



INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

MATERIALS MANAGEMENT DIVISION

Powai, Mumbai - 400076

TECHNICAL SPECIFICATIONS

INDUCTIVELY COUPLED PLASMA–MASS SPECTROMETER

- I. Quadrupole Mass Spectrometer:** Fully automated and computer controlled brand new system capable of elemental analysis for REE and PGE in concentrations ranges from ppm to ppb and ppt and also isotopic abundance measurements in geological and environmental samples including rocks, soils, sediments and natural waters. Compact, bench mount design of the system with all required accessories. Mention the country of origin of the equipment.
- II. RF Generator and Plasma:** Digitally driven solid state RF generator with 500–1600 watts power and 27 MHz or 40 MHz frequency. Robust plasma with stability/regulation better than 0.1 % for water-, acid-and organic-based solutions. Automatic adjustment of reflected power on changing from aqueous to organic samples without turning off the plasma. Automatic ignition and shutdown of plasma with user-defined sequence.
- III. Torch:** Single piece quartz torch and quartz injector. Fully computer controlled and auto tunable in motorized XYZ axes with independent movement of each axis. Torch position resolution and reproducibility of 0.1 mm in all the three axes. Capability of using a demountable torch.
- IV. Gas Control:** Individual MFC for plasma, auxiliary, nebulizer, make-up and carrier gases. Give full information and number of MFCs. Full computer controlled flow of all gases.
- V. Collision/Reaction Cell:** Collision mode using pure helium. Reaction gas line with MFC for hydrogen gas. Full computer control of each gas. Analysis of samples containing Cl and SO₄ without interference correction. System preferably upgradable in future for oxygen and ammonia reaction gas lines. System with low consumption rate of gases will be preferred.
- VI. Quadrupole Mass Analyser:** Mass range from 3 to 260 amu with resolution of 0.3 to 0.5 amu or better for the entire mass range. Frequency of 2 to 3 MHz. Background equivalent count less than 3 cps at 5 amu in no gas mode and less than 0.5 cps in gas mode. Mass calibration stability of 0.03 amu or better per day. Abundance sensitivity at Cs should be 5×10^{-7} in the low mass side and 1×10^{-7} in the high mass side or better.
- VII. Ion Detection System:** Discrete dynode electron multiplier detectors with pulse count and analogue modes. Linear dynamic range of ten orders or more. Dwell time of minimum 100 microseconds in both pulse and analog modes. Longer lifetime of detector will be preferred.
- VIII. Vacuum System:** Efficient vacuum system with rotary and turbomolecular pumps for high vacuum in ion optics, quadrupole and detector. Instrument with low maintenance vacuum system will be preferred.

- IX. Sample Introduction System:** Quartz concentric nebulizer for running solutions with 3–5% TDS. Quartz cyclonic spray chamber with software controlled peltier cooling (-10 °C to +20 °C). Nickel sampler cone (2 numbers) and nickel skimmer cone (2 numbers). Platinum sampler cone and platinum skimmer cone. Peristaltic pump with 3–4 channel roller pump with computer control.
- X. Autosampler:** Designed with anticorrosion and acid-resistant material. Arm movement resolution of $0.1 \text{ mm} \pm 5\%$. 90 or more vessel positions. Tray sizes of and 50–60 x 15–17 ml vials. Easy sequence set up via graphical interface. Integrated operation of autosampler with the machine.
- XI. Chiller:** Recirculating chiller with temperature stability of $\pm 0.1^\circ\text{C}$. Cooling temperature range of +15 to +25°C. Electronic display for controlling and monitoring temperature. Robust design for vibration-free and quiet operation. Suitable for ambient temperatures of 38°C in Mumbai climate. Energy efficient and suitable for 24/7 operation. Maximum dimensions of 80 x 70 x 50 cm or equivalent volume.
- XII. Computer and Software:** Workstation of a reputed brand like Dell/HP. Intel Xeon processor (3.3 GHz, 8MB cache, 4 cores). 8 GB DDR4 RAM. 1TB 7200 rpm hard disk. DVD-RW drive. Intel HD Graphics. Serial port as per requirement of the ICP-MS system. 24" LED monitor. Cordless keyboard. USB optical scroll mouse. Licensed copy of suitable Windows operating system. B&W LaserJet printer. Easy-to-use ICP-MS software package for monitoring and documentation of all parameters of the instrument. Automatic optimization of routine parameters for analysis of all elements. Online automatic log creation facility to monitor the instrument activities. Full remote access to the instrument for remote monitoring of the system. One set of operation and maintenance manuals of the whole system on CD-ROM.
- XIII. Essential Accessories:** Instrument table. Tuning solutions (500 ml). Exhaust hood. Standard spare set. Consumable package including different pump tubings, O-rings for spray chamber, and other essential consumables.
- XIV. Spares:** Single piece quartz torch with quartz injector. Quartz cyclonic spray chamber. Quartz concentric nebulizer. HF-resistant sample introduction system including appropriate spray chamber, injector and nebulizer.
- XV. Performance Specifications:** Oxide formation ratio (CeO/Ce) less than 2% preferably. Double charge ion ratio (Ce⁺⁺/Ce⁺) of less than 3% preferably. Sensitivity preferably more than 50 Mcps/ppm for Li/Be, 80 Mcps/ppm for U/Tl, and 160 Mcps/ppm for In/Y for oxide formation ratio <1.5. Mass resolution of 0.7 amu at 10% of peak height across the entire mass range. Stability of the instrumental parameters should be less than 3.0% RSD for both short term and long term. Auto tune facility should optimize plasma condition, lens and cell voltages, mass resolution and mass accuracy for best ionization and sensitivity. Low noise operation of vacuum pumps and chiller. All the performance specification documents should be provided dully stamped and signed along with tender.
- XVI. Analytical Capability Test:** During technical evaluation, supplier would be requested to demonstrate in India, the operational capabilities of the instrument and the accuracy and precision (within 5% error) of trace and ultra-trace elements on reference materials provided by the customer. Sampler and skimmer cones should be easily mountable and demountable. Instrument with user-friendly software, ease of operation and maintenance will be given preference.
- XVII. Working Conditions:** Input power at 230 volts $\pm 10\%$, 50 Hz. UPS would be supplied by the customer. Should work optimally within the room temperature range of +20°C to +30°C and at high humidity (60–90% at 20°C) atmospheric conditions of Mumbai.
- XVIII. Training:** Onsite training for 5 consecutive days for operation and maintenance of the instrument immediately after installation. No supplementary payment for travel, boarding and lodging of the trainer.

XIX. Service Support: Remote assistance with same day response. Telephone/mail assistance when user has sufficient knowledge to attempt small repairs. Maximum onsite response time of 5 working days for both hardware and software related problems. Give information on whether the vendor/Principal keeps stock of spares/accessories in India. Provide the list of users in India, preferably from reputed Earth Sciences departments, with their contact details. Customer will seek information on service support from the users directly and preference will be given to vendor with excellent service support.

XX. Warranty: 24 months comprehensive warranty from the date of commissioning including warranty for collision/reaction cell, detector, and also parts non-manufactured by the supplier. For free replacement of defective parts, taxes and import duties are to be borne by the supplier. Basic consumable parts for two years. Unlimited breakdown calls.