


**DEPARTMENT OF CHEMICAL ENGINEERING  
INDIAN INSTITUTE OF TECHNOLOGY DELHI**

**NOTICE INVITING QUOTATION**

May 22, 2012

The department of chemical engineering wishes to procure a *Dynamic Rotational and Oscillatory Rheometer* as per the **attached technical specifications**. Interested vendors may send their "Technical Bid" and "Financial Bid" in two separate envelopes mentioning the same. The item for which the bid is **should be mentioned** clearly on the envelopes along with the tender number. The bids, as per the **attached specifications**, should be submitted latest by June 13, 2012 to:



Prof. Bhaskarwar A  
Head of the Department  
Department of Chemical Engineering  
Indian Institute of Technology Delhi  
Hauz Khas, New Delhi - 110016  
India

**TERMS AND CONDITIONS**

1. **The technical bid should accompany a compliance chart.**
2. **Bidder providing misleading or wrong information will be disqualified.**
3. Enclose the pre-installation guide for the details on power and room plan.
4. The quoted equipment should comply the Indian Power supply (220 V, 50 Hz) condition.
5. Vendor should provide purchase order execution copy of the same equipment in any central government organization, India in last 5 years (Enclose full list of users in India)
6. 3 years essential spares including all important control electronics should be provided. The detailed list of spares to be enclosed.
7. Minimum five representative spectra should be provided to establish performance of the instrument for the solid, liquid and colloidal as well as thin film samples.
8. One set of operating manual and service manual (in English) should be provided with the equipment.
9. Routine training on Principal's Supply Centre and Application Laboratory for 10 working days as well as training during installation at site free of cost.
10. **Apart from the specification given above, all the higher specification, resolution, and advance in-built technology model will be preferred.**
11. Indicate proof of being a genuine dealer for the brand you are quoting.
12. If there is any deviation from the mentioned requirements, make sure to mention it clearly in your quotation.
13. **Mention the warranty / installation / insurance / freight terms clearly. The financial bid should contain the charges for complete installation including wiring etc. if required.**
14. Provide a photocopy clearly indicating PAN/TIN number and sales tax registration details.
15. Please keep the Technical and Commercial Bid in different sealed envelopes mentioning the Subject, Ref. No. Due Date etc. (Tender will be rejected if Technical and Financial bids are not quoted separately).
16. Payment terms will be according to IIT Delhi rules.
17. IIT Delhi reserves right to accept/reject any or all quotations without assigning any reason.

For any queries, interested parties may contact Dr. Gaurav Goel on 9810607784 or 011-26591025; email: [goelg@chemical.iitd.ac.in](mailto:goelg@chemical.iitd.ac.in).



Dr. Gaurav Goel  
Assistant Professor  
Department of Chemical Engineering  
Indian Institute of Technology Delhi  
(Buyer)

### Specifications of *Dynamic Rotational & Oscillatory Rheometer*

<b>A) Motor Technology</b>	
1.	Air-bearing-supported Synchronous motor or Brushless DC motor for precision dynamics. Motor torque output should not change with temperature or cause motor heating. Motor torque should be proportional to motor current. Dual Air bearing technology - with a radial and axial air bearing supporting the motor.
2.	The Rheometer should cover a torque range from 2nNm to 200mNm (or better) with resolution of 0.1nNm (or better).
<b>B) Motor Dynamics</b>	
1.	The Rheometer should cover a frequency range from $10^{-7}$ to 628 rad/s or better.
2.	It should have rotational speed from $10^{-9}$ to 314 rad/s or better.
3.	It should have a Sample-adaptive Shear-rate controller to intelligently adapt to the sample conditions at hand without prior information on the sample. The sample strains, shear rates or stresses should be precisely controlled without any pre-testing.
4.	It should have real-time position control over the complete sine wave for drift-free strain-controlled oscillatory measurements at nano-torques and strains.
5.	It should have Digital Current sources integrated with high-speed digital signal processing to perform measurements at data rate of 2ms or less per data point.
<b>C) Motor measurements</b>	
1.	It should have a high-resolution optical encoder for nano-strain measurement with a strain resolution of 10nrad or better.
2.	It should have a Normal force sensor integrated in the air bearing with capacitive measurement principle. The Normal force measurements should be possible during transient and steady-state tests as well as static normal force measurements for DMTA, tack, or penetration tests. Normal force measurements should be available for all temperature devices and application-specific accessories.
3.	The Normal force range should be from 0.005 to 50N (or better) with a Resolution of 0.0005 N (or better).
<b>D) Measuring tools gap setting/control</b>	
1.	Automatic gap setting for controlled & reproducible sample loading.
2.	Automatic compensation for thermal expansion of the measuring systems.
3.	A gap speed controllable from 10 micrometer/sec to 16000 micrometer/sec for tack/squeeze measurements .
4.	Direct measurement and precise adjustment of the measuring gap to the desired position irrespective of the temperature and thermal expansion. One single zero-gap setting should suffice allowing flawless documentation and complete traceability of the actual gap.
5.	Indicate and confirm sample thermal uniformity using the feedback from the gap sensing mechanism.
<b>E) Measuring Systems</b>	
1.	Measuring systems with built-in transponder chip for automatically recognizing and configuring all systems as soon as they are connected to the rheometer.
2.	Compliance free screw-less quick connect fitting for easy connection/exchange of measuring systems.
3.	Geometries: One Plate-Plate (50mm Diameter); Cone-plate (25mm Diameter with 1deg Cone Angle; 25mm Diameter with 2deg Cone Angle & 50mm Diameter with 1deg Cone Angle- one each)); One concentric cylindrical measuring system with a cup having a gap of 20mm and a height of 200mm.

**F) Temperature Control System**

1. An independent Peltier plate system with a temperature range of -20 °C to 200 °C (or better) with auto-recognition.  
This Peltier temperature control should be common with C/P & P/P measuring geometries and rheo-microscopy. The same Peltier temperature control should be common with SALS/ UV Cell attachment /Fluorescence Microscopy attachment for up-gradation in future.
2. It should be supplied with another independent liquid temperature control based co-axial cylinder device with temperature range of -20 °C to 180 °C (or better).
3. It should be provided along with an effective counter-cooling circulation system.

**G) SPECIAL ACCESSORIES: RHEO-OPTICS MODULE**

The following rheo-microscope setup (upgradable to rheo-SALS) needs to be offered.

1.	Rheomicroscope Setup	Brightfield setup with same side illumination.
	Lens System	20x with air-cooling arrangement.
	Resolution	1 µm or better (20x lens).
	Polarizer Setup	Twin polarizer installed for polarized microscopy
	Capturing/Recording Camera	1/3" CCD Camera
	Field of View	0.22mm x 0.165mm (20x lens)
	Light Source	Cool shadow free illumination from 150W visible light source
	Temperature Control	Transparent Peltier plate system to mount rheo-optics module like rheo-microscope, rheo-SALS, etc. with a temperature range of -20 °C to 200 °C (or better).
2.	The Rheometer should be up-gradable to Interfacial Rheology, Small Angle Light Scattering Systems (SALS), UV Cell attachment, Fluorescence Microscopy attachment, Small Angle X-ray Scattering Systems (SAXS), Di-Electroscopy, Magnetorheology, Tribology attachments & DMTA attachment (Solid samples, Thin Films & Fibers)	

**H) Rheology software:**

The Rheology software should provide for real-time position control in oscillation to ensure fast and accurate strain control. It should also provide for an adaptive controller in rotation and step strain. Further, it should allow for following measurements:

	Architecture	Template based with at least 60 built-in templates pre-programmed for all types of materials.
	Analysis Modules	Integrated modeling/curve fitting, inter-rheological conversion, data reduction and handling protocols with special optional modules like master curve, intrinsic viscosity module, spectrum relaxation/retardation, molar mass distribution, rheo-optics adapter module, squeeze flow rheology, and extensional rheology modules.
	Testing Protocols	Rotational with control stress/combination of CSR + CSS. Oscillatory with direct strain amplitude/control stress. Transient with creep (single/multi-level)/step-strain (stress relaxation). Combination with any modes above, e.g., Transient + Rotational. Superimposed steady and oscillatory shear flow.

**I) Air Compressor:**

Compact oil free air compressor commensurate with the rheometer specifications, and necessary tubing and connector & membrane air dryer/filter.