carbon fiber should be provided. Mag. calibration grid; STEM grid, Carbon tapes-50 meters; Holey carbon coated copper grids - 200 Nos. and Plasma cleaner to be provided. Silver paste-50 grams should be provided. The power requirements and gas requirements of sputter coater must be mentioned in the bid/offer.
17.	Local charge compensation	It should be possible. Needle-based Local charge compensation by N_2 gas for	imaging and analysis of non-conductive sample without

	facility (Optional Item)	imaging and analysis of non-conductive sample without conductive coating.	conductive coating.
18.	Computer	Intel i7 processor, 2 TB HDD, 8 GB RAM, 2 Gb Nvidia graphics card, five year warranty including parts and labor. Windows 7 or higher compatible OS to operate FESEM and all attachments. All the computers for FESEM, EDS-EBSD must be imported /factory fitted and tested with pre-loaded softwares for operating these systems.	No Change
19.	Software	pre-loaded licensed software for total system control, including EHT, lens supplies, scanning conditions, imagining, chamber pressure control, and image. Complete software for image analysis like particle size analysis, 3D imaging, super position of images etc. Image file in JPEG, TIFF and BMP formats. EBSD, STEM, WDS and EDS should be assessed simultaneously using a single user interface.	No Change
20.	User Interface	Operational keyboard with control and adjustment knobs for frequently used SEM parameters (focus, magnification, etc.)	No Change
21.	Energy dispersive X-ray Detector	Latest Integrated FET technology based Peltier Cooled Silicon Drift Detector with a sensor size of 30 mm^2 or higher detector area and resolution of ≤121eV or better Mn Kα @100,000 cps . At the installation site, the detector should also show ≤70 eV at F-Kα and 60 eV ≤C-Kα at 100,000 cps, as per established ISO norms. The detector should have a Super Ultra-Thin Window for better light element performance and capability to detect from Be to U. The software should have capability to do Qualitative & Quantitative Analysis, Peak and Auto ID routine, Spectral Match	Latest Integrated FET technology based Peltier Cooled Silicon Drift Detector with a sensor size of 30 mm^2 or higher detector area and resolution of ≤124 eV or better Mn Kα @100,000 cps . At the installation site, the detector should also show ≤70 eV at F-Kα and 60 eV ≤C-Kα at 100,000 cps, as per established ISO norms. The detector should have a Super Ultra-Thin Window for better light element performance and capability to detect from Be to U. The software should have capability to do Qualitative & Quantitative Analysis, Peak and Auto ID routine,

		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. Provision should be there to integrate the quoted EDS system with the EBSD for simultaneous acquisition of EDS-EBSD. The supplier should arrange for seamless interfacing, software, installation and commission for EDS and EBSD systems. Data acquisition facility in the form of ASCII values of the EDS spectra Separate PC and Monitor for EDS should be provided. Specifications for the computer as per the Sl. No 18.	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. Provision should be there to integrate the quoted EDS system with the EBSD for simultaneous acquisition of EDS-EBSD. The supplier should arrange for seamless interfacing, software, installation and commission for EDS and EBSD systems. Data acquisition facility in the form of ASCII values of the EDS spectra Separate PC and Monitor for EDS should be provided. Specifications for the computer as per the Sl. No 18.
22.	Wavelength Dispersive Spectrometer (WDS)	Data acquisition facility in the form of ASCII values of the WDS spectra. Appropriate crystals should be incorporated in the given configuration to cover the elemental range from Be to U Automatic and fast crystal change should be possible Rowland circle of diameter 100 mm or greater The WDS detector should have a mechanism of protection from any kind of damage by contact with specimen or specimen stage.	No change in specification; Additionally P10 gas filled cylinders (2 Nos.) to be supplied.
23.	Electron Backscatter Diffraction (EBSD)	Forward Scattering Detector (FSD) should be provided.	

	Detector	Versatile camera with Integrated forward Scatter detector fulfilling the requirement for both high speed and high sensitivity applications, indexing speed of 1000 patterns/sec at 5 nA with 99% indexing success, 99% indexing at 5 KV and 99% indexing at 100 pA to generate high quality data for non conductive and beam sensitive samples also. The high speed EBSD camera should be able to perform scan at a speed greater than 600 fps (frame per second). The EBSD camera should be capable of providing a high pixel resolution, minimum resolution of 640×480 pixels. The EBSD camera should have a high contrast ratio, which is the ratio of the luminance of the brightest color (white) to that of the darkest color (black) that the system is capable of producing. The EBSD system should be capable to pick up minimum angular deviation (i.e. angular resolution) down to 0.1 degree. Orientation precision measurement should be less than 0.1 degree which shows true sample deformation structure to allow understanding of process/property relationship. The camera should be retractable with digital slide control and have a touch sensor alarm, which is audible. The camera should also have a bellow assembly to avoid any vacuum leakage, circular phosphor screen for better sensitivity at edges. The EBSD camera should have a mechanism of protection from any kind of damage by contact with specimen or specimen stage.	Versatile camera with Integrated forward Scatter detector fulfilling the requirement for both high speed and high sensitivity applications, indexing speed of 860 patterns/sec at 5 nA with 99% indexing success, 99% indexing at 5 KV and 99% indexing at 100 pA to generate high quality data for non conductive and beam sensitive samples also. The high speed EBSD camera should be able to perform scan at a speed greater than 860 fps (frame per second). The EBSD camera should be capable of providing a high pixel resolution, minimum resolution of 640×480 pixels. The EBSD camera should have a high contrast ratio, which is the ratio of the luminance of the brightest color (white) to that of the darkest color (black) that the system is capable of producing. The camera should be retractable with digital slide control and have a touch sensor alarm, which is audible. The camera should also have a bellow assembly to avoid any vacuum leakage, circular/rectangular phosphor screen for better sensitivity at edges.

		An alarm facility/indicator may be provided to alert the user if the specimen is about to touch the phosphor screen. - Fully integrated EDS-EBSD set-up in one interface, facility for automatic optimization of camera settings, automatic background collection and subtraction, camera setting match to EDS conditions. EBSD should have highest indexing accuracy and quantified measurement of data quality. Software should include (i) camera optimization for data collection (binning, brightness and gain), (ii) background collection and subtraction, (iii) point analysis (for collection of patterns from multiple spots in a given area. The EBSD software should be able to index all seven crystal systems (metallic, ceramic, semiconductor, minerals and rock samples) , and should include multiple Hough Transform routines as well as ability to optimize parameters for high speed or high resolution indexing requirements. The EBSD software should also have capabilities for dynamic mapping (for producing orientation and phase maps with SEM image with pie charts showing phase and structural information) to ensure data collected matches data needed. The EBSD software should have the ability to collect data from a selected point continuously using the mouse in a manner that each data point is time stamped, allowing the user to go back to any frame collected to select the optimal data point in case of beam sensitive /contamination problems. The EBSD should be able to dynamically	

		adjust the drift correction frequency based on the changes occurring during collection. Beam control and data acquisition software should be included for providing digital control of the electron microscope beam and acquisition of up to two simultaneous videos signals with 16-bit resolution. User-selectable processing times should be possible for allowing collection tailored to application-specific needs. The software should have options for pile-up rejection and reduction of sum peaks. There should be option for choice of 5 or 10 eV/channel resolution for spectral collection to improve overlap deconvolution EBSD off-line Software License (5 Nos.) should include all applications for use on another workstation. The analysis software should have the capabilities for advanced texture analysis (example: ODF calculations by both series expansion and binning), in-grain misorientation analysis, misorientation distribution function (MDF's), Taylor and elastic stiffness analysis at any strain tensor. Software should support analysis of thin films and coatings along with bulk materials. The EBSD camera should have a mechanism of protection from any kind of damage by contact with specimen or specimen stage. An alarm facility/ indicator may be provided to alert the user if the specimen is about to touch the phosphor screen.	
24.	STEM Detector	STEM Detector for simultaneous imaging	STEM Detector for simultaneous

		of both Bright Field (BF) & Dark Field (DF) imaging, Possibility of carrying out HAADF. The STEM detector should have a mechanism of protection from any kind of damage by contact with specimen or specimen stage.	imaging of both Bright Field (BF) & Dark Field (DF) imaging, Possibility of carrying out HAADF or ADF.
25.	Control panel	Control panel for entire operation of FESEM	No Change
26.	Chiller & compressor	High quality chiller and compressor for FESEM unit; Specify the manufacturer and model. Warranty applicable to chiller and compressor for 5 years for both parts and labor	No Change
27.	Calibration	Standard samples to check system calibration i.e., magnification etc. should be supplied along with the system.	No Change
28.	Standards	Standard samples for day to day analysis and calibration	No Change
29.	Expandability	Provision for attaching additional detectors	No Change
30.	Tools, spares and consumables	Recommended spare kit for 5 years (New additional Field Emission filament cartridges (specifications as per Sl. No 1)- 3 numbers; Carbon tapes- 3 numbers; Stubbs 10 numbers; complete list should be provided) along with three spare FE-electron emitter sources (to be provided whenever it is necessary within three weeks) and 5 set aperture strips of 10, 20,30,30,50 microns.	Recommended spare kit for 5 years (New additional Field Emission filament cartridges (specifications as per Sl. No 1)- 3 numbers; complete list should be provided) along with three spare FE-electron emitter sources (to be provided whenever it is necessary within three weeks) and 5 sets of aperture strips.
31.	Diagnostic support	Remote diagnostics with internet connectivity with the manufacturer to solve hardware and software issues at site (NIT Trichy).	No Change
32.	Power Backup	30 kVA UPS with 10 hours backup for FESEM And 20 kV UPS with 10 hours back up for Chiller unit	15 kVA UPS with 10 hours backup for FESEM, chiller and other accessories.
33.	Environmental control accessories	System to maintain the humidity, room temperature and other necessary parameters for	No Change

		optimum performance of FE-SEM system	
34.	warranty	five year warranty including parts and labor for FESEM and accessories also	No Change
35.	Electron Optics	Beam Deceleration/Gentle Beam/Beam Booster technology or equivalent for high resolution imaging at low kV.	No Change
36.	Chamber	Chamber design should allow changing of the specimens quickly. Chamber should allow up-gradation to in-situ tensile/heating experiments.	No Change
37.	Accessories	five year warranty including parts and labor	No Change
38.	Protection system	WDS, EDS, EBSD, BSE and SE detector s should have a mechanism of protection from any kind of damage by contact with specimen or specimen stage.	No Change
39.	Spares and undertaking for spares	List of standard spares to be provided for each year starting from 1st to 5th year along with cost 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 Bank guarantee of 10% of total cost to be provided.	Bank guarantee of 5% of total cost to be provided for spares after the warranty period and before the releasing of performance bank guarantee given for warranty period.
40.	Pre-installation requirements	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. It is the supplier's responsibility to clearly provide details of the above mentioned requirements before 120 days of delivery of the equipment.	No Change
41.	Environmental requirements	Necessary environmental requirements, i.e., temperature, humidity etc during the operation of FESEM/EDS system should be specified clearly. The operator should be not only trained in operating but also know the installation requirements for smooth	Necessary environmental requirements, i.e., temperature, humidity etc during the operation of FESEM/EDS system should be specified clearly.

		uninterrupted functioning of the FESEM.	
42.	Warranty Training and Service Support	Five years comprehensive on-site warranty should be offered for entire offered configuration (after successful commissioning of the equipment). Service response time, turn-around time & up-time of the equipment should be clearly specified. Service response time must be less than 72 hours. The supplier may provide a highly skilled full time Engineer with suitable expertise for training to designated users and providing technical assistance and routine maintenance of the proposed FESEM for a period of 2-years from the date of installation of the system in the institute. The institute shall have no responsibility for his/her service liabilities. The expenses for such service are to be included in the quote. The FESEM must have provision for on-line diagnosis of faults. Suitable service facility for computer hardware or software related problems should also be provided.	The supplier must provide a highly skilled full time Engineer with suitable expertise for training to designated users and providing technical assistance and routine maintenance of the proposed FESEM for a period of 2-years from the date of installation of the system in the institute. The institute shall have no responsibility for his/her service liabilities. The expenses for such service are to be included in the quote.
43.	Compliance Statement	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. Features not matching – must be clearly indicated. Additional features and features in the quoted equipment which are better than those in the indent – may be clearly explained. 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 being quoted	No Change
44.	Required Documents along with technical specifications	The supplier must provide a comprehensive list of users of FESEM (Schottky Field Emission SEM) in India. They should also submit the name(s) of the service engineer(s) employed by them who is/are competent to service the equipment being quoted with their	No Change

		locations in India.	
45.	Terms and conditions	(a) A single order will be processed for the entire configuration. (b) The firm has to guarantee support for both system and spares for a minimum period of 10 years. (c) Provision for on-line remote diagnosis of faults. (d) The firm must have at least 5 installations of Schottky Field Emission SEMs within India for desired experience of maintenance. (e) Free training on different applications to selected users. (f) Compliance of all listed specifications/terms and conditions sheet should be indicated by the vendors in tabular form. (g) Date of manufacturing of the equipment should be after the placement of order. (h) Break up of price for optional items should be shown separately in the price bid.	No Change
46.	Warranty period required (Years) Page 17 in the tender document	Three years	Five years

Note: Any other accessories apart from the mandatory accessories and systems mentioned above may be quoted separately. Pre-installation/post-installation training expenses (including travel, boarding and lodging) should be born by the supplier.

Dr. S.Natarajan
Chairman- CECASE &
Prof/MME
(Initiating Faculty)