

Indian Institute of Technology Kanpur

Call for quotation: High resolution transmission electron microscope (HRTEM) for atomic contrast imaging and nano/microanalysis

IITK/CHM/sverma/2012

Dated: 29.02.2012

Closing Date: 07.03.2012

Specifications and requirements on High resolution transmission electron microscope (HRTEM) for atomic contrast imaging and nano/microanalysis

1. Basic configuration:

- (a) **Accelerating voltage** :60-300 kV
- (b) **Electron source**: Field Emission Gun (Schottky FEG)
- (c) **Resolution**: Point-to-point resolution 0.1nm or better
- (d) **Information limit**: 0.1 nm

- (e) **Upgradability**: The microscope should be upgradable to achieve point-to-point resolution of 0.08nm with analytical capabilities such as EELS with energy resolution of 0.8eV or better.
- (f) **Specimen tilt**: With motorized tilting $\pm 30^{\circ}$ or better with 3.0mm grid.
- (g) **Compatibility**: The microscope may have scope for variety of in-situ experiments with holder compatibility for like heating, straining, cooling, tomography etc.
Any handicap in these applications should be clearly mentioned with advice/quotes* on alternative suggested. Suggestion should be with minimal sacrifice on resolution and information limit. This should be included in the main package itself.
- (h) **Specimen chamber** Fully computer-controlled Goniometer stage Eucentric, side entry. Goniometer stage should accept variety of specimen holder including heating, cooling and low-background double tilt holders.
- (i) **Specimen movement**: X, Y ± 1 mm or better (Manual, optionally fully computer controlled with specimen position recall facility)

*If there is going to be sacrifice on the resolution because of in-situ applications, a separate cryo-TEM can be quoted for with following specifications to go within this package alongwith 300 kV HRTEM.

- (a) Accelerating voltage : 100-120 kV

- (b) Resolution: Point-to-point resolution 0.24 nm or better
- (c) Tilt : $\pm 70^{\circ}$
- (d) Cryo-holder compatibility
- (e) Tomography compatibility
- (f) Heating holder compatibility
- (g) Strain holder compatibility

2. Mandatory attachments to be included in the microscope configuration

(a) Scanning transmission electron microscope with HAADF detector

- i. With ultra high-resolution STEM High Angle Annular Dark Field (HAADF) detector supported with software for data acquisition and analysis. Bright field, annular dark field and z-contrast modes.
- ii. STEM HAADF resolution: 0.14nm or better
- iii. Collection angle: at least 11°

(b) In-column solid state detector for x-ray energy dispersive spectroscopy

- i. Detector SDD detector with 30 mm² or higher
- ii. Detector range from Boron-Uranium
- iii. Detector resolution 140 eV or better
- iv. Software for qualitative and quantitative elemental analysis, X-ray mapping, Capability for spectrum analysis, Digital control of the beam for composition profile. Phase mapping. Peak deconvolution. Element to phase map and phase to element map. Drift correction facility. Most versatile and state of the art software to be quoted. At least one future software upgrade/version should be provided free of cost. Most versatile model and software with complete features will be preferred.

(c) Data recoding systems: High resolution CCD Camera (retractable bottom mount; 2048 X 2048 or better) including tomography-3D imaging, image processing and diffraction pattern analysis software.

(d) 3-D reconstruction/tomography kit including necessary softwares

(e) Microscope Softwares: Upgradation of the software has to be supplied free of cost as and when it is upgraded within 5years of microscope supply

(f) Specimen holders

- i. Standard single tilt holder (1 no)
- ii. Standard double tilt holder (1 no)
- iii. Low emission holder for EDS analysis
- iv. Tomography holder

3. Optional attachments/accessories

- (a) Additional attachments/upgrades/accessories which enable EELS and microscope capability to a point-to-point resolution $< 0.1\text{nm}$ and STEM resolution/information limit 0.8 nm may be provided as optional with specific details and pricing separately.

- (b) One FEG emitter
- (c) All calibration standard

4. Other items/details to be included in the microscope configuration quote:

- (a) **Vacuum system:** Clean ultrahigh dry pumping differential pumping system. Vacuum should be suitable for FEG (high resolution) and spectroscopic analysis with fully interlocked differentially pumped column.
- (b) **Cooling system:** An efficient automatic temperature controlled closed circuit water cooling system. Proven brand, to be specified.
- (c) **Softwares:** For qualitative and quantitative elemental analysis, X-ray mapping, Capability for spectrum analysis, Digital control of the beam for composition profile. Phase mapping. Peak de-convolution. Element to phase map and phase to element map. Drift correction facility. Most versatile and state of the art software to be quoted. At least one future software upgrade/version should be provided free of cost. Software for analysis of atomic resolution electron micrographs. All software offered should include all period updates for the next 5 years and at least one higher version to be committed free of cost.
- (d) **Guarantee/Warranty:** The entire equipment must have warranty for free repairs and replacement for a period of 5 years from the date of installation and commissioning.
- (e) **Uninterrupted power supply (UPS):** Online UPS two (10 kVA each) for the power back-up of the system for at least two hour, compatible with the FEG TEM and the peripherals.
- (f) **Training:** On site full scale workshop-cum-training to the researchers by the application expert from the principal company.
- (g) **Annual Maintenance Contract:** AMC policy beyond warranty period of 5 years be specified. The quote should specify the response time for call and spare parts.
- (h) **Initial operation and maintenance support for 5 years:** The vendor needs to provide at least two well trained persons to take care of scientific management, maintenance and running the facility for a minimum of five years for the users. An objective declaration on 'Machine down time per annum' must be provided with the acceptable penalty clause specified.
- (i) **The technical specifications should also include the following:**
 - i. The year of the introduction of the model quoted.
 - ii. List of users in India.
 - iii. Number of service engineers trained in the service and maintenance of above system.

5. Terms and Conditions: As per IIT Kanpur Rules

- (a) The supplier and their Indian agent should give evidence of their ability to maintain a 300 kV high resolution TEM and their list of clients including contact address so that one can directly contact whenever there is need, and evidence of maintenance in India. These information/details will be considered as an important technical qualification for evaluation of the bids.
- (b) All the claimed specifications of the microscope and the attachment should be demonstrated after completion of the installation at our site.
- (c) IIT Kanpur reserves the sole right to decide on the technical specifications over and above the specified ones and best suited machine configuration with appropriate attachments/accessories/add-ons.

Tender(s) to be submitted to
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By 5:00 PM on 7th March, 2012