

	<p style="text-align: center;"><b>INDIAN INSTITUTE OF TECHNOLOGY MADRAS</b> <b>Chennai 600 036</b></p> <p style="text-align: center;">Telephone: [044] 2257 9723/9798 E-mail: tender@imail.iitm.ac.in</p>	
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The Senior Manager (Project Purchase)

**Ref: PH/1920/738/MZCVDF**  
Date: 30.01.2020

**Open Tender No: PH/1920/738/MZCVDF**

**Due Date: 19.02.2020, 5 PM**

**Pre-Bid meeting: - NA**

**Technical Bid opening meeting on 20.02.2020, 4:00 PM at Department of Physics, IIT-Madras.**

Dear Sir/Madam,

On behalf of the Indian Institute of Technology Madras, offers are invited for the supply of **“Multi ZONE CHEMICAL VAPOUR DEPOSITION FURNACE”** conforming to the specifications given in Annexure I.

**Instructions to the Bidder**

- I. **Preparation of Bids:** - The tenders should be submitted under two-bid system (i.e.) Technical bid and Financial bid.
- II. **Delivery of the tender:** - The tender shall be sent to the address mentioned below, either by post or by courier so as to reach our office before the due date and time specified in our schedule. The offer/bid can also be dropped in the tender box on or before the due date and time specified in the schedule.

The tender box is kept in the office of the:

**The Senior Manager,  
Project Purchase,  
IC & SR Building, 2<sup>nd</sup> floor,  
I.I.T. Madras,  
Chennai - 600 036.**

- III. **Opening of the tender:** - The offer/bids will be opened by a committee duly constituted for this purpose. The technical bids will be opened first and will be examined by a technical committee which will decide the suitability of the bids as per our specifications and requirements. All bidders will be invited for opening of the technical bids. For opening the financial bid, only technically qualified bidders will be called.

- IV. Prices:** - The price should be quoted in net per unit (after breakup) and must include all packing and delivery charges to the **Department of Physics**. The offer/bid should be exclusive of taxes and duties. The percentage of tax & duties should be clearly indicated separately. Kindly note that IIT Madras is eligible for concessional GST and relevant certificate will be issued.

In case of import supply, the price should be quoted without custom duty. IIT Madras is exempted from levy of IGST on Imports and eligible for concessional custom duty (not exceeding 5%) and the price should be quoted on EX WORKS and CIP basis (stating the Cost, Insurance, Freight separately) and indicating the mode of shipment.

- V. Agency Commission:** - Agency commission, if any, will be paid to the Indian agents in rupees after receipt of the equipment and its satisfactory installation. Agency Commission will not be paid in foreign currency under any circumstances. The details should be explicitly shown in the tender document even in the case of 'Nil' commission. The tenderer should indicate the percentage of agency commission to be paid to the Indian agent. The Foreign Principal should indicate the percentage of payment and it should be included in the basic price quoted originally (if any)..
- VI. Terms of Delivery:** - The item should be supplied to the **Department of Physics, IIT Madras** as per the Purchase Order. In case of import supply, the item should be delivered at the cost of the supplier to our Institution. The Installation/Commissioning should be completed as specified in our important conditions.
- VII. Technical Bid Opening:** The technical bid will be opened on **20.02.2020, 4:00 PM** at the **Department of Physics, IIT-Madras**. The financial bids of those tenderers who are technically qualified will be opened at a later date under intimation to them.
- VIII. IIT Madras** reserves the full right to accept / reject any tender at any stage without assigning any reason.

Yours sincerely,

**The Senior Manager (Project Purchase)**  
**IC&SR Building, I.I.T. Madras,**  
**Chennai - 600 036.**

## SCHEDULE

### Important Conditions of the tender

1. The due date for the submission of the tender is **19.02.2020, 5 PM.**

The offers / bids should be submitted under two bid system (i.e.) Technical bid and financial bid. The Technical bid should consist of all technical details / specifications only. The Financial bid should indicate item-wise price for each item and it should contain all Commercial Terms and Conditions including Taxes, transportation, packing & forwarding, installation, guarantee, payment terms, pricing terms etc. The Technical bid and financial bid should be put in separate covers and sealed. Both the sealed covers should be put in a bigger cover. The Open Tender for supply of **“Multi ZONE CHEMICAL VAPOUR DEPOSITION FURNACE”** should be written on the left side of the Outer bigger cover and sealed.

2. **EMD: - The EMD (Should be in INR) in the form of Account Payee Demand Draft / Banker's Cheque for 2% of the quoted value of the item; drawn in favor of The Registrar-IIT Madras, payable at Chennai should be enclosed in the cover containing financial bid.** Any offer not accompanied with the EMD shall be rejected summarily as non-responsive.

The EMD of the unsuccessful bidders shall be returned within 30 days of the end of the bid validity period. The same shall be forfeited, if the tenderers withdraw their offer after the opening during the bid validity period. The Institute shall not be liable for payment of any interest on EMD. EMD is exempted for Micro and Small Enterprises (MSE) as defined in MSE Procurement Policy issued by Department of Micro, Small and Medium Enterprises (MSME).

***When a foreign vendor does not have a local agent in India, he can submit a demand draft equal to 2% or wire transfer the amount to our account as detailed in the attachment (Annexure II) and enclose the proof with the financial bid.***

3. **Performance Security: -** The successful bidder should submit Performance Security for an amount of 5% of the value of the contract/supply. The Performance Security may be furnished in the form of an Account Payee DD, FD Receipt from the commercial bank, Bank Guarantee from any nationalized bank in India. **The performance security should be furnished within 21 days from the delivery of the purchase order.**

**Performance Security in the form of Bank Guarantee: -** In case the successful bidder wishes to submit Performance Security in the form of Bank Guarantee, the Bank Guarantee should be routed through the Beneficiary Bank to the end user bank. Otherwise, the Indian Agent of the foreign vendor has to submit a Bank Guarantee from a Nationalized Bank of India.

The Bank Guarantee should remain valid for a period of sixty days beyond the date of completion of all contractual obligations of the supplier including the warranty obligations.

4. **Indian agent:** If an Indian agent is involved, the following documents must be enclosed:

Foreign principal's proforma invoice indicating the commission payable to the Indian Agent and nature of after-sales service to be rendered by the Indian Agent.

- ✓ Copy of the agency agreement with the foreign principal and the precise relationship between them and their mutual interest in the business.

5. The offer/bids should be sent only for a machine that is available in the market and supplied to a number of customers. A list of customers in India and abroad with details must accompany the quotations. Quotations for a prototype machine will not be accepted.
6. Original catalogue (not any photocopy) of the quoted model duly signed by the principals must accompany the quotation in the Technical bid.
7. Compliance or Confirmation report with reference to the specifications and other terms & conditions should also be obtained from the principal.
8. **Validity:** The validity of Quotation should not be less than 90 days from the due date of tender.
9. **Delivery Schedule:** - The tenderer should indicate clearly the time required for delivery of the item (subjected to the executive committee-IITMadras approval). In case there is any deviation in the delivery schedule, liquidated damages clause will be enforced or penalty for the delayed supply period will be levied.  
If there is delay, the penalty will be @1% per week of delay subject to a max of 10% of the value of purchase order and if the delay is more than accepted time frame by IITM, the PO would be cancelled and liquidated damages will be enforced.
10. **Risk Purchase Clause:** - In the event of failure of supply of the item/equipment within the stipulated delivery schedule, the purchaser has all the right to purchase the item/equipment from other sources on the total risk of the supplier under risk purchase clause.
11. **Payment:** - 100% payment will be made only after installation and demonstration of MoS<sub>2</sub> growth at the IIT Madras.
12. **On-site Installation:** - The equipment or machinery has to be installed or commissioned by the successful bidder within number of days (as prescribed by PI) from the date of receipt of the item at site of IIT Madras
13. **Warranty/Guarantee:** - The offer should clearly specify the warranty or guarantee period for the machinery/equipment. Any extended warranty offered for the same has to be mentioned separately (For more details please refer our Technical Specifications).
14. **Late offer:** - The offers received after the due date and time will not be considered. The Institute shall not be responsible for the late receipt of Tender on account of Postal, Courier or any other delay.
15. **Acceptance and Rejection:** - I.I.T. Madras has the right to accept the whole or any part of the Tender or portion of the quantity offered or reject it in full without assigning any reason.
16. **Do not quote the optional items or additional items unless otherwise mentioned in the Tender documents / Specifications.**

17. **Disputes and Jurisdiction:**

**Settlement of Disputes:** Any dispute, controversy or claim arising out of or in connection with this PO including any question regarding its existence, validity, breach or termination, shall in the first instance be attempted to be resolved amicably by both the Parties. If attempts for such amicable resolution fails or no decision is reached within 30 days whichever is earlier, then such disputes shall be settled by arbitration in accordance with the Arbitration and Conciliation Act, 1996. Unless the Parties agree on a sole arbitrator, within

30 days from the receipt of a written request by one Party from the other Party to so agree, the arbitral panel shall comprise of three arbitrators. In that event, the supplier will nominate one arbitrator and the Project Coordinator of IITM shall nominate an arbitrator. The Dean IC&SR will nominate the Presiding Arbitrator of the arbitral tribunal. The arbitration proceeding shall be carried out in English language. The cost of arbitration and fees of the arbitrator(s) shall be shared equally by the Parties. The seat of arbitration shall be at IC&SR IIT Madras, Chennai.

- a. **The Applicable Law:** This Purchase Order shall be construed, Interpreted and governed by the Laws of India, Court at Chennai shall have exclusive jurisdiction subject to the arbitration clause.
- b. Any legal disputes arising out of any breach of contract pertaining to this tender shall be settled in the court of competent jurisdiction located within the city of Chennai in Tamil Nadu.

18. All Amendments, time extension, clarifications etc., will be uploaded on the website only and will not be published in newspapers. Bidders should regularly visit the above website to keep themselves updated. No extension in the bid due date/ time shall be considered on account of delay in receipt of any document by mail.

**Acknowledgement:** - It is hereby acknowledged that the tenderer has gone through all the conditions mentioned above and agrees to abide by them.

**SIGNATURE OF TENDERER  
ALONG WITH SEAL OF THE  
COMPANY WITH DATE**

**Technical specifications for multi Zone Chemical Vapor Deposition (CVD) system to grow transition metal dichalcogenides and their heterostructures.**

- In general, a CVD furnace having horizontal reaction tube with gas inputs, temperature and pressure controllers and vacuum pump is required. We aim to use the solid precursors for the TMD growth.
- Furnace should have a foot print of 2.5m (W) x 1.50m (H) x 0.80m (D) and should be capable of having pre-programmed recipes and process storage controlled with computer and PLC allowing remote access.
- Supplier should also provide a working recipe to grow MoS<sub>2</sub> and demonstrate the growth at IIT Madras campus after installation.

In detail, the CVD furnace should have the following specifications:

1	Furnaces	Two number movable split tube furnaces mounted on chrome plated stainless steel rails. Both furnace should be powered by Kanthal A-1 elements Third zone should be movable jacket type zone placed on quartz tube on a stand.
2	Hot Zone Length	Furnace 1: 200mm, Furnace 2: 200mm Heater Jacket : 75mm
3	Uniform Hot Zone (+/- 5 °C)	Furnace 1: 70mm, Furnace 2: 70mm Furnace 3: 25mm
4	Hot Zone Tube of Quartz	Outer Quartz Tube: Outer Dia: 60mm, Inner Dia: 55mm, Length: 1700mm Inner Quartz Tube: Outer Dia: 45mm, Inner Dia: 40mm, Length: 600mm
5	Furnace Dimension	Furnace 1: Length- 350mm, WxH- 350x350mm Furnace 2: Length- 350mm, WxH- 350x350mm Heating Jacket: Length- 150mm, Dia-200-225mm
6	Furnace Working Temperature	Furnace 1: 1200 °C Furnace 2: 1200 °C Heating Jacket: 600 °C
7	Stand and Control Panel	Furnace should be installed on a table with control panel and PLC touch-screen below the furnace table.
8	Position of MFC	Should be below the furnace table.
9	Material of construction of Both Furnace	Both furnaces should be of dual body type made of powder Coated Cold rolled sheet of suitable thickness.
10	Movement of furnace on rails	Furnaces should be manually moved from side to side with maximum sliding distance of 300mm. Total length of sliding rail is 1300 mm. Two slide stopping clamps should be in place to hold the position of furnaces.
11	Heating rate of furnaces	Upto 30 °C/Min

<b>VOLTAGE AND UTILITY REQUIREMENTS</b>		
1	Power Supply Panel	Through a separate control panel
2	Voltage Rating	Max. power rating should be 12KW, with 3Ø, 4wire
3	Water for chiller	2-3kgf/cm <sup>2</sup> , ½” tube
4	Weight	200 kg Maximum
5	Footprint	2.5m (W) x 1.50m (H) x 0.80m (D)

<b>INSULATION</b>		
1	Insulation type for continuous working at 1200 C	Ceramic fiber board insulation should be used for making furnace. Only those fiber materials are to be used which are not classified as carcinogenic according to TRGS 905, class 1 or 2.
2	Number of insulation layers	2
3	Hot face insulation temp. rating (°C)	1400 C

<b>HEATING ELEMENTS AND THERMOCOUPLE</b>		
1	Heating element type	Should be open type Kanthal A-1 supported on Alumina tube and partially 1/3 rd embedded in Fiber boards
2	Thermocouple type and number	Calibrated by NABL certified lab, K/N Type housed in protective Inconel Tube, Duplex; Four number for three furnaces and in-situ temperature measurement.

<b>FLANGES</b>		
1	Flanges (Water cooled)	<ol style="list-style-type: none"> <li>1. SS flanges with double Viton O-ring for leak tightness.</li> <li>2. Flanges with provision for vacuum and gas purging. Vacuum provision with KF 25 vacuum port.</li> <li>3. Flange specially designed for easy sample loading and unloading with hinge type support.</li> <li>4. Flanges and tube to have heavy duty support</li> <li>5. Flange to have provision for carrying thermocouple for in-situ temperature measurement of samples at two points simultaneously.</li> </ol>

<b>MFC</b>		
1	MFC	Flow Rate-0-200SCCM Four number MFCs, One each for CH <sub>4</sub> , Hydrogen, Argon and Nitrogen
2	Power Supply	0-24 V DC
3	SS Double Stage Regulator	4 numbers
4	Gas Manifold with pipe line of SS310 for 10 meters from gas cylinder to furnace	1 number
5	SS Gas Piping upto Gas Supply Cylinders	Electro polished SS316
6	Necessary gas valves	Needle Valves

<b>Vacuum System</b>		
1	Vacuum pump	Rotary Vacuum dry Pump (HVI-250), Double stage, Direct Drive, Pumping Speed 250 liters per min.
2	25 mm diameter SS bellow for with KF 25 end flange	1 number
3	1 inch butterfly valve suitable for 1 x10 <sup>-3</sup> mbar vacuum	1 number for chamber isolation
4	KF 25 – KF 10 SS T joint	1 number

5	Digital Pirani Gauge	1 number
6	KF-25 Clamps, ring, center ring	1 set
7	KF-10 Clamps, ring, center ring	1 set
8	Flanges	SS flanges with double Viton o-rings

<b>CHILLER SYSTEM</b>		
1	Water Chilling Unit	A chiller unit to chill the water to circulate the SS fittings for the Quartz tube for better vacuum and air purging is required.
2	Capacity	20-30 liter tank
3	Temp controller	Automatic on/off Digital temperature controller with set temperature
4	Cooling	Automatic cooling on/off facility
5	Working Temp Range	5-10 °C for secondary coolant (water)
6	Water Circulation	10 lit/min
7	Wheel Mounting	The water chilling plant should be constructed with the wheel to move the equipment easily.
8	Switches	Independent control for chilling plant and water circulation pump.

<b>CONTROL PANEL</b>		
1	Temperature control system	Driven by touch-screen based PID temperature controller of minimum 16 segments. Data entry by touch screen, key pad and jog dial.
2	Software with preprogrammed recipes.	To ensure ease of use a fully functional PLC/Graphical User Interface (GUI) built around National Instruments LabVIEW software. This PLC/GUI should allow full control of each system parameter, load and save custom growth recipes, and enables “1-click” unattended operation via an auto process feature. Pressure should be manually set between 0.1 to 30 torr during growth cycle.
3	Temperature control resolution	+/- 1°C for entire temperature range
4	Over current & temperature protection with alarms	Yes, with system interlocks programmed in PLC

<b>SPARES</b>		
1	Sample placement rod	SS rod to place sample at center of hot zone
2	Sample handling wares	Quartz boat of length 10cm : 4 numbers
4	O-rings for flanges	2 set (8 numbers)
5	SSR for furnaces	2 set ( 4 numbers, 2 for each furnace)
6	PP coated fume hood	<ul style="list-style-type: none"> <li>• Laboratory fully acid proof polypropylene fume hood. Working size: 4 feet L , 2.5feet W and 7.5feet H with provision of water containment and easy removal just below work top.</li> <li>• Transparent Sliding front Door, Auto Bypass Standard, Chemical Storage Base Cabinet, LED Tube Light 15watt, Water Sink : Size 200mmX100mm</li> <li>• Gas &amp; Water Line on/off Valve, Electrical 4 Point.</li> <li>• PP FRP Exhaust Blower 2HP 1440 RPM</li> <li>• PP FRP Pipe 10” 20 Feet dia 4mm thick with Tee&amp; Elbow pipe Holding Clamp, 10” PVC Flexible Pipe</li> <li>• Exhaust Air Ducts (Exhaust ducts to open at roof top), ON/OFF PP Dampeners 2000 CFM, 3Phase Electrical Power 3.7KW. 3phase/Voltage 415V.</li> </ul>



<b>Acceptance Criteria</b>		
1	Training and hand holding	Should train the students at IITM immediately after completion of installation of equipment.
2	Manual	Should provide a detailed operating and service manual with drawing and circuit diagram in English.
3	Users details	Supplier must have installed similar furnaces at least in 15 institutions in India. Supplier should provide the contact details (address, email id, phone number) of all these users.
4	Warranty	3 Years on all components of the furnace, electrical parts, vacuum pump.
5	Payment terms	100% payment will be made only after installation and demonstration of MoS <sub>2</sub> growth at the IIT Madras.



CENTRE FOR INDUSTRIAL CONSULTANCY & SPONSORED RESEARCH (IC&SR)  
INDIAN INSTITUTE OF TECHNOLOGY MADRAS  
CHENNAI 600 036



**ELECTRONIC CLEARING SERVICE (Credit Clearing) / REAL TIME  
GROSS SETTLEMENT (RTGS) FACILITY FOR RECEIVING PAYMENTS**

**A. Details of Account Holder**

Name of the Institution	Indian Institute of Technology - Madras
Complete Contact Address	Industrial Consultancy and Sponsored Research Indian Institute of Technology-Madras, IIT- Madras Campus Post Office, Sardar Patel Road, Guindy, CHENNAI - 600 036
Telephone No./ Fax No.	Tel - 044-22578355 / Fax - 044-22570545
E- mail ID of the FO/AO/REG/DIR	dricsr@iitm.ac.in

**B. Bank Account Details:**

Institution Account Name (As per Bank Record)	The Registrar, Indian Institute of Technology - Madras
Account No.	2722101001741
Account Print Name	IIT F A/C , The Registrar IIT Madras
IFSC CODE	CNRB0002722
Bank Name (in full)	Canara Bank
Branch Name	IIT-Madras Branch
Complete Branch Address	Canara Bank, IIT-Madras Branch, IIT- Madras Campus Post Office, Sardar Patel Road, Guindy, CHENNAI - 600 036
MICR No.	600015085
Account Type	Savings Account

Certified that the Institute's account is in an RTGS enabled branch.  
I hereby declare that the particulars given above are correct and complete.

Date: \_\_\_\_\_ Signature of the Competent Authority  
of the Institution with seal.

*K. M. G. R.*  
DEPUTY REGISTRAR (IC&SR) (Vc)  
IC & SR, I.I.T. MADRAS  
CHENNAI - 600 036

Certified that the particulars furnished above are correct as per our records.

Date: \_\_\_\_\_ For **CANARA BANK**  
Signature of the Authorized  
Bank Official with Bank Seal.



*B. Sekar*  
SENIOR MANAGER  
I.I.T. CHENNAI-600 036.

**B. SEKAR**  
Senior Manager  
SP No 39312



CENTRE FOR INDUSTRIAL CONSULTANCY & SPONSORED RESEARCH (IC&SR)  
INDIAN INSTITUTE OF TECHNOLOGY MADRAS  
CHENNAI 600 036



K VIJAYALAKSHMI  
DEPUTY REGISTRAR (IC&SR) *KL*

Project Accounts  
July 5, 2019

TO WHOMSOEVER IT MAY CONCERN

In connection with project, US currency may be transferred to CANARA BANK, IIT – MADRAS  
Branch In connection with the following details.

**FOR TRANSFER OF CURRENCY US DOLLAR**

**Please Credit in USD**

(THROUGH)

JP MORGAN CHASE, NEW YORK  
SWIFT CODE: CHASUS33

**For credit to**

USD ACCOUNT No: 001 – 1395969, of CANARA BANK INTERNATIONAL DIVISION MUMBAI

**For Further Credit to**

ACCOUNT NO: 2722101001741 of IIT Chennai – Swift Code: CNRBINBBIIT OF THE  
REGISTRAR, IIT, MADRAS

*K Vijayalakshmi*  
DEPUTY REGISTRAR(IC & SR) i/c

This is to certify that particulars furnished are correct.

*[Signature]*  
Senior Manager  
Canara Bank – IIT Madras branch

B. SEKAR  
Senior Manager  
SP No. 39312



DEPUTY REGISTRAR (IC&SR) (i/c)  
IC & SR, I.I.T. MADRAS  
CHENNAI - 600 036