

A Compact, Stand-Alone, Integrated MS/Vacuum Package

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Reducing the size, weight and power consumption of a mass spectrometer has been the object of significant ongoing research for over 30 years, driven especially by NASA's need to place highly sensitive chemical detectors in very remote and harsh environments. As the latest instruments have continued to shrink, the key remaining "Achilles Heel" limiting the deployment of these smaller, ruggedized MS units is the vacuum system. Ceramitron, LLC has recently tackled this problem with a novel design that eliminates the mechanical pumps and vacuum chamber and substitutes a self-contained package featuring chemical sorption pumps integrated into the vacuum enclosure. The result is a rugged, general purpose chemical/gas sensor that reduces weight and power consumption by nearly two orders of magnitude over conventional MS offerings.

In even the smallest MS devices, the empty volume inside the vacuum chamber occupies most of the space, and stainless steel enclosures contribute to the bulk of the weight. Ceramitron's tiny double-focusing magnetic-sector MS measures only $50 \times 620 \times 10$ mm, weighs <150g and consumes <10W. The device enclosure doubles as the vacuum chamber with an internal volume of <5ccm. A small ion pump (IP) and a non-evaporable getter (NEG), both residing inside in an attached enclosure, maintain an operating pressure between $10E-6$ and $10E-4$ Torr. Gas "pulsed" into the analyzer provides low duty cycle sampling of the target compounds.

Ceramitron's double-focusing MS sensor, constructed entirely from fiberglass (ultimately, from alumina) is hermetically sealed and is intended to be delivered commercially as a service-free consumable, easily replaced in the field by minimally-trained operators. A service life of 2-12 months is expected, depending on the application, with a sensor replacement cost of ~\$400.

Low duty cycle applications include monitoring of landfills, GHG depth profiling using weather balloons, military standoff detectors, down-hole gas measurements, and terrestrial and extra-terrestrial research applications on unmanned platforms.