Sophisticated Instrument Facility
National Institute of Technology, Tiruchirappalli 620015

19th Dec 2016

Proceedings of the pre-bid meeting

Tender No: NITT/F.No: SIF-001/PLAN/2016-17/MME

Name of the equipment: FESEM with EDS and EBSD attachments

Venue: MME committee room, NIT Trichy

The bidders should submit their bid with the corrections/ additions/amendments/ clarifications provided in column 4 below. The vendors bid should also meet all the technical specifications, tender terms and conditions of the original tender document unless it is modified in the column 4 below. Last date for the submission of bid extended to 1.00 pm 6th Jan 2017 and technical bid will be opened at 2.30 pm 6th Jan 2017.

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Sl. No	Specification	Tender specification as on 30-11-2016	Corrections/additions/amendments/clarifications after the Prebid meeting
1.	Essential scope of the supply and Specifications	FESEM instrument must be the state of art, computer controlled user friendly system for high resolution imaging of metallic, non-metallic, ceramics, crystals, thin films, polymers, metal oxides etc. of micro to nano scale dimensions, which will be either coated/uncoated while imaging. The FESEM should have STEM, EDS and EBSD capability. The FESEM, STEM, EDS and EBSD must have the following technical specification:	
2.	Electron gun	Field emission electron source Schottky FEG	
3.	Resolution	0.8 nm or better at 15 kV and 1.2 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..	0.9 nm or better at 15 kV and 1.3 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..
4.	Acceleration voltage	≤ 0.2 kV to 30 kV continuously adjustable	
5.	Chamber	Large chamber with at least 7	

		accessory ports. Anti-vibration table must be inbuilt.	
6.	Magnification	≤25X to 1,000,000X or more. Minimum and maximum magnification should be specified	≤30X to 1,000,000X or more. Minimum and maximum magnification should be specified
7.	Probe current	Suitable for all applications, and should be up to 100 nA or higher.	
8.	Specimen stage	PC controlled fully eucentric 5 axis motorized stage movements equivalent to X ≥110 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. Store and recall of sample position functions to select features, centre and zoom selected feature, multidirectional stage drive, compucentric rotation.	
9.	Multi Specimen holder	Suitable for loading many specimens (≥ 5); 70 degrees pre-tilt holders-5 nos; Cross sectional sample holders – 1 No Stubs-50 Nos. STEM Holder-1 No	
10.	Removal of sample contamination	Plasma cleaner to be provided	
11.	Detectors	In-chamber SED (Everhart-Thornley). Independent In lens/In column Secondary Electron Detector (SED) or equivalent. Independent In-lens/In-column Backscattered Electron (BSE) Detector or equivalent. Angle Selective BSE/ Directional backscattered	In-chamber SED (Everhart-Thornley). Independent In lens/In column Secondary Electron Detector (SED) or equivalent. Independent In-lens/In-column Backscattered Electron (BSE) Detector or equivalent. Angle Selective BSE/ Directional backscattered detector or

		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 (Optional)	Equivalent Technology. Pneumatically/motorized 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 (Optional)
12.	Camera	Camera (IR-CCD) or suitable device to view the samples and stage inside the chamber.	Navigational camera along with Camera (IR-CCD) or suitable device to view the samples and stage inside the chamber.
13.	Non conductive samples/Magnetic samples	Should be capable of imaging non-conducting samples without conductive coatings. Should be capable of imaging magnetic samples at higher magnifications Provide the details of magnification and resolution.	Should be capable of imaging non-conducting samples without conductive coatings. Should be capable of imaging magnetic samples at higher magnifications Polymer and biological samples to be imaged in the low vacuum mode or using alternate technology to be demonstrated with customers sample. Published literature (Polymer and biological samples) must be supplied with the technical bid.
14.	User Interface	Keyboard, Mouse, Control Panel with multifunction for the control and adjustment of frequently used SEM parameters, Manual Joystick control for stage axis.	
15.	Electron Optics	Beam deceleration technology or equivalent for high resolution imaging at low kV. Ease of operation is desired.	
16.	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. Suitable vacuum system equipped with ion pumps, turbo-molecular pump & rotary pump. Pump down time should be less than 5 min	
17.	Scanning/Display	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; Laser printer with duplex printing at 20 ppm It should have the following capabilities: a. Design of the imaging and processing should be optimized for field emission scanning electron microscopy b. Image Frame Size: Selectable up to pixel density of 4096 x 3536 or better c. Frame averaging for up to at least 250 frames d. Line averaging for up to at least 250 lines e. Combination of Pixel and Frame averaging f. Combination of Pixel and Line averaging g. Image post-processing	

		h. 4 detector inputs and signal mixing or above, extendable up to 8 detector inputs **Image Display** a. 23" high end LED screen or better b. Standard data zone includes magnification, working distance, EHT, scalebar and date Custom data zone c. Multiple point-to-point and line width measurement systems freelyadjustable for orientation d. Line profile display e. Images can be viewed live, averaged or integrated **Image Storage** a. 2 TB hard disk or better b. Front panel USB ports. CD/DVD recorder c. Storage of SEM images on hard disk in standard TIFF, BMP, orJPEG Formats and in 8-bit or 16-bit depth d. Operating conditions easily stored and file management through Microsoft® Windows operating system	
18.	Sample Exchange	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	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 without breaking chamber vacuum
19.	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-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.	
20.	Computer	Intel i7 processor, 2 TB HDD, 16 GB RAM, 2 Gb Nvidia graphics card, three 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.	
21.	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. Software for controlling and analyzing the detectors chosen along with the FESEM should be provided.	
22.	User Interface	Operational keyboard to control and adjustment knobs for frequently used SEM parameters (focus, magnification, etc.)	
23.	Energy Dispersive X-ray Detector	Latest Integrated FET technology based Peltier Cooled Silicon Drift Detector with Ultra dry detector with 30 mm^2 crystal area or higher detector area and with a resolution of ≤125 eV or better Mn Kα @100,000 cps . At the installation site, the detector should also show ≤70	At the installation site, the detector should also show ≤70 eV at F-Kα

		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 Uranium (U).. 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. 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. Should have quantification algorithm for uneven surfaces and under tilted conditions	and 60 eV ≤C-Kα as per established ISO 15632-2012 norms. Printed catalogue confirming compliance to be submitted along with quotation attached.

		Pile up correction and background noise reduction, simultaneous imaging and analysis should be possible. Thin film analysis software with nanometer scale resolution in both space and depth capabilities should be quoted. 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 20.	Thin film analysis software with nanometer scale resolution in both space and depth should be quoted (optional)
24.	Wavelength Dispersive Spectrometer (WDS) (Optional)	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. P10 gas filled cylinders (2 Nos.) to be supplied.	Automatic and fast crystal change should be possible ~~Rowland circle of diameter 100 mm or greater~~

25.	Electron Backscatter Diffraction (EBSD) Detector	Forward Scattering Detector (FSD) should be provided. 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 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/rectangular 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. 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	The EBSD software should also

		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.	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 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.	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.
26.	STEM Detector	The scanning transmission electron microscope (STEM) detector should be capable of detecting bright-field (BF) and dark-field (DF) signals generated by a thin specimen. b. The detector must be automatically inserted into the chamber by a pneumatically driven mechanism. c. The device should consist of a multi hole sample holder, and separate diodes for the BF and DF detection. d. Switching between BF and DF detection mode must be possible at any position of the sample. e. The generated signals should be mixed using the GUI.	
27.	Essential Accessories	• Chiller. Specify the manufacturer and model for chiller. • Compressor. Specify the manufacturer and model for compressor.	

		• Chiller and compressor to be supplied form a reputed manufacturer. • Interface among FESEM, STEM, EDS and EBSD. • Filaments should be supplied and installed without any additional cost as and when they are required up to warranty period of 3 years. It is the responsibility of the supplier to store the filaments and provide it within a short period time. • Cost of the 3 additional filaments (coupons/vouchers valid for ten years) to be quoted for using after the warranty period. • Tools necessary for emitter exchange to be supplied. • 50 number of single stubs and 10 number of multiple • sample holders • 5 sets of aperture strips of 10, 20,30,40,50 microns.	Filaments or assembly as necessary should be supplied and installed without any additional cost as and when they are required up to warranty period of 3 years. It is the responsibility of the supplier to store the filaments and provide it within a short period time. Cost of the 3 additional filaments or assembly as necessary coupons/vouchers valid for ten years) to be quoted for using after the warranty period.
28.	Calibration	Standard samples to check system calibration i.e., magnification etc. should be supplied along with the system.	
29.	Diagnostic support	Remote diagnostics with internet connectivity with the manufacturer to solve hardware and software issues at site (NIT Trichy).	
30.	Power Backup	15 kVA UPS with 2 hour backup for FESEM, chiller and other accessories.	

31.	Electron Optics	Beam Deceleration/Gentle Beam/Beam Booster technology or equivalent for high resolution imaging at low kV.	
32.	Accessories	The year warranty (not including the down time) including parts and labor	
33.	Chamber visualization system	There should be provision to see live positions of detectors and sample.	
34.	Spares and undertaking for spares	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	
35.	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.	
36.	Environmental requirements	Necessary environmental requirements, i.e., temperature, humidity etc during the operation of FESEM/EDS system should be specified clearly. .	
37.	Warranty Training and Service Support	Three years comprehensive on-site warranty should be offered for entire offered configuration of FESEM, all attachments and accessories.(after successful commissioning and installation of the equipment). 3 years warranty includes for both parts and labor (not including the down time) for FESEM and all attachments and accessories also.	

		Warranty applicable to chiller and compressor for 3 years (not including the down time) for both parts and labor. Warranty should start from date of installation. Service response time, turn-around time & up-time of the equipment should be clearly specified. Necessary on-site training must be provided. Service response time must be less than 72 hours 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 1-year 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 on-site enginner should be not only trained in operating, he should be as well as capable of installation and maintenance requirements for smooth uninterrupted functioning of the FESEM 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.	
38.	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 tender – 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 Compliance statement needs to be provided by vendors clearly specifying COMPLY/DO NOT COMPLY for all items with REMARKS.	
39.	Required Documents along with technical specifications	For the equipment quoted, the supplier must provide: a. List of at least 5 users in India, with (exactly) similar systems installed preferably in last 5 years. b. The name(s) of the service engineer(s) employed by them who is/are competent to service the equipment being quoted with their locations in India. c. The supplier should provide calibration/traceability certificate of the equipment as per National institute of Standards & Technology (NIST)/National Physical Laboratory (NPL) UK / United Kingdom Accreditation System (UKAS) preferably.	For the equipment quoted, the supplier must provide: (a) List of at least 5 users in India, with Schottky Field Emission SEMs installed preferably in last 5 years (d). Compliance sheet referencing page numbers in printed catalogue (or) letter from the manufacturer indicating compliance of specifications to be

			submitted along with quotation attached.
40.	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.	
41.	Installation and training	Pre-installation/post-installation and training expenses (including travel, boarding and lodging) should be born by the supplier. 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. Consumables for 3 years	
46.	Warranty period required (Years)	Three years	

N Ramesh Babu
19/12/2016

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