The ICP-MS at IIT Roorkee caters to the need of various users from all over the country since 2005.

Inductively coupled plasma mass spectrometry (ICP-MS) is the fastest multi-element trace element analysis technique. ICP-Q-MS is mainly used for rapid, precise and accurate trace (<1000 ppm) element determinations in liquid and solid samples, but other applications include isotopic determinations and speciation studies. The power of modern ICP-Q-MS resides in its ability to rapidly measure trace elements at very low detection limits (to sub parts per trillion levels) as well as minor and major elements (at parts per million levels) in the same analytical run on suitably diluted samples.

Type: Inductively Coupled Plasma Quadrupole Mass Spectrometer

**Specifications:**
- **Detection range and limit**: Li to U, up to sub ppb
- **Frequency**: 40 MHz, free running
- **Power**: 1600 Watts
- **Torch**: Concentric Quartz Tube
- **Injector**: Alumina, 2.0 mm i. d.
Spray Chamber: Scott Type
Nebulizer: Cross flow design with Gem Tips
Variable speed Peristaltic Pump
Dynamic Reaction Cell

Applications:
The most common applications for ICP-MS are in biological, environmental, geological, and industrial fields. The following is a modest list of materials that have been analyzed by ICP-MS.

Archaeological Applications: raw materials
Biological and Applications: bones, feathers, hair, human breath, milk, shells, stomach contents, teeth, tissues, urine, zooplankton.
Plants: barks, fertilizers, fruits, grass, leaves, mushrooms, roots, tree rings, wood.
Foods: beverages, food packaging, juices, milk, metabolites, rice flour, seafood, wine.
Health sciences: pathology, chemotherapy drugs, illicit drugs, medicines, toxicology studies, metabolism studies, dietary supplements.
Earth Science Applications: fossils, minerals, meteorites, rocks, soil, waters.
Environmental Applications: atmospheric deposits (wet, dry), pollution, brines, car exhaust particles, coal fly ash, dust, gases from landfills, organic waste, paint, snow, sludge.
Industrial Applications: alloys, automobile catalytic converters, ceramics, dyes, glass, nuclear industry products, paint, paper, petroleum based products, plastics, rare earth element compounds, steel, silica, superconductors, sulfides.

Laser Ablation System:
UP-193
(New Wave)

Laser Ablation Microanalyzer works in conjunction with ICPMS. The sample is ablated by a laser beam and carried by Argon or a mixture of Ar and He into the plasma of ICPMS. The
plasma in ICP-MS is used to generate ions that are then introduced to the mass analyzer. These ions are then separated by a quadrupole and collected according to their mass to charge ratios. It is the most suitable technique for in situ elemental analysis. Any type of solid sample can be ablated for analysis. There is no sample-size requirement and no sample preparation procedure. Chemical analysis using laser ablation requires a smaller amount of sample (micrograms) than that required for solution nebulization (milligrams). In addition, a focused laser beam permits spatial characterization of heterogeneity in solid samples, with typically micron resolution both in terms of lateral and depth conditions.

The laboratory at IIC, IITR currently operates a Laser Ablation Microanalyser coupled to ELAN DRCe quadrupole ICP-MS. The Laser Ablation Microanalyser employs ArF 193 nm laser beam. The high energy UV laser beam produces craters in the sample ranging in sizes from 4 microns to 200 microns. The LA system is fully computer controlled with a real-time video imaging system capable of reflected and transmitted light (polarized light available) viewing. The system can be programmed to ablate continuous lines, spots or a variety of more complex ablation patterns.

Essential Requirement for LA-ICP-MS analyses is that the sample must be of known matrix. A suitable reference standard with matrix matching with the sample must be available.

**Specifications:**

- **Type**: Eximer Laser
- **Wavelength**: 193 nm
- **Maximum Average Power**: 15 Watts
- **Output**: 150mJ/pulse
- **Maximum repetition Rate**: 50 Hz
- **Spot size**: 5µm to 200µm

**Applications:**

The most common applications for LA-ICP-MS are in biological, environmental, geological, and industrial fields. The following is a modest list of materials that have been analyzed by LA-ICP-MS.

- **Archeological Applications**: artifacts (e.g. ancient ceramics, bronze mirrors) and raw materials
- **Earth Science Applications**: fossils, minerals, meteorites, rocks, soil.
- **Forensic Science**: glass, illicit drugs and plants, soils, paint, metals.
- **Industrial Applications**: alloys, automobile catalytic converters, ceramics, dyes, glass, lab gloves, nuclear industry products, paint, paper, petroleum based products, plastic, rare earth element compounds, steel, silica, superconductors.

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**Charges**