Technical specifications for Transmission Electron Microscopy (TEM) Sample Preparation Setup for Carrying out TEM Analysis

TEM sample preparation set-up is required for the preparation of sample for TEM investigation of metallic materials. Major unit of TEM preparation setup shall comprises of the following:

1. **Precision Vertical Wire Saw**
2. **Slow Speed Diamond Saw**
3. **Disc Punch**
4. **Disc Grinder with Lapping Kit**
5. **Dimple Grinder with Optical Microscope**
6. **Twin Jet Electro-polisher for metallic samples**

1. PRECISION VERTICAL WIRE SAW

Precision vertical diamond wire saw is required for precisely cutting of samples for further prepartion for sample for TEM analysis. The detailed technical specifications of the equipment are given below:

S. No.	Item	Description/Features of the item
1.	Set-up details	i. Bench top instrument with Vertical type with gravity feed for the sample ii. Should be suitable for cutting sample of 50 x 50 x 50 mm or 50 mm diameter iii. Minimum thickness to be sectioned 0.5 mm or better iv. Sample positioning micrometric table mounted inside wire loop. v. It should have micrometric cut end switch and cutting time counter vi. Turn Table with 360° movement with Graduation marking. vii. Sample holder should be supplied with suitable ceramic mounting plate. viii. Drum – Suitable drum of ϕ 80- 100 mm pre wound

		(min 10 meter) with diamond wire. ix. It should be supplied with suitable rewinding device x. Diamond Wire of ϕ 0.1- 0.3 mm (60 μm) of minimum length of 120 meter shall be supplied xi. Should be supplied with suitable wire cleansing solution- 1 bottle
2.	Precision vertical diamond wire saw	i. Smooth, sharp-edged cut surfaces ii. Vertical arrangement of the wire iii. Linear feed (60 mm or more) iv. Variable wire speed v. Automatic shut-down of the saw upon termination of cutting or in the event of wire breakage vi. Equipment for operation with cutting fluids vii. Easy servicing and largely maintenance free viii. The specimen holder should be situated inside the wire loop such that it can serve as a reference while the specimen can be turned
3.	Power supply available	i. 230V, 50 Hz Operation, 1- Phase
4.	Consumables/ Spares (Accessories attachments required)	Provide the following spares /consumables. i. Double vice (Dimensions 55 x 75 x 40 mm)- 1 No ii. Vice for round samples of Dia.: 12-32 mm; Dim.60x45x40mm – 1 No iii. Sample holder (Dimensions 60x40x40 mm w/5 ceramic plates) – 1 No iv. Stereo Microscope, Zoomable upto 80X v. Mounting Assembly for Microscope vi. Plexiglas cover for Vertical Saw- 1 No vii. Replacement Spool of 120 m Diamond Wire (Standard Dia. 0.22mm, of 40μ Diamond Grit- 1 Spool viii. Replacement Spool of 120 m Diamond Wire (Standard Dia. 0.3 mm, of 60 μ Diamond Grit- 1 Spool ix. Adhesive Wax 100° C- 1 No x. Cleansing Concentrate Bottle 500ccm – 1 No xi. Wire Holding Clamps – 1 set of 8 - 5 Nos List of additional spares/consumables reqyured for 3 years of normal operation should be provided

2. SLOW SPEED DIAMOND SAW

S. No.	Item	Description/Features of the item
1.	Slow speed diamond saw	**I. Motor Details** a. Motor shaft speed: continuously variable range from 100-420 rpm b. Diameter : 12.5 mm (min) c. Wheel diameter Range : 75-125 mm **II. Specimen Holder**: a. **Universal Specimen Holder :** i. Arm balance specimen holder which can able to handle work pieces up to 200 g ii. Cutting pressure range: 0-325 g or better iii. Axial movement: 0-20 mm or better iv. Minimum thickness to be sectioned 0.5 mm or better v. Holding of specimen dia 25 mm or better **b. Other types of specimens holders** i. Single Vice Holder: Opening- 25 mm dia or more- 1 No ii. Double parallel vice holder for long specimen: Opening - 25 mm dia or more- 1 No iii. Round specimen holder: Opening 30 mm dia or more-1 No. iv. Irregularly-shaped specimen holder with screw- 1 No arrangements: Opening - 30 mm or more - 1 No v. Specimen holder for adhesive mounting specimens: Opening : 30 x 40 mm- 1 No vi. Teardrop type specimen holder for round specimen: opening 20 mm dia or more -1 No **III. Cooling system** a. Coolant tank Volume: 250 ml b. Supplied with suitable coolant tank c. Cutting additive for recirculation water to avoid corrosion of machine. **IV. Diamond Cutoff Wheels suitable for ½" holder shaft** a. Dia- 4", thickness- 0.006" - 5 Nos

		b. Dia- 5", thickness- 0.006" - 5 Nos
2.	Power supply available	220 – 240 V, 50 Hz Operation, 1- Phase
3.	Consumables/ Spares (Accessories attachments required)	Diamond Cut off wheels and dresser Dia- 4", thickness- 0.006" Dia- 5", thickness- 0.006" List of additional spares/consumables required for 3 years of normal operation should be provided

3. DISC PUNCH

S. No.	Item	Description of the item
1.	Disc Punch	i. Suitable for 3 mm dia samples, equipment should have 3 mm dia circular punch ii. It should be able to smoothly cut discs from typical metal foil of ~100 μm thickness. iii. Design should ensure the prevention of plastic deformation of the disc, especially in the central region of the specimen, while punching. iv. Preferable user independent, horizontal or vertical cutting/punching action.

4. DISC GRINDER WITH LAPPING KIT

The required technical specifications of the equipment are given below:

S. No.	Item	Description of the item
1.	Disc grinder	i. Disc grinder manual / automated operation should be suitable for samples up to 10 mm diameter with 10 μm graduation on the scale ii. A grinder must be a goniometer type manual disc grinder with precision of 10 μm or better to thin down small samples of 3 mm discs. iii. Should also be suitable for grinding samples down to 25 μm in thickness.
2.	Specimen lapping kit	i. One thick metal base with 3 ultra flat glass lapping plates of lapping discs of 5μm, 15μm and 40 μm with at least

		20 Nos of each size
3.	Consumable/ Spares	Provide the following spares /consumables. Price detials shall be provided seperately in price bid. i. Specimen Mount (Pyrex) (set of 4 x 2 Nos) ii. Specimen Mount (stainless steel) (set of 4 x 2 Nos) iii. Lapping Discs 5µm, 15µm & 40 µm (100 nos. each) iv. List of additional spares/consumables reqyured for 3 years of normal operation should be provided

5. DIMPLE GRINDER WITH OPTICAL MICROSCOPE

The required technical specifications of the equipment are given below:

S. No.	Item	Description of the item
1.	Sample Size	i. Suitable for 3 mm dia. sample
2.	Dimpling process specs	ii. Should have auto terminating facility for terminating the dimpling process when pre-set dimple depth is achieved. iii. Dimpling depth - It should be capable for thinning 100 µm thick sample to 10 µm or less thin sample, iv. Should be able to dimple and polish specimen with uniform thickness. v. Digital Micrometer & Analog Micrometer to indicate depth in Dimple Grinder & progress of dimpling process is essential. vi. It should have a depth indicating display. vii. Digital Micrometer (least count of 1µm) viii. Analog Micrometer (least count of 1µm) ix. Optical microscope should be fitted for setting up of the position where dimple will be made. x. Should be capable of terminating the dimpling process at predefined thickness.
3.	Sample monitoring during grinding	i. Optical microscope (at least 10X magnification) for alignment of the sample essential as should be offered.
4.	Consumables/	Should provide the following spares /consumables. Price detials shall be provided seperately in price bid.

	spare parts	**Spares** i. Phosphor bronze (spherical), 2 mm wide, set of 4- 1 No ii. SS (spherical), 2 mm wide, set of 4- 1 set iii. Polishing wheel 15 mm(standard) set of 4- 1 No iv. Felt polishing rings 15 mm(standard) set of 4- 1 No **Consumables** v. Diamond polishing compounds (2 – 4 µm)- 5 Nos vi. CBN polishing compound (0-2 µm)- 5 Nos vii. CBN polishing compound (4-6 µm)- 5 Nos viii. Alumina suspension 0.05 µm- 10 Nos ix. Felt polishing ring- 6 Sets (each set consist of 15 Nos) x. List of additional spares/consumables required for 3 years of normal operation should be provided
5.	Power supply requirements	i. 220-240 V, 50 Hz, single phase

6. **TWIN JET ELECTRO-POLISHER for electrolytic thinning of the metal specimens**

S.No.	Item	Description
1.	Polishing Unit	i. Automatic electrolyte thinning equipment should allow to prepare perforated specimen of size 3 mm dia for TEM measurements. ii. The unit should have a controller and a polishing unit, compatible with each other. Polishing Unit iii. Should have of set of jets for thinning the specimen. iv. Should have a specimen holder for 3 mm diameter and 0.5 mm thick specimens where one part of the holder should carry a platinum conductor so that electrical connection to the polishing circuit is automatically established. v. The polishing unit should allow polishing from both sides simultaneously, so that the structure is available with minimum deformation. vi. A built-in scan function to determine the correct polishing

		voltage for any material will be given preference. vii. Infrared detector to stop the thinning process automatically as soon as perforation occurs. viii. Should have a well-insulated electrolyte container/tank for cooling and maintaining the desired electrolyte temperature and minimal loss of liquid nitrogen coolant. ix. All the parts, which would be in contact with chemicals, should be made of corrosion resistant material.
2.	Control Unit	A separate control unit should be provided incorporating power supply, programming and monitoring functions. It should have the following features: i. Fully automatic, microprocessor controlled control unit with electronic thermometer and adapter for the connection of Polishing Unit ii. Automatic control for determination of perforation end-point detection and termination. iii. The controller should have digital display of current, electrolyte temperature and elapsed thinning time. iv. Adapter to connect to the polishing unit. v. Mains voltage should be single phase, 220-240 V, 50Hz. vi. Output voltage should be in the range 0-120V DC. vii. Automatic or manual stopping of the polishing process if the temperature of the electrolyte exceeds the selected temperature. viii. Setup should have built-in voltage scan functionality for determination of polishing regime. ix. A database or, manual to accommodate up to 200 user methods of electrolytic thinning for different materials.
3.	Consumables / Spares	Additional specimen holder for 3mm dia. Specimens- 1 No, rate thould be specified seperately in price bid.

General Requirements

1. The vendor should be capable of preparing samples on site using these equipments and demonstrate, train the users in preparing the samples for TEM analysis of different materials of our choice at LPSC.

2. One company/supplier should be responsible to supply all the listed equipment as a package/bundle.
3. Vendor /Supplier offering all these equipment as a package should have an experience of setting up such TEM Sample Preparation labs for at least 5 years as on date of submission of quote. Party should also have executed at least 2 Nos of order in INDIA in the last 5 years. User names and references along with model number and year of supply should be provided along with the bid.
4. **Warranty:** The complete equipment shall be under comprehensive warranty for a period of **1 Year** from the date of successful commissioning & demonstration of performance at our site. During this period, any defects/malfunctions reported are to be attended within short time by the factory trained service personnel at our site for rectifying the defects, including free replacement of spares required. Labour charges, shipment, packing forwarding charges etc. will not be paid during warranty period.
5. **Quote for Extended Warranty-** Party is requested to submit separate quotation for extended warranty for additional two years (year wise cost) after expiery of standard warranty.
6. **Non-Comprehenisve AMC :** Non comprehensive AMC has to be provided immediately after expiry of warranty for the full equipment including all sub-systems and AMC charges shall be indicated in the quotation separately for initial five years (year wise cost) after expiry of warranty. The AMC shall include 2 Nos of mandatory preventive maintenance visit annually and breakdown visits on chargeable basis as on when required, as per attached fomat. **LPSC has the right to include the cost of AMC to decide the lowest offer**.

Description	Each Visit Charge	Charges for each additional day
Preventive maintenance		
Breakdown Visit		

7. **Party is requested to provide the following documentation**
    i. Operations and maintenance manual (hard & soft copies including essential circuit diagrams (as applicable) for all systems have to be provided
    ii. Authorization Certificate from OEM, if equipment is sold by authorized dealer.
    iii. Document certifying that the system offered is brand new and not refurbished/ remanufactured.
    iv. Site preparation guide – with utilities requirement.
5. **Pre-installation requirement:** Bidder should state the space required and condition of floor and any other requirements for installation of the equipment.

6. **Installation, Commissioning and Training:** The equipment must be installed, commissioned and demonstrated with all features at our site. Training of LPSC personnel shall be provided for all the systems and features of equipments, TEM sample preparation for a week free of cost.
7. The supplier should be able to provide after sales support on site (LPSC) for at least 6 years by the factory trained engineers. The supplier should also be able to provide uninterrupted supply of spares and accessories during the above-mentioned period.
8. Delivery period: 6 Months from date of placement of PO.