INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Microscale Collector-Injector Technologies for Passive Environmental Vapor Sampling

TECHNOLOGY NUMBER: 7372

Technology ID
7372

Category
Hardware
Engineering & Physical Sciences
Semiconductors, MEMS, and Electronics

Inventor
Joseph A. Potkay
Edward T. Zellers
Changhua Zhan
Robert W. Hower

Further information
Joohee Kim
jooheek@umich.edu

View online

OVERVIEW

Microscale collector-injector for gas chromatography for air quality analysis

- Enhances existing micro gas chromatographs by improving VOC injection sharpness and reducing energy.
- Environmental monitoring, medical diagnostics, and chemical threat detection.

BACKGROUND

Volatile organic compounds (VOCs) are significant in various fields, notably in environmental monitoring, medical diagnostics, and the detection of hazardous substances. Historically, analyzing VOCs on-site involved bulky equipment, making it impractical for fieldwork. The emergence of micro gas chromatographic (μGC) systems promised portability, but existing devices often had to compromise between high capacity and efficient thermal desorption, often consuming substantial power and requiring pumps to draw samples. The limitations also included relatively broad injection bands, reducing the separation efficiency and accuracy of VOC analysis. These constraints necessitate improved technology to enable efficient, energy-saving VOC sampling and analysis with sharper injection bands, optimizing μGC systems for detailed and precise analyses in diverse applications.

INNOVATION

Researchers at the University of Michigan have developed μCOIN device, a microscale collector-injector designed for μGC systems, comprising two main components: the micro passive preconcentrator (μPP) and the micro progressively heated injector (μPHI). The μPP passively collects VOCs with enhanced adsorption capacity, significantly optimizing energy consumption and flow. Following this, the μPHI rapidly injects VOCs with precision, utilizing progressive heating to produce sharp injection pulses, necessary for accurate and efficient separations in shortened columns. This integration of the μPP and μPHI improves upon traditional systems by reducing power use and allowing sharper injections with reduced volumes of air transfer. Potential real-world applications include fields where precise VOC measurement is crucial, such as occupational health monitoring, environmental surveillance, clinical diagnostics, and defense-related chemical detection scenarios, highlighting the technology's versatility and significance in improving VOC analysis outcomes.

ADDITIONAL INFORMATION

REFERENCES

A Micro Collector Injector (μCOIN) for μGC Systems, M Akbar, N Nuñovero, R Hower, C Zhan, J Potkay, ET Zellers, Technical Digest, Solid-State Sensors, Actuators, Microsystems Workshop, 291-294

INTELLECTUAL PROPERTY

US11782033 "Microscale collector-injector technologies for passive environmental vapor sampling and focused injection"