THE Ames Laboratory

Creating Materials & Energy Solutions

Inductively Coupled Plasma – Mass Spectrometry

- Key analytical tool for ultratrace analysis – parts-per-trillion detection limits.
- Developed in a Basic Energy Sciences project at the Ames Laboratory.
- Helps to identify where trace elements end up in the body; used in nutrition, cancer and AIDS research.
- Essential tool in semiconductor-manufacturing.
- Broad applications in environmental-monitoring and nuclear nonproliferation.
- Every DOE National Laboratory now uses this technology.
- Six companies worldwide manufacture and distribute instruments based on ICP-MS.

Inductively coupled plasma-mass spectrometry is a widely used method for elemental and isotopic analysis. Its applications range from routine monitoring of mercury and arsenic in drinking water to the discovery of new elements. An economically critical application is the analysis of solvents and silicon in the semiconductor industry.

It would not be possible to make chips with today's performance levels without the detection limits and multielement capabilities of ICP-MS. The ability of ICP-MS to rapidly measure isotopes of uranium and plutonium also makes it a critical tool in the nuclear nonproliferation mission of the DOE.

ICP-MS grew out of experiments performed at the Ames Laboratory beginning in 1975, with support mainly from the Enviornmental Protection Agency. Basic Energy Sciences then supported ICP-MS research at the Ames Laboratory, beginning in the early 1980s. Two companies, Sciex in Canada and VG in the United Kingdom, began selling the instruments in 1983. Today there are about six ICP-MS suppliers, and roughly 5,500 instruments have been sold. Continued support by BES led to the demonstration and development of most of the important improvements now incorporated in the newer versions of the instruments, such as collision cells, micronebulizers and solvent removal. This evolution of ideas from a DOE lab into commercial products is a key point since most scientific users of instrumentation rely on what they can buy commercially and do not build their own devices.

Inductively coupled plasma-mass spectrometry developed at Ames Laboratory helped the Food and Drug Administration trace the batch of potassium cyaninde used to contaminate the Tylenol® capsules that killed seven people in Chicago on a single day in September 1982.

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