High Sensitivity Stable Sensors and Methods for Manufacturing

---

Inefficiencies in single-gate silicon FET sensors call for innovation

Single-gate silicon FET sensors are typically used to amplify small electrical signals that result from physical or chemical interactions. However, they have several limitations. The performance of these sensors can degrade irreversibly over time, and there are limited engineering approaches for optimizing sensing functionality. Low-power signal amplification and detection can result in inefficiencies, and there have been challenges in fabricating sensors on flexible or unconventional substrates. Finally, existing sensor technologies for large-area deployments are high-cost and complex, making wide-scale production difficult.

New manufacturing method improves sensitivity, selectivity, and dynamic range of dual-gate FET sensors

Researchers at the Georgia Institute of Technology have developed a method for manufacturing dual-gate FET sensors that improve drastically on the sensitivity, selectivity, and dynamic range of the sensor. It allows for longevity of the device as well as the ability to measure cumulative effects of exposure to signals to transient carriers.

This technology introduces a cutting-edge method for manufacturing dual-gate field-effect transistor sensors. By ingeniously separating the sensing and amplifying functionalities across two gate dielectrics, the technology achieves unparalleled stability and sensitivity in detecting physical, chemical, or biological agents. This breakthrough addresses the common challenges faced by single-gate FET sensors, such as performance degradation, slow response times, and limited engineering optimization opportunities.

Summary Bullets

- This technology introduces dual-gate sensors, separating sensing and amplifying functions for unparalleled stability and sensitivity.
- The innovation addresses limitations of single-gate sensors, providing high sensitivity, low-voltage operation, and compatibility with diverse substrates.
- Applications include wearables, IoT, environmental monitoring, with cost-effective large-scale production.

Solution Advantages

? High sensitivity and stability in sensor operation.
? Low-voltage operation enabled through advanced engineering of the first gate dielectric layer.
? Optimization of sensing mechanisms via the second gate, enhancing detection capabilities.
? Compatibility with non-conventional substrates, allowing for diverse applications.
? Cost-effective production suitable for large-area fabrication.
? Flexibility and low processing temperature requirements, broadening the scope of usable materials.

Potential Commercial Applications

? Wearable electronics and health monitoring devices.
? Internet of Things (IoT) connectivity sensors.
? Environmental monitoring through chemical and biological sensors.
? Radiation sensing for safety and medical applications.
? Large area imaging arrays for both ionizing and non-ionizing radiation sources.

Inventors

- Dr. Bernard Kippelen
  Professor - Georgia Tech School of Electrical and Computer Engineering ; Director, Center for Organic Photonics and Electronics
- Canek Fuentes-Hernandez
  Research Scientist II — Georgia Tech School of Electrical and Computer Engineering
- Xiaojia Jia
- Weng-Fang Chou

IP Status

<p>Patent application has been filed.</p>: US20220123240A1

Publications

Stable Organic Field-Effect Transistors for Continuous and Nondestructive Sensing of Chemical and Biologically Relevant Molecules in Aqueous Environment, ACS Applied Materials and Interfaces - 2014

Images

Visit the Technology here:
[High Sensitivity Stable Sensors and Methods for Manufacturing]
