Materials for Radiation Shielding and Cement free concrete Division

Date: 20.11.2018

Sub: Pre-bid conference for procurement of Transmission Electron Microscope Sample Preparation Facility

As per CSIR-AMPRI, Global Tender Invitation Notice Pur/Eqp/40/(2018-19)/NIT-2, regarding procurement of TEM Sample Preparation Facility, a pre-bid conference was held on 19.11.2018 at 3.00PM at CSIR-AMPRI, Bhopal for clarification of queries. No firm attended the pre-bid conference however two following firms have submitted their queries through email:

1. M/s Harley Instruments, Pune
2. M/s Icon Analytical , Delhi

The Technical Sub Committee have gone through the queries of both the firms and recommended for the following amendments in the technical specifications:

S. No.	Item	Specification
1.	ION BEAM MILLING SYSTEM	**Spares/ consumables** ~~• Should be providing with the complete range of essential spares/consumables required for 3 years.~~
2.	TWIN-JET ELECTROPOLISHER (Optional)	~~• Offer additional spares for at least 3 years operation.~~
3.	DIMPLE GRINDER	• Suitable optical microscope for alignment of the sample. ~~• Provide the essential spares/consumables required for 3 years.~~
7.	LOW SPEED DIAMOND SAW (Along with appropriate cutting wheels suitable for Metals, composites & ceramic materials)	• Number of grades of wafering blades (5 no's) should be included.
8.	TEM CROSS SECTION KIT	~~• Offer additional spares for at least 3 years operation.~~
General terms and conditions	• The manufacturer or their representative should undertake to install and commission the above supplied equipment's with all the attachments and accessories and also demonstrate the performance guaranteed as per specifications at site. • The warranty period and AMC policy should be clearly declared. • Assurance about supply of spares and services till the functional life of the equipment should be provided.	

Amended detailed technical specification for TEM Sample Preparation infrastructure consisting of the following items:

S. No.	Item	Specification
1.	ION BEAM MILLING SYSTEM	The ion-beam thinning equipment should be a capable of preparing transmission electron microscopy specimens (3 mm diameter) of both conducting and non-conducting samples, such as metal, alloys, ceramic, semiconductors. Also, it should result in large electron transparent regions for viewing in a TEM; both conventional and high resolution TEM modes. The construction and operation of the equipment should be user friendly. The required technical specifications of the equipment are given below: **Ion-guns** • Two ion guns each with independently adjustable, gas control utilizing mass flow controllers to permit either rapid milling or slow precise ion polishing. • Ion beam energy shall be continuously adjustable from 100 eV to 8 keV or higher. • The alignment of the ion beams should be user friendly. Ion gun should produce sharp and narrow ion beam spot. • Full width at half maximum of the beam diameter shall be around 600-800 micrometer for standard guns at 5 kV with ion current density of ~ 10mA/cm^2. • The milling angle shall be continuously variable from +10 degree to –10 degree or higher. • The ion guns should have very long life with no consumable requirements for continuous operation. • The current range should be variable from 0 to 100 μA, • The current should be measurable for each gun independently and measured at the gun. **Stage and specimen holder** • A specimen exchange mechanism shall be incorporated in the system to permit loading or unloading of samples without venting the work chamber to atmosphere. Specimen stage should allow rapid transfer of specimens (~3 minutes). • The specimen stage should have provision for the rotation of the specimens during milling. Rotational speed shall be continuously variable from 0 – 5 rpm. • The stage should incorporate X, Y motion to assist the user in positioning the specified mill location at the center of the beam polishing area. Details to be provided. • The specimen holder should be able to hold 3 mm diameter TEM specimen by either clamping mechanism or sticking mechanism. For loading/unloading of the sample in specimen holders, suitable user-friendly mechanism should be provided. • The holder should have long life time and durability. They should be compatible for cooling the specimen with liquid nitrogen during the ion milling. • Cold stage should be offered as standard as per the following specifications: a. Dewar and conductor rod should share the main vacuum system. b. Dewar capacity for 4 hours or higher.

		c. The specimen stage should have user defined temperature in the range of -75 °C to 30 °C (i.e., in the cryogenic to room temperature range) or better, during milling. A mechanism to measure the relevant temperature should be provided. **Specimen Viewing** • In-situ viewing should be possible any time without shutting down the ion guns or raising the sample into the airlock. • Sample illumination: Reflection and through transmission with adjustable intensity. • A Stereo Optical Microscope should be supplied along with the ion milling equipment as standard. **Milling Terminator** • Auto-Terminator to be provided with all required instrumentation. **Vacuum System and vacuum reading** • The vacuum system shall be totally self-contained within the enclosure. • A totally oil-free vacuum system, pumping with turbo pump and oil free backing pump • Work chamber base pressure: ~5e-6 Torr or lower. • Operating pressure: ~ 1e-5 Torr or lower. • Suitable gauges to monitor the vacuum levels in main chamber and baking pump. • Vacuum gauge should be present in the chamber area to read the vacuum. **Power** • 230 V, 50 Hz, single phase
2.	TWIN-JET ELECTROPOLISHER (Optional)	• Twin-Jet Electropolisher employing two jets to direct the electrolyte flow onto the sample material, simultaneously polishing both sides of the specimen. • The polishing cell should consist of the electrolyte pump and motor, jet assemblies, specimen holder, receptacles for the light source and photocell, and fiber optic assemblies mounted on a PVC lid. • A variable flow rate pump. • Wide range of voltages and currents to be made available.
3.	DIMPLE GRINDER	• Suitable for 3 mm dia. Sample. • Dimpling depth down to 10 microns. • Digital Micrometer and Analog Micrometer to indicate depth in Dimple Grinder is essential. • Should be capable of terminating the dimpling process at predefined thickness. • Suitable optical microscope for alignment of the sample.
4.	DISC PUNCH	• Should facilitate manual punching of 3mm dia. circular samples of metallic materials. • Should handles hard materials like high strength steel and superalloys. • Should be able to cut discs from samples with thickness from 60 μm to 100 μm or more. • Well designed with appropriate tool for long service life.
5.	HOT PLATE FOR SAMPLE MOUNTING	• With thermostatic control of temperature and suitable sample mount holder.

6.	DISC GRINDER & SPECIMEN LAPPING KIT	• Specimen lapping kit for manual operation of 3 mm dia. samples. • Disc mounts with goniometer with at least 10 micron graduation on the scale. • Specimen lapping kit one heavy metal base with 3 ultra flat glass lapping plates and approximately 100 lapping discs for each grit size.
7.	LOW SPEED DIAMOND SAW (Along with appropriate cutting wheels suitable for Metals, composites & ceramic materials)	• Thin section /wafering equipment for slicing samples from bulk Stock. • Sectioning/slicing equipment should have low speed diamond precision saw. • Coolant circulation facility should be provided. • Wide range of speeds and loads to be made available. • Cut-off wheels for hard and brittle materials, cooling fluid, sample holders and all required consumables & accessories. • Number of grades of wafering blades (5 no's) should be included.
8.	TEM CROSS SECTION KIT	• Complete cross sectional specimen preparation kits for thin films and multilayers should be quoted with all the required accessories. • List out all the parts included in the kit.
9.	ULTRASONIC DISC CUTTER	• Circular cutting tool 3 mm diameter for ceramic and hard materials. • Depth of cut display indicator. • Spring loaded sample stage with X-Y motion.
10.	Plasma Cleaner for SEM & TEM Samples & Sample Holders (Optional)	**Plasma Source:** • The system shall have a low energy glow discharge ion source creating hydrogen and oxygen radicals. • The system shall have appropriate RF Source. • The system shall have auto-tuning to couple the source to the chamber and generator. **Vacuum System:** • Vacuum pumping system shall consist of a two-stage diaphragm pumping stack backing a turbo molecular pump • The pumping system have very short pump down time. **Main Chamber:** • The chamber shall have two airlock ports to support all side entry TEM goniometers **Gas Control System:** • Gas flow controller shall be used. • The system shall support a minimum of three gases these should include Argon, Hydrogen and Oxygen • The gas flow should be controlled using MFCs. • System should be capable of cleaning with minimal plasma damage. • System should be capable to clean holey carbon grids without damaging them.
11.	COMPACT TURBO PUMP BASED SPUTTER COATER / CARBON	• Metal sputtering and carbon evaporation – in one bench top design. • Minimum 50L/s two-stage rotary pump, with oil mist filter. • High vacuum turbo pumped Sputter Coating. • High Current (>100mA) sputter Power Supply. • Precise thickness control using the film thickness monitor.

	COATER (for TEM specimen preparation applications) (Optional)	• Stage should be Rotatable, with tilt and height adjustment. • Automatic vacuum control should be provided, which can be pre-programmed to suit the process and material. • The system should have Thick film capabilities – up to 60 minutes sputtering time without breaking vacuum. • Full range vacuum gauge for low and high vacuum measurement should be provided.

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- The warranty period and AMC policy should be clearly declared.
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