Nano Chemical and Radiation Sensors

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Single-wall carbon nanotubes (SWCNTs) exhibit a surface area as high as 1600 m^2/g which is attractive for the adsorption of gases and vapors. Gas adsorption can change SWCNT's properties such as conductance, capacitance, dielectric constant etc, and measuring/monitoring one of these properties can then form the basis for gas/vapor sensing. Our group has constructed a chemiresistive sensor using SWCNTs with variations such as doping, metal loading, functionalization etc. A 1 cm x 1 cm chip typically consisting of 32 sensor elements is used with a pattern recognition algorithm in the operation of an electronic nose. Examples of gas and vapor sensing using this sensor array will be provided.

For radiation sensing, we use a silicon CMOS based approach. A vertical FINFET type device is used but the conventional SiO_2 dielectric is replaced with a gel-like dieletric that responds to radiation. The device has been exposed to 1-100 kRad gamma radiation and the current-voltage characteristics change in a reproducible manner. In the long term, the gel can be replaced if it has undergone extensive damage and the device with replacement gel recovers its original characteristics.

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