A New Aerosol Threat Detector

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Abstract

Non-volatile chemical compounds can persist in the atmosphere as aerosols ranging in size from nanometers (nm) to micrometers (µm), posing significant risks during acts of terrorism, industrial accidents, and environmental disasters. Real-time, in-situ detection of such airborne threats is critical for timely response and mitigation. Detect-ION (DI) is developing **SPECTRAL**, a compact, low-SWaP (Size, Weight, and Power) platform designed to collect, separate, and identify aerosolized chemical agents across a broad size range. The system integrates three novel subsystems: a Miniature Aerosol Collector (MAC), a low-thermal-mass gas chromatograph (LTM-GC), and a chip-scale mass spectrometer (µMS), leveraging prior IARPA-supported technologies.

The MAC utilizes DI's patent-pending Glass Array Collector (GLAC) design to enable efficient aerosol impaction, high surface area capture, and rapid desorption for sharp GC injections. The LTM-GC offers performance comparable to traditional ovens while operating in a compact form factor. DI's inline GC split technology enables increased sample throughput to the µMS without sacrificing separation quality. The µMS employs a high-density microfabricated ion trap array and low-power electronics to deliver ppb-level sensitivity across 40–210 m/z, with a resolution of 1–2 amu and power consumption under 3 W. The system produces NIST-compatible electron impact (EI) mass spectra, supporting rapid identification via existing spectral libraries. Prior demonstrations across >200 volatile and semi-volatile compounds validate the µMS performance.

Conflict of Interest Disclosure

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Biography - Gottfried Kibelka

Gottfried Kibelka holds a master's degree in chemistry from the University of Hamburg, Germany. His passion for mobile mass spectrometers started in 1988 when he developed field methods for Bruker's pioneering MM1 system. After developing an underwater mass spectrometer for the German Coast Guard. He joined Tim Short's group, continuing his work on underwater mass spectrometry. He continued developing portable mass spectrometers throughout his career and serves now as a Senior Instrumentation Scientist at Detect-Ion, in Tampa, Florida, where he contributes to the development of next-generation mass spectrometry solutions for healthcare and environmental applications.

Keywords

Ion trap array, Miniature mass spectrometer