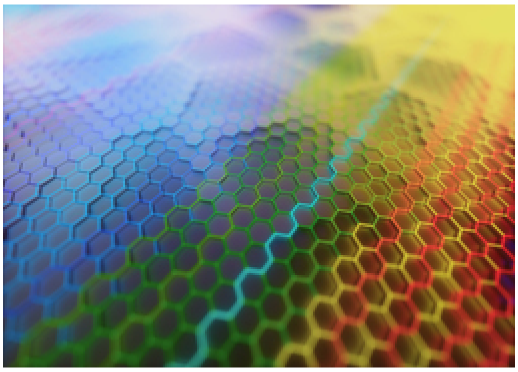
INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

# Direct Current Nanoelectronic Vapor Sensors

### TECHNOLOGY NUMBER: 2022-033



### OVERVIEW

Broad spectrum, real-time gas sensing with high sensitivity and DC electronics

- Compatible with existing microGC devices
- Small, portable, and low-power

### BACKGROUND

Nanoelectronic sensors based on low dimensional materials such as graphene benefit from their extremely high surface-to-volume ratio, low power consumption, chemical robustness, and convenient electrical readout. Although direct current (DC) sensors offer the potential benefit of simpler circuitry compared to alternating current (AC) systems, nearly all existing DC chemical vapor sensing methodologies require charge transfer between the sensor surface and the adsorbed molecules being sensed. Although these systems can display high sensitivity, the high binding energies required significantly slow the response time of the sensors and render them unsuitable for the detection of non-polar analytes.

### INNOVATION

Researchers at the University of Michigan have developed a DC-based nanoelectronic vapor sensor that is able to rapidly and sensitively detect a broad range of vapor molecules, including polar, weakly polar, and non-polar chemical compounds. The sensor incorporates a graphene field-effect transistor configuration cleverly employed and integrated with a unique

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#### Category
Hardware
Engineering & Physical Sciences

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microfabricated system that amplifies the DC signal response. The response and regeneration time can be as short as sub-second and the sensitivity can be at the sub-ppb level with power consumption as low as tens of microwatts.

With its capability to detect a full range of analytes (polar, non-polar, weakly polar, inorganic, organic) and its excellent sensitivity and rapid regeneration, the technology is a promising detector in micro gas chromatography systems and is already compatible with many existing microGC platforms. The physical footprint of the device is approximately one square centimeter. Its small size, coupled with its low power requirements and the simplicity of DC electronic circuitry, makes this technology suitable for portable applications, including wearable devices.

The technology is an excellent solution for broad spectrum, real-time gas sensing in a variety of applications, including environmental monitoring, industrial safety, and biomedicine.