NATIONAL CENTER FOR COMBUSTION RESEARCH AND DEVELOPMENT (NCCRD)
INDIAN INSTITUTE OF TECHNOLOGY MADRAS
CHENNAI – 600036, INDIA

Ref. No. ICS/11-12/013/DSTX/TSUN **Date: 21 May 2014**

Due date: 11 June 2014

Item name: MICROWAVE REACTOR

1. Quotations are invited in duplicate for the items shown overleaf (in Annexure I). The quotations duly sealed and superscribed on the envelope with reference no. and due date, should be addressed to the undersigned so as to reach on or before the due date mentioned above.
2. The quotations should be valid for sixty days from the due date and the period of delivery required should also be clearly indicated.
3. The total cost of the equipment in terms of CIP Chennai should be clearly mentioned.
4. Terms of warranty and guarantee should be explicitly mentioned.
5. Packing and delivery charges, customs and clearance duty should be clearly stated.
6. Goods shall not be supplied without an official supply order.
7. Local firms : Quotations should be for free delivery to this institute. If quotations for ex-godown delivery charges should be indicated separately.
8. Firms outside Chennai: Quotations should be for F.O.R. Chennai. If F.O.R. consignor station, freight charges by passenger train / lorry transport must be indicated. If ex-godown, packing, forwarding and freight charges must be indicated.
9. The rate of sales / general taxes and the percentage of such other taxes legally leviable and intended to be claimed should be distinctly shown along with the price quoted. Where this is not done, no claim for sales / general taxes will be admitted at any stage and on any ground whatsoever. The taxes leviable should take into consideration that we are entitled to have Concessional Sales Tax (CST) applicable to non-government educational institutions run with no profit motive for which a concession sales tax certificate will be issued at the time of final settlement of the bill.
10. Payment : Specify the mode of payment and if advanced payment has to be made. Every attempt will be made to make payment within 30 days from the date of receipt of bill / acceptance of goods, whichever is later.
11. IIT Madras is exempt from payment of excise duty and is eligible for concessional rate of customs duty. Necessary certificate will be issued on demand.
12. IIT 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.
13. In case of any queries/clarifications, please contact Dr. R. Vinu, Dept. of Chemical Engineering, IIT Madras, Chennai, Ph. +91-44-22574187, E-mail: vinu@iitm.ac.in.
14. The sealed quotation may be sent to

    Prof. S. R. Chakravarthy
    NCCRD Office
    No. 201, Rarefied Gas Dynamics Lab (Behind Aerospace Engineering Dept.)
    Chennai – 600036
    (P) +91-44-22575025

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Annexure I

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Specifications for Microwave Reactor

Scope of the instrument: Pretreatment of biomass, Cellulose hydrolysis, Pyrolysis reactions, Biofuel synthesis, Reactions under inert gas or reactive gas atmospheres and Heterogeneous catalytic reactions under atmospheric pressure and high pressure conditions.

Modes of operation: Batch and Parallel reaction modes.

Microwave cavity: Stainless steel housing coated with Teflon. Resistant to chemical attacks.

Cavity should be illuminated during operation

Magnetron: Single or dual magnetron system with diffuser for homogeneous distribution of microwaves.

Power output: 1000 W (1200 W preferable). Power level should be controlled by microwave processor. Should be possible to set time/power programs in pulsed or continuous mode.

Temperature control: IR-based temperature sensor shielded to avoid ignition and a suitable controller for temperature tuning.

Provision for fiber optic/thermocouple-based sensor (quote separately).

Pressure control: Pressure monitoring and control systems which can deliver pressure up to maximum limit of the reaction vessels.

Reaction vessels:

- Batch reactor:

  Vessel volume - atleast 200 mL working volume (upgradable upto 2 L)
  Maximum Temperature - 200 °C (250 ^{o}C desirable)
  Should contain vessel rotation system (inclined or horizontal configuration for slurries), which delivers homogeneous temperature distribution.

- Parallel reactors: Vessel volume - atleast 30 mL working volume

  Maximum Temperature - 200 °C (250 ^{o}C desirable)
  Maximum Pressure - 40 bar
  Number of vessels/tubes - atleast 8; upgradable at a later stage to 20
  Magnetic stirring in each reaction vessel, with adjustable speeds.

Accessories: Reflux setup for reactions involving volatiles under atmospheric pressures. Should be possible to use round bottom flasks of volume upto 500 mL. A provision for inert gas purging or gas injection into reactor vessels to facilitate gaseous/ gas-liquid/ gas-solid reactions is also desirable. Stirring of the reaction mixture should be possible.

Material of construction of reactors/vessels: quartz or ceramic, capable of withstanding the above mentioned temperature and pressure limits.

Provide standard consumables kit.

Software: User friendly system to save and run experiment method files and easy storage of temperature and pressure data in USB drives. Touch screen mode of operation is preferable. Data should be readable in any Windows O/S. Instrument should have extra USB/serial ports for connecting printer and other hardware devices.

Safety: Appropriate interlock system to prevent emission of microwaves into atmosphere.

Power requirements: 230 V/ 50-60 Hz. Socket: Three pin (Indian Type).