

1. Simultaneous TG-DTA (1500 °C)

| Features | Specifications |
|--------------------------|---|
| General description | State-of-the-art Simultaneous Thermal Analyser capable of measuring Thermogravimetry and Differential Thermal Analysis |
| TG specifications | |
| Measuring range | Upto 1500 mg |
| Noise (RMS) | 1 µg or better |
| Resolution | 1 µg or better |
| Sensitivity | 0.2 µg or better |
| Balance precision | ±0.3% or better |
| DTA specifications | |
| Measuring range | ± 1000 µV or better |
| Sensitivity | 0.1 µV or better |
| Noise | 0.03 µV or better |
| Common for TG & DTA | |
| Temperature range | Ambient to 1600 °C |
| Heating rate | 0.1 to 100 °C (K) /min or better |
| Temperature accuracy | 1 °C or better at all temperatures |
| Segment types | Static (isothermal) and dynamic |
| Gas atmospheres | Inert, oxidizing, reducing and vacuum (1x10 ⁻⁴)mbar |
| Thermocouple | Pt-Rh |
| Sample pan | Alumina crucibles (100 Nos) |
| Sample crucible volume | 200 µl or better |
| Mass flow controller | Capable of individual control of protective and purge gases |
| Calibration standards | Suitable standards for entire range |
| Power requirements | 220V/ 50Hz |
| Accessories /other items | Thermostat (Chiller), gas regulator, moisture filter, gauge, Spatula, tweezers, Nitrogen generator and UPS |
| Supporting software | Latest version capable of measuring and evaluating : mass changes, decomposition temperature, temperature stability, oxidation/reduction behavior, corrosion studies, compositional analysis, reaction steps, transition temperatures, melting, enthalpies, polymorphism, glass transition and phase diagrams |
| Personal Computer | Latest configuration compatible with the instrument |
| Manual | Software and Hardware |
| Optional items | Platinum crucibles (2 Nos) Coupling systems : MS / FTIR |

2. Differential Scanning Calorimetry DSC (700 °C)

| Features | Specifications |
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| General description | State -of -the- art Differential scanning calorimeter suitable for Normal DSC and Cp |
| Sensor type | Heat flux |
| Temperature range | -170 °C to 700 °C or better |
| Temperature accuracy | ± 0.2 °C or better |
| Temperature repeatability | ± 0.2 °C or better |
| Enthalpy precision | ± 0.3 % or better |
| Heating / Cooling rate | 0.1 to 100°C or better |
| DSC measuring range | ±2000 μV or better |
| Heat flow Resolution | 0.02 μW or better |
| Calorimetric Sensitivity | 4.0 μV/mW or better |
| Cooling device | Suitable one for the range specified |
| Segment types | Static(isothermal) and dynamic |
| Gas atmosphere | Inert, oxidising and reducing conditions |
| Mass flow controller | Capability for independent control of protective and purge gases |
| Software | Latest version capable of measuring and evaluating melting, crystallinity, polymorphism, phase transitions, liquid crystal transitions, eutectic purity, solid liquid ratio, glass transition, specific heat capacity, cross linking reactions, oxidative stability and decomposition onset. |
| Calibration standard kit for temperature and sensitivity calibration | Suitable standards for entire range |
| Standards for C _p measurements | Set of Sapphire standards |
| Power supply | 230 V / 50Hz |
| Accessories | Liquid Nitrogen dewar with supply system, crimping tool / press, tweezers and cleaning brush |
| Sample pan and volume | Aluminium pans and lids (500 pcs) minimum 25μl or better |
| Personal computer with printer | Latest configuration compatible with the instrument |
| Manual | Software and Hardware |
| Optional | Automatic sample changer for 50 samples or more. Advanced software for thermokinetics, peak separation and purity determination |

3. X-ray Diffraction System (Table Top XRD)

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| 1.0 | X-ray Generator |
| 1.1 | Tube load-500W or more |
| 1.2 | Tube voltage-30k V (Variable) or more |
| 1.3 | Tube current-10 mA (Variable) or more |
| 1.4 | High voltage generation-High frequency method |
| 1.5 | Stability $\pm 0.05\%$ (for a $\pm 10\%$ variation in line voltage) |
| 1.6 | X-Ray shutter-Mechanical rotary shutter linked to Main door. |
| 1.7 | X-ray tube-Cu 1.0kW or higher |
| 1.8 | <p>Safety Features</p> <ul style="list-style-type: none"> a. Abnormal Generator Overload Detection. b. Abnormal Tube Voltage & Current Detection. c. Abnormal Cooling Water Flow and Pressure. d. X-rays completely Shut Off, Alarm and Warning. e. Light are activated if any Fail-safe Devices are. f. Tripped or Fail to operate. g. X-rays Shutt Off if any fails of warning light. h. Emergency Stop Switch |
| 2.0 | Goniometer Details |
| 2.1 | Type-Vertical Theta Theta or Theta 2 Theta |
| 2.2 | Radius minimum 140mm or more |
| 2.3 | Scanning method: θ - 2θ coupling mode. |
| 2.4 | Drive system-Pulse motor drive |
| 2.5 | Scanning range -at least $-3 \sim +145^\circ$ (2Theta) or more |
| 2.6 | Scanning Speed-atleast $0.01 \sim 100^\circ/\text{min}$ (2Theta) or more |
| 2.7 | Minimum step width- atleast 0.005° (2Theta) |
| 2.8 | Variable DS- Effective below 20° (2 θ) to limit measurement area 20mm width |
| 2.9 | Accuracy Better than 0.02° |
| 2.10 | Variable Divergence-Slit |
| 2.11 | SS (Scattering slit)- 1.25° or better |
| 2.12 | Soller slit- 2.5° or better |
| 2.13 | K-Beta reduction-Ni-Filter |
| 2.14 | Sample Holder-Standard sample holder for accommodating both solid (metallic) and powder samples. |

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| 3.0 | X-ray Detector Details-Fast 1D solid state multistrip detector. Should be able to suppress Fluorescence. Also should work in both 0D and 1D. |
| 4.0 | Basic system should have the following Software Provisions |
| 4.1 | System condition setting |
| 4.2 | Real time angle calibration. New Angle correction method using Pre-measured Calibration data gurantees below 0.01°Accuracy |
| 4.3 | Manual measurement |
| 4.4 | Standard measurement |
| 4.5 | User-settable conditions |
| 4.6 | Sample name, Sampling width (step size), Scanning range, Scanning speed, Measurement mode (Continuous, step scan, integral measurement, skipscan) |
| 4.7 | Peak Search Background calculation and subtraction, Profile smoothing, K-a2 calculation and removal, Peak Search. |
| 4.8 | Integrated Intensity calculation, Background calculation and subtraction, Profile Smoothing,K-a2 calculation and removal, Peak search, LPA calibration, Integrated calculation |
| 4.9 | Multiple Recording Software |
| 4.10 | Software for Qualitative Analysis |
| | Si Standard (NIST Traceable) |
| | Sample holders 20 nos |
| 5.0 | Chiller |
| 5.1 | External Chiller for the above XRD |
| 6.0 | Sample Plates |
| 6.1 | 0.5mm Grove plates 10nos |
| 6.2 | 0.2mm Grove plates 10nos |
| 7.0 | Operational Manual |
| 7.1 | A detailed system description document and operation manual should be provided along with the system. The document should include part details and allowable detachment/replacement procedures for all important components of the system. |
| 8.0 | Installation Commissioning and Training |
| 8.1 | After receipt of the item at purchaser's site the complete system shall be integrated installed and commissioned at the designated place (at purchaser's site) by vendors representative. The vendor's representative should also provide complete hands-on training to the purchaser after installation and commissioning |

4. Wave length Dispersive System (Bench Top XRF)

Bench-Top Wavelength Dispersive XRF analyser

| Sr. no | Specification |
|--------|---|
| 1 | Bench Top model –Sequential, Wavelength Dispersive XRF analyser is required for the elemental analysis of different samples (Solids and Powders) for different applications. Instruments should have capability of analysing elements O (Atomic No.8) to U(Atomic No.92) from periodic table. |
| 2 | System should have at least twelve position automatic sample changer with sample holders. Sample holders (12 nos.) suitable for handling solids and pressed powders, 40mm dia should be offered. Samples can be added or removed from the 12-position automatic sample changer without halting the current data measurement |
| 3 | The system should have Pd target, 200 W or better, air-cooled X-ray tube. |
| 4 | The system should have at least three position automatic crystal changer. |
| 5 | Three crystals should be offered to cover the elemental range Oxygen (8) to Uranium (92). LiF 200 (for Ti-U) and PET (for Al-Ti) and RX25 (for O – Mg). |
| 6 | Detectors: Light elements: F-PC (gas flow proportional counter), heavy elements: SC (scintillation counter) |
| 7 | Primary beam filter: Automatic in and out; Programmable Aluminium filter for trace amounts of K. |
| 8 | Spectrometer chamber atmosphere: Vacuum (10^{-1} mbar or lower – rotary vacuum) |
| 9 | During sample loading and unloading, the X-ray Tube should not be in Power Off mode. |
| 10 | The sample spinner should be offered as a standard feature, required to handle inhomogeneous samples |
| 11 | The built-in heater should be standard scope of supply to maintain constant temperature inside the spectrometer chamber, and therefore to enable stable measurements |
| 12 | Standardless / Semi-quantitative analysis based on fundamental parameter method should be part of the main instrument scope. |
| 13 | Windows10 based software to include facilities of : Qualitative and Quantitative analysis Regression analysis Matrix Correction Drift correction Maintenance functions capability |
| 14 | Necessary P10 gas cylinder(1no) with two stage regulators(1no) should be offered with the system, from reliable indigenous sources. |
| 15 | Power requirements: 240V (50/60 Hz) |
| 16 | Spares and consumables for 3 years of operations should be offered with the instrument |

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| 17 | The instrument should have Type Approval from Atomic Energy Radiation Board (AERB) – Safety Compliance Certificate has to be submitted |
| 18 | A complete set of operation-maintenance module manuals and circuit diagrams of all units including the accessory/peripheral units should be provided in hard copy as well as softcopy along with the instrument |
| 19 | Free of cost installation and comprehensive hands-on onsite training for laboratory personnel in preventive maintenance, operations and application software of the instrument after installation must be given by an expert engineer. |

| Sr.no | Technical Specification | |
|-------|----------------------------|---|
| 1 | Type | Bench Top model –Sequential, Wavelength Dispersive XRF analyzer |
| 2 | Elemental Coverage | Oxygen (O) through Uranium (U) With wide dynamic range (a few ppm to 100%) |
| 3 | X-ray Tube | Pd or Rhor equivalent target |
| 4 | X-ray Power | 200 W |
| 5 | Generator | 50 kV, 4 mA or equivalent |
| 6 | Cooling | Air Cooled |
| 7 | Beam Filter | Programmable Aluminium |
| 8 | Crystals | LiF (200), PET and RX25 (or equivalents) |
| 9 | Detectors | Flow proportional counter and Scintillation Counter |
| 10 | Sample Size | Diameter < 44 mm; Height < 33 mm |
| 11 | Auto Sampler | 12-position Turret |
| 12 | Spectrometer Chamber | Vacuum; Built-in Heater for constant temperature |
| 13 | Vacuum Pump | Rotary |
| 14 | Power Supply | 240 V (50/60 Hz) |
| 15 | Data Handling Software | Software for Qualitative and Quantitative analysis, Regression analysis, Matrix Correction and Drift correction |
| 16 | P10 gas | If needed – 1 cylinder with regulator |
| 17 | Manuals & circuit diagrams | Operation-maintenance manuals & circuit diagrams of all units including the accessory/peripheral units |
| 18 | Spares and Consumables | All standard spares and consumables for 3 years of operation |
| 19 | Installation and Training | At the site by a factory trained engineer. |

5. Atomic Force Microscope (AFM)

| Sr.no | Feature | Specification |
|-------|---|--|
| 1. | Sample size - diameter | Should be able to handle sample of 200 mm (or more) |
| 2. | Sample size - height | 10 mm (or more) |
| 3. | X Y scan range | 90 micron x 90 micron (or more), in closed loop |
| 4. | Z range | 10 micron (or more) |
| 5 | X, Y sensor resolution | < 150 pm (pico meter) |
| 6. | Z sensor resolution | < 35 pm |
| 7 | Stage type | Motorized, software controlled, programmable for multi-site data acquisition |
| 8 | Scan type | Sample or tip scanning |
| 9 | High speed scanning | 20 Hz or higher |
| 10 | Modes | Contact, non-contact, phase imaging, intermittent/tapping mode or equivalent, lateral force microscopy, F-D microscopy, MFM, EFM, KPFM and PFM |
| 11 | Force spectroscopy | Standard force spectroscopy with force curve and force volume |
| 12 | High speed and high resolution controller | Should be available |
| 13 | Automatic setting of parameters | Should be available |
| 14 | Microscope optics | 5 MP camera |
| 15 | Quantitative nano mechanical mapping | Measurements of Modulus, Adhesion, Stiffness, Dissipation and Deformation should be possible |
| 16 | Probe | Quote with minimum of 30 probes. In addition, separately quote price of 1 box (10 probes) for each mode , purchase may be made as required |
| 17 | Anti-vibration | Integrated acoustic isolation AND active vibration isolation table |

Quote separately for the following OPTIONS

Options may not be purchased, or may be purchased only partially

| Sr.no | Feature | Specification |
|-------|-------------------------------|---|
| 1. | Conductive AFM | Quote |
| 2. | STM | Quote |
| 3. | Heating / cooling stage | From -20 °C to +180 °C (or wider range) |
| 4 | Multi-sample chuck capability | Quote |

6. Energy Dispersive Analysis (EDS)

7. Scanning Electron Microscope (SEM)

Specifications for the Scanning Electron Microscope (SEM) system with SE, BSE and EDS detectors and high pressure (Low vacuum) mode

| Sr.no | Feature | Specification |
|-------|--------------------------------|--|
| 1. | Electron source | LaB ₆ |
| 2. | Resolution | <=3 nm in 30 kV and <= 4 nm in Low vac mode |
| 3. | Accelerating voltage | <= 500 V to 30 kV (Adjustable) |
| 4. | Magnification | 10 x to 300000x or better |
| 5. | Beam current | Upto 1 μ A or better for clarity in imaging |
| 6. | Stage movement | 5 axes motor driven movement with x, y = 100 mm or better, z = 40 mm or better along with tilt and rotation (360°), Manual movement option |
| 7. | Sample dimension | Suitable for 50 mm dia sample, stubs to be provided for regular, smaller samples |
| 8. | Detectors | SE, BSE and EDS detectors and Suitable detector for operating in Low vac mode should also be provided |
| 9. | Vacuum system | Oil-free pumps and Turbo Molecular or similar high vacuum pump to achieve the required vacuum |
| 10. | Imaging | Automatic correction for focus, brightness and astigmatism and auto beam alignment |
| 11. | Variable pressure (Low vacuum) | 10 to 400 Pa or better, for imaging of soft matter and biological samples |
| 12. | Chamber | Should have sufficient ports to support future upgrades with other types of detectors such as WDS, EBSD |
| 13. | Sputter coater | A benchtop sputter coating unit for 2 inch targets fitted with an oil-free vacuum pump, optimised for SEM coating, A gold target (99.99 % purity, 0.5 mm thickness) to be provided |
| 14. | EDS detector | LN ₂ free detector with active area 30 mm ² or larger, Elemental mapping and quantification with colour imaging with a resolution of 130 eV or better |

Additional requirements and Pre-Qualification criteria for all the equipment's:

1. The manufacturer must be an ISO9001 company & equipment model must be with CE compliance. Please attach relevant certificates.
2. Should have supplied similar system to other IITs/IISc/Central institutes in India. Provide a list of recent installations of the quoted models/other models, in India, with contact details of users.
3. The local vendor of OEM must have supplied similar equipment (s) to IITs (Preferably IIT-Madras), IISERs and other Govt. of India organizations. Please attach a reference list of supplies in last 1 year with contact details (Name, Phone, email address) of users.
4. Price: Quote for CIF Chennai. Any additional charges for LC or other bank processes should also be mentioned
5. Warranty: 3 years from the date of installation, additional warranty for 2 years may be quoted as optional
6. Brochure for the equipment with all its attachments must be provided along with the tender document.
7. Operating manuals/Users' guide for all systems/components must be provided (one hard copy) for ready reference.
8. Standard samples required must be provided.
9. Pre – installation check: Must be done free of cost at the proposed site and a report has to be submitted.
10. Training of personnel: Staff have to be trained at the site free of cost.
11. Suitable computer to be quoted separately. Specifications of computer needed to operate the equipment to be listed. IIT M may buy the computer from other sources.
12. Windows family compatible software for complete control and analysis, to be included in the price
13. Vibration isolation system and EMI shielding kit may be quoted as optional.
14. Specify all other requirements, such as compressed air availability, for smooth operation of the equipment setup

