THE GEM & JEWELLERY EXPORT PROMOTION COUNCIL
3rd FLOOR, RAJASTHAN CHAMBER BHAWAN
M.I. ROAD, JAIPUR 302003

Tender No. TIES/2018-19/01: ANNEXURE 1

(Revised: 15th May 2019, Re-Tender)

TECHNICAL SPECIFICATIONS FOR LA-ICP-MS

Key features: Fully-automated, high-end bench top system, capable of performing elemental and isotopic analyses of gemstones and minerals directly in solid state, measurements in traces at PPT levels. Following are the desired minimum specifications.

Section A: ICP-MS

Feature / Item	Specification	Compliance (Yes / No)	Quoted item with part no. (If any). Please mark the item in submitted brochure.	Deviation (if any) with consequences on analyses / results
A.1. Sample Introduction system	A.1.1. Sample Introduction Kit including Peltier Cooled Spray Chamber (Temp Range -5 to 20 Deg C) – factory fitted; Quartz Nebulizer, Ni/Cu Sample and Skimmer cones.			
	A.1.2. Single piece quartz with minimum 2.5 mm diameter for matrix decomposition and sample ionization			
	A.1.3. Suitable kit to be included to analyze samples with > 20% TDS.			
A.2. Ion Source and RF plasma:	A.2.1. Computer controlled 27 or better MHz RF generator operating from 500 to 1600 watts for automatic control of torch ignition, shutdown, and system warm up.			
	A.2.2. The system should be able to change over from normal Plasma conditions to cool Plasma with direct control from software.			
	A.2.3. Plasma torch should have provision for software controlled alignment for horizontal position, vertical position and sampling depth.			

	A.2.4. Torch position resolution and reproducibility should not be higher than 0.1 mm in all three axes			
A.3. Ion Extraction Interface:	A.3.1. Standard large orifice Ni/Cu sampling and skimming cones with suitable diameters. Additional suitable Sample and Skimmer cones should also be provided for high 20% TDS			
	A.3.2. Minimum orifice diameter: Sampling cone – 1.0 mm; Skimmer cone - 0.4 mm			
	A.3.3. Sample and skimmer cones should be easily mountable and dismountable, on the lines of 'plug and play'			
A.4. Ion Focusing System:	A.4.1. Maintenance-Free ion extraction/ quadrupole ion system should have efficient mechanism for removing all neutrals from the Ion path.			
	A.4.2. The Ion path must be maintenance free.			
A.5. Cell Technology	A.5.1. ICP MS shall incorporate a Cell offering operation: Standard Mode, Collision Cell (He) Mode with KED and Reaction Cell for all possible interference removals with detection limit of 0.1 ppm or better			
	A.5.2. Reaction cell should allow 100% Hydrogen, Methane, Oxygen or Ammonia as per application requirement			
	A.5.3. Minimum two dedicated channels /lines for gases as mentioned above should be offered with system – one dedicated channel for collision cell, and one dedicated channel for reactive gases.			
	A.5.4. Cell should have dedicated, automated software controlled MFC (Mass Flow Controller) for Collision and Reaction each.			
A.6. Gas control	A.6.1. System should have dedicated MFCs or devices to control plasma, auxiliary, nebulizer, optional gas for laser, reaction gas and collision gas.			
	A.6.2. Gas system must be completely software controlled			

A.7. Quadrupole Assembly	A.7.1. Quadrupole operating at 2.0 MHz or more				
	A.7.2. User definable resolution for improved dynamic range and abundance sensitivity				
	A.7.3. Mass calibration assessed and automatically updated.				
	A.7.4. The Mass range should be from 2-260 u or better				
A.8. Ion Detector Assembly:	A.8.1. The ion detector is a simultaneous dual mode discrete dynode electron multiplier, 9 orders or more magnitude of dynamic range in a single scan. During full range background should be <1cps.				
	A.8.2. The dual-mode detector assembly must come standard with the system.				
	A.8.3. Both, analogue and pulse counting modes should be protected against overload with minimum dwell and integration time of 100 µs each, with no settling time				
A9. Vacuum System:	A.9.1. Turbo pump should be differential pumping.				
	A.9.2. In the event of power failure, either high vacuum is maintained or the entire vacuum system is to be automatically back-filled by inert gas to preserve the cleanliness of the system.				
A.10. Guaranteed Performance Specifications Sensitivity(MCPS/PPM OR KCPS/PPB) Note: Either of A.10.1.a or A.10.1.b may be claimed and demonstrated during Demo as well as at the time of installation.	***A.10.1.a*** Standard Mode	***A.10.1.b*** Reaction Mode			
	50 or better for Li/Be	6 -8 or better for Li/Be			
	114 or better for In/Y	40 - 100 or better for In/Y			
	250 or better for U/Tl	40 - 100 or better for U/Tl			
	A.10.2. Oxide ratio (%) CeO/Ce <2.5 or better				
	A.10.3. Ba^{++} or Ce^{++}/ Ba or Ce <3 or better				
	A.10.4. Background mass 4.5/9/220: No gas <1 cps				
	A.10.5. Short Term Stability <3% RSD or better				
	A.10.6. Long Term Stability<4% RSD or better				

A.11. Detection Limits Note: These values are to be demonstrated in the mode as quoted above in A.10	9Be < 1 ppt 56Fe < 2 ppt 59Co < 0.5ppt 115In < 0.5 ppt 238 U < 0.5 ppt			

Section B: Laser Ablation (for direct solid sample analysis)

Feature / Item	Specification	Compliance (Yes / No)	Quoted item with part no. (If any). Please mark the item in submitted brochure.	Deviation (if any) with consequences on the analyses
B.1. Laser	B.1.1. The laser must be a frequency quintupled Nd:YAG, producing laser light of 213 nm wavelength for good coupling with nearly all sample types, including highly transmitting materials.			
	B.1.2. Laser source energy at sample: 3 mJ/pulse or higher			
	B.1.3. Laser pulse width: 5 nsec			
	B.1.4. Software controlled continuous laser energy output from 0 -100%			
	B.1.5. Spot sizes from 4 µm to 200 µm diameters must be achievable with aperture imaging, with larger spots achievable via defocusing.			
	B.1.6. A sampling repetition rate range of 1-20 Hz must be provided.			
	B.1.7. The number of laser transfer optics must be as low as			

	possible, minimizing energy losses. There must not be more than 5 mirrors and one lens in the beam path between the laser head and the sample surface.			
	B.1.8. Spot selection must be via a ceramic aperture wheel.			
B.2. CCD Camera	B.2.1.A high resolution color CCD video camera must be used, offering sample viewing resolution of 2 µm or better.			
	B.2.2. The field of view of the primary CCD camera viewing system must offer a wide field of view of ≥6 mm of sample surface.			
	B.2.3. Optical zoom: 2.5x to 32x or better			
B.3. Lighting	B.3.1. A high intensity LED lighting system must be used for sample illumination with light intensity controlled through software.			
	B.3.2. Incident as well as transmitted light illuminations should be present			
	B.3.3. The system must offer software controlled cross-polarizer.			
B.4. Sample Cell / Chamber	B.4.1. The system shall offer a large sample cell, able to accommodate and measure samples up to 50 mm or more in height.			
	B.4.2. X-Y stage resolution must be 0.16µm or lower. Stage travel must be 100 mm in the X and Y planes.			
	B.4.3. The washout performance of the chamber must be <1.5 seconds for washout to 1% at any point in the cell area.			
	B.4.4. The LA system must include a sample cell gas purge system controlled by precision calibrated mass flow controllers that uses helium to transport and entrain the ablation particles into the argon stream of the ICP.			

	B.4.5. Open architecture for maximum flexibility			
B.5. Others	B.5.1. Footprint cart must be provided with the system for easy movement of the system.			

Section C: Software, Controls and others

Feature / Item	Specification	Compliance (Yes / No)	Quoted item with part no. (If any). Please mark the item in submitted brochure.	Deviation (if any) with consequences on the analyses
C.1. System Controller and Operating System:	C.1.1. Suitable Data Station with all Software controls & future upgrade controls with Instrument software.			
	C.1.2. Software control for all functions like system operations, component optimization, method development, calibration, analyses, report generation, etc.			
	C.1.3. Comprehensive functionality for analysis through fully automated process with auto tuning.			
	C.1.4. Preferably, synchronized ablation control and Integrated laser system control software with host ICP-MS			
	C.1.5. Fully integrated triggering of ICP-MS with Laser			
	C.1.6. Data handling, management, customizable reporting etc.			
	C.1.7. Option for single-click export of images and data files.			
	C.1.8. On screen display of safety interlocks and laser status.			
	C.1.9. Sample mapping function allowing full view of the sample area and rapid navigation			

	C.1.10. High resolution image and video capture of ablations using onboard software			
	C.1.11. Automatic X-Y-Z axis mapping			
	C.1.12. Method parameter preferences must be stored for future use.			
	C.1.13. Sample map developer to facilitate visual sample navigation.			
	C.1.14. Fully automated multiple line scan capability with user friendly timing features for easy sync with ICP-MS (gas blank, pause between scans, time read-back for each line).			
	C.1.15. Ability to change ablation parameters for lines and spots in an automated sequence (Energy, Spot Size, etc.).			
	C.1.16. Option to turn laser off during multiple analyses (no wasted shots).			
	C.1.17. Helium carrier gas auto-shutdown feature (no wasted Helium following after the end of a multiple analyses sequence).			
	C.1.18. Sub-micron line-scan rates (as low as 0.16µm/s) for deep, continuous ablation of new material.			
	C.1.19. Routine maintenance and scheduled alerts via software for continued operation			
	C.1.20. Suitable software (if required) for real-time interactive data reduction for Laser Ablation analysis.			
	C.1.21. Suitable software (if required) for sample abundance profiles by using Principle Component Analysis, study sample groups, etc.			

	C.1.22. The software should support Application Programming Interface (API) access to test results / data			
C.2. Computer Configuration:	C.2.1. High-end, latest branded (e.g. HP/Dell) Personal Computer/s should be supplied as required by the complete LA-ICP-MS system for its smooth operation			
	C.2.2. Laser printer			
C.3. Controls / Installation Utilities	C.3.1. All cables, gas connections and aerosol connections must be provided for the specified instrument or parts including Re Circulating Chiller			
	C.3.2. Exhaust system with fume hood and accessories.			
	C.3.3. Argon Gas Cylinder (filled at the time of delivery and installation) – 10 nos.			
	C.3.4. Helium Gas Cylinder (filled at the time of delivery and installation) – 3 nos.			
	C.3.5. Reaction Gas Cylinder like Oxygen, Hydrogen, Methane or Ammonia as per application requirement (filled at the time of delivery and installation) - 2 nos. each of 99.999% purity			
	C.3.6. Gas Regulator for all the gases mentioned above – 1 no. each			
	C.3.7. Purification panel for all gases, whether reactive or non-reactive			
	C.3.8. Automatic double cylinder manifold for Argon cylinders			
	C.3.9. Any other item as required (please specify and quote)			

C.4. Calibration Standards	C.4.1. NIST Certified Multi element (at least 21 elements) aqueous calibration standard (100 ml)- 2 bottles			
	C.4.2. NIST Glass Standards: 610, 612, 614 / 616			
	C.4.3. USGS standard: MACS-3			
	C.4.4. In addition to the elements listed in the above mentioned NIST / USGS glass standards, following element standards are also required for quantification in solid matrix (e.g. glass): Be, Mg, P, S, V, Ge, Br, Y, Zr, Rh, Pd, Sn, Cs, Ta, W, Pt, Hg, Bi and Pr. These may be certified by NIST, USGS or any other internationally accepted certifying body.			
C.5. References	C.5.1. Vendor has to give at least 3 references in India where the quoted (or the immediate earlier generation) ICPMS system is working satisfactorily, preferably equipped with Laser Ablation unit.			
	C.5.2. At least 2 references world-wide with similar applications in gemmological / mineralogical laboratory.			
	C.5.3. Submit latest published articles / papers in gemmology / mineralogy using the quoted (or the immediate earlier generation) system.			
C.6. Training Schedule	C.6.1. Minimum one week on-site training immediately on completion of the installation and demonstration, making the user fully aware about operation of the equipment to the satisfaction.			
	C.6.2. Thereafter, minimum 4 (i.e. quarterly) 'on-site' training sessions of 5 days each for the first year.			
	C.6.3. Assistance in data processing and analysis for first two years after installation, as and when required. This may be remote assistance.			

C.7. Warranty It will be the responsibility of the vendor to keep the supplied instrument in optimized operating condition during the pre-decided warranty period (C.7.1.A or C.7.1.B) from the date of acceptance of installation and demonstration of claimed specifications. <u>Minimum samples per year</u>: 6000	C.7.1.A. <u>Comprehensive 5 years warranty</u> to be offered, applicable on all instrument parts, accessories and utilities supplied by the vendor, with no exceptions. C.7.1.B. <u>Comprehensive 3 years warranty</u> to be offered, applicable on all instrument parts, accessories and utilities supplied by the vendor, with no exceptions. Both options to be quoted separately in the bid.			
	C.7.2. All necessary consumables or spares or parts are to be covered under warranties as above in clauses C.7.1.A and C.7.1.B., and need to be supplied as and when required during the period of comprehensive warranty for keeping the instrument operational all the time.			
	C.7.3. Maximum response time in case of any breakdown On-line support: 24 Hours Physical (On-site) support: 48 Hours			
	C.7.4. A detailed scope of warranties as above in clauses C.7.1.A and C.7.1.B, to be furnished with the bid.			
	C.7.5. Indicative cost of per sample analyses to be provided			
C.8. AMC / CMC	C.8.1. Vendor should be able to provide support for next 5 years through AMC / CMC, after completion of initial period of comprehensive warranty.			

Note:

1. Technical evaluation will be based on:

   a. Submitted compliance statement along with the supporting document for each parameter.

   b. Demonstration of the quoted make / model (or the immediate earlier generation model)

2. Attach supporting documents such as brochures, declaration, etc with the claimed specifications. The quoted items must be marked with consecutive item nos. as per the technical-cum-compliance statement.

3. The Gem & Jewellery Export Promotion Council reserves the right to relax any of the above mentioned specifications in overall evaluation, without giving any reason whatsoever.