Instrument for Measuring Particulate Aerosol Elemental Composition

Tech ID: 34646 / UC Case 2026-433-0

ABSTRACT

Researchers at the University of California, Davis have developed advanced spectroscopy devices enabling real-time, cost-effective measurement of elemental composition in airborne particulate aerosols.

FULL DESCRIPTION

This technology features spark-induced breakdown spectroscopy devices designed to measure the elemental composition of particulate aerosols in real time. Using a combination of air sampling, spark generation, optical signal detection, and spectral analysis, the device detects trace metals emitted from various sources such as industry and traffic. The system includes a removable spark electrode cartridge, high-voltage circuitry to generate plasma from captured particles, an optical fiber to relay light signals, a spectrometer for spectrum generation, and a microcontroller to analyze elemental composition and source identification. The technology is optimized for rapid, accurate analysis while overcoming the limitations of costly and maintenance-heavy traditional instruments.

APPLICATIONS

- Environmental justice and community air quality monitoring.
- Industrial emissions compliance and process control.
- Mobile air quality monitoring platforms for rapid response.
- Regulatory agencies requiring real-time data for decision-making.
- Urban and traffic pollution surveillance.
- Research in atmospheric sciences and environmental health.

FEATURES/BENEFITS

- Reduces costs by providing an affordable alternative to high-priced X-ray fluorescence instruments.
- Delivers real-time, continuous measurement of particulate metal concentrations.
- Simplifies maintenance through a modular design with a removable spark electrode cartridge.
- Lowers operational costs by minimizing power and service requirements.
- Detects trace metals such as lead, chromium, nickel, cadmium, and manganese with high sensitivity.
- Enhances precision in elemental identification and concentration estimation using integrated machine learning.
- Attributes particulate sources accurately via spectral analysis and mixture modeling.

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INVENTORS

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OTHER INFORMATION

KEYWORDS

air sampling, airborne pollutants, aerosol elemental analysis, environment sensing, machine learning, particulate metals, plasma spectroscopy, real-time monitoring, spark-induced breakdown spectroscopy, spectrometer

CATEGORIZED AS

- **Environment**
  - Sensing

- Facilitates deployment in diverse settings with a compact, portable design.
- Eliminates the high cost and operational complexity associated with traditional real-time particulate metal analyzers.
- Expands accessibility to advanced monitoring for community-based and mobile applications.
- Provides rapid detection for acute emission events and fluctuating airborne metal concentrations.
- Addresses the need for low-maintenance, energy-efficient devices in environmental monitoring.
- Improves source attribution and exposure risk assessment of particulate metals.

PATENT STATUS

Patent Pending

- **Engineering**
  - Engineering
- **Sensors & Instrumentation**
  - Analytical
  - Environmental Sensors

RELATED CASES

2026-433-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Mathematical Model and Apparatus to Optimize Functional Electrical Stimulation for Non-Isometric Limb Movement
- Biomimetic Chemical Compounds for Capturing Carbon Dioxide from Power Plant Stacks and the Atmosphere

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