

Revised Detailed Technical Specifications for Rhemoter Based
on Pre Bid Conference

1.MAIN INSTRUMENT		
1.1. Measuring head type	Direct current synchronous motor or Single rotational & oscillatory motor for combined motor transducer mode. under simultaneous rotational shear & oscillation.	
1.2. Torque Range	1.2a. Min. Torque (Rotation / steady shear)	1.00 nNm or lower
	1.2b. Min. Torque (Oscillation)	0.50 nNm or lower
	1.2c. Max Torque	200 mNm or above
1.3. Motor Bearing	Air Bearings / Magnetic Bearings	
1.4. Motor control	Digital current source with high-speed digital signal processing.	
1.5. Speed Range / Angular Velocity	0 To 300 Rad /s or better	
1.6. Frequency Range	10E ⁻⁶ To 100 Hz or Better	
1.7. Strain Sensor / Displacement Sensor/ transducer	Optical Encoder	
1.8. Measurement Types	Rotational, Oscillatory and Transient (Creep & Relaxation)	
1.9. Normal Force Range	0.005 N To 50 N or better	
1.10. Gap Control (Standard)	Automatic precise Gap Compensation related to normal force.	
1.11. PC Interfaces	Direct USB Interface, Ethernet and Serial Interface	
1.12. Warranty	Minimum one-year onsite warranty from the date of satisfactory installation. To quote for 5 years AMC, post warranty this will not be considered in the BOQ.	

1.13. Spares & Service	Support availability: Minimum 10 years from the date of satisfactory installation.
1.14. Upgradability	The rheometer should be upgradable to Starch Pasting Cell, Tribology cell, Fluorescence Microscopy, Rheo-Raman, Humidity Attachment, Small Angle Light Scattering. This should be invariably confirmed on the manufacturer's website & product brochure.
2. TEMPERATURE CONTROL DEVICES	
2.1. A Peltier temperature control for cone/parallel plate / sand blasted or Crosshatched or Serrated plate measuring geometries	
2.2. Temperature Control	Peltier Temperature Control
2.3. Temperature Range	5 °C To 200 ° C or better
2.4. Max Heating	20 °C /Min or Better
3. REQUIRED GEOMETRIES FOR MEASUREMENT	
Plate/Plate & Cone/Plate Geometries	<p>3.1 . 40 mm or above Parallel Plate Geometry made of SS- 1 Qty.</p> <p>3.2 . 40 mm or above Smooth Surface Cone plate (SS) with 1 or 2 Degree - 1 Qty.</p> <p>3.3 . 40 mm or above - sand blasted or Crosshatched or Serrated plate - 1 Qty.</p> <p>3.4 . The above Geometries should have auto tool recognition or similar mechanism by the rheometer software.</p>
4. ADVANCED RHEOLOGY ACCESSORIES	
4.1. Microscopy Attachment	<p>4.10. Rheo Microscope:</p> <p>4.11. Temperature range: -10 to100 Deg. C or better</p> <p>4.12. Temperature controller type: Peltier</p> <p>4.13. Suitable Heating rates & Cooling rates</p> <p>4.14. high-resolution camera or Color CCD Camera for Image/ video Capturing</p> <p>4.15. Mode: Polarization microscopy for birefringent samples, brightfield or darkfield</p> <p>4.16. Objective Lens with 20X (Long working distance) Magnification with correction for the optical properties for best image quality</p>

	<p>4.17. High intensity LED light source or Modular Light source</p> <p>4.18. Rheometer / Microscopy / Software should capable of automatically records images and video simultaneously during rheological testing of samples.</p>
4.2. Powder Rheology accessories	<p>4.21. The Powder Rheology Accessory should provide ambient measurements of both consolidated powder (Shear) and loose, free-flowing powder (Flowability).</p> <p>4.22. Should be offered with the powder shear cell</p> <p>4.23. Software should be able to measure the Bulk Density, Wall friction angle, Caking, compressibility cohesion, flow function, yield strength, angle of internal friction</p>
5. UTILITIES	
5.1. Air Compressor	100Psi, 5cfm Oil-free or Suitable
5.2. Air Dryer	Multistage with Micro-filters or Suitable
5.3. Circulator / Chiller	Suitable circulator/chiller to be quoted, for proper functioning of the Rheometer, in the given temperature range and compatible for future upgradeability.
5.4. Desktop Computer, Printer & Table	<p>5.4.1. Computer DELL / HP or equivalent (factory installed software, Licensed windows 11, 64bit, MS office packages - commercial license) with i9 processor (11th Generation or better), 32 GB ram, 2TB SSD, 4GB or higher NVIDIA graphics card, Keyboard and Mouse, licensed anti-virus software, DVD writer, Speaker, Connectivity- Wi-Fi 5 (11ac, 2x2) or better Bluetooth 4.0, 26" or above ultra-wide screen LED monitor, USB HD Webcam with Built-in Mic or Inbuilt HD Web CAM, USB 3.0/1394b firewire port, USB 3.2 Type-C, suitable HDMI and RJ45 ports. The system should compatible with the rheometer / software/ microscopy. - 1 No</p> <p>5.4.2. Computer DELL / HP or equivalent (factory installed software, Licensed windows 11, 64bit, MS office packages - commercial license) with i7 processor (11th Generation or better), 16 GB Ram,</p>

	<p>2TB SSD, 4GB or higher NVIDIA graphics card, Keyboard and Mouse, licensed anti-virus software, DVD writer, In-built Speaker, Connectivity- Wi-Fi 5 (11ac, 2x2) or better Bluetooth 4.0, 22" or above ultra-wide screen LED monitor, USB HD Webcam with Built-in Mic or Inbuilt HD Web CAM, USB 3.0/1394b firewire port, USB 3.2 Type-C, suitable HDMI and RJ45 ports. The system required for post data processing / rheological regression model fitting, should compatible with the rheometer software. - 1 No.</p> <p>5.4.3. All-in-One Color Laser Printer (HP LaserJet Pro MFP M128fw or equivalent) Auto- Duplex, Scan & Copy, ADF with Built-in Ethernet and Wi-fi Direct - 1 No.</p> <p>5.4.4. Suitable vibration free table for main instrument shall be provided - 1No.</p>
5.5. Warranty	Minimum one-year warranty on computer & monitor.
5.6. Installation & Commissioning	Installation & Commissioning, Training & demonstration of operating procedure of the instrument are under the scope of the supplier.
6. RHEOLOGY SOFTWARE	
6.1. Architecture	Template based with at least 100 built-in Templates Pre-Programmed for all Types of Materials
6.2. Analysis Modules	Integrated Modelling/Curve Fitting, Rheo-Optics Adapter Module, Squeeze Flow Rheology and Extensional Rheology Modules.
6.3. Testing Protocols	<p>6.31. Oscillation Mode Tests:</p> <ul style="list-style-type: none"> a. Torque/Stress sweep (linear or log) at single frequency b. Frequency sweep (linear or log) at single torque c. Frequency sweep (linear or log) at single strain d. Strain/angular displacement sweep

	<p>(linear or log) at single frequency</p> <ul style="list-style-type: none"> e. Temperature sweep at single frequency/torque f. Superimposed stress oscillation and steady shear g. Superimposed strain oscillation and steady shear h. Multiple simultaneous frequencies superimposed on above modes <p>6.32. Flow Mode Tests:</p> <ul style="list-style-type: none"> a. Controlled stress or torque sweeps. b. Controlled rate (1/s) or speed (rad/s) sweeps. c. Stress stepped flow. d. Equilibrium stress stepped flow (ensures material has time to respond to each level of stress). e. Temperature sweeps at constant stress or rate. <p>6.33. Creep Mode Tests:</p> <ul style="list-style-type: none"> a. Constant stress creep and recovery. b. Automatic sensing of steady state during creep test. <p>6.34. Suitable software for Powder rheology measurement</p> <p>6.35. Suitable software for Rheo-Microscope measurement</p>
6.4 Calibration	Manufactures calibration certificate / traceability, re-validation standards
<p style="text-align: center;">7.0 Spares /consumables / Standards:</p> <p>Silicon Viscosity Standards to be supplied in bottles, each bottle containing at least</p>	

500 mL of the standard fluid. Each Viscosity Standard should be duly calibrated at three different temperatures (24, 21 and 18 deg C), and supplied with a certificate of calibration. Accuracy should be +/- 1% (or better) of the viscosity value at the specified temperatures.

Standards (viscosity) and quantities required:

i. 50 CPS: 1 bottle, ii. 100 CPS: 1 bottle, iii. 500 CPS: 1 bottle

8.0 Manuals:

All the operational manual, application manual as well as service manual along with schematic in English are to be provided both as soft copy or hard copy. Test Reports for all the modes of operation to be provided.

9.0 Training at Site:

The supplier shall provide on-site training with regular operation and maintenance of the instrument. **Application specialist should provide special training about sample analysis** (Data collection, measurements and data analysis, etc.)