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Gas Sensor Array Based on Metal-Decorated Carbon Nanotubes

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Abstract:

Here we demonstrate design, fabrication, and testing of electronic sensor array based on single-walled carbon nanotubes (SWNTs). Multiple sensor elements consisting of isolated networks of SWNTs were integrated into Si chips by chemical vapor deposition (CVD) and photolithography processes. For chemical selectivity, SWNTs were decorated with metal nanoparticles. The differences in catalytic activity of 18 catalytic metals for detection of H₂, CH₄, CO, and H₂S gases were observed. Furthermore, a sensor array was fabricated by site-selective electroplating of Pd, Pt, Rh, and Au metals on isolated SWNT networks located on a single chip. The resulting electronic sensor array, which was comprised of several functional SWNT network sensors, was exposed to a randomized series of toxic/combustible gases. Electronic responses of all sensor elements were recorded and the sensor array data was analyzed using pattern-recognition analysis tools. Applications of these small-size, low-power, electronic sensor arrays are in the detection and identification of toxic/combustible gases for personal safety and air pollution monitoring.

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