

Nanocavity FET Sensor for Real-Time Molecules Detection

Technology Domain: Electronics

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Status (Patent/TRL): Patent Pending / TRL 4

Technology Summary:

This invention details a highly sensitive and versatile Field-Effect Transistor (FET) sensor designed to detect a wide range of target molecules, including gases, liquids, biomolecules, and chemicals. The core innovation lies in creating a nanocavity within the FET's gate stack region, which serves as the primary sensing surface. When target molecules adsorb onto this nanocavity, they induce a change in the gate stack's work function, leading to a measurable and significant shift in the sensor's threshold voltage (V_T). This V_T variation, in turn, causes a corresponding change in the device's drain current (I_{ON}), allowing for the identification and quantification of the specific target molecule. The sensor achieves high sensitivity, real-time detection capabilities, low power consumption, and compatibility with existing CMOS technology, making it ideal for miniaturized, on-chip systems and diverse applications in environmental monitoring, medical diagnostics, and chemical sensing, particularly through the use of optimized CombFET and Fishbone FET structures for enhanced sensing surface area.

