

Sensors

Graphene Chemical Sensor

Using 2-D materials for ultrasensitive, chip-based nanosensors

Researchers at NASA Goddard Space Flight Center have developed a highly sensitive, low-power graphene-based detector designed to sense trace gases and neutral atoms without having to ionize them. The detector was developed in an effort to detect trace gases for planetary science missions, as well as to investigate the impact of atmospheric drag experienced by orbiting spacecraft due to the presence of atomic oxygen in the upper atmosphere, which is highly corrosive and can cause orbiting spacecraft to lose altitude prematurely and plunge to Earth.

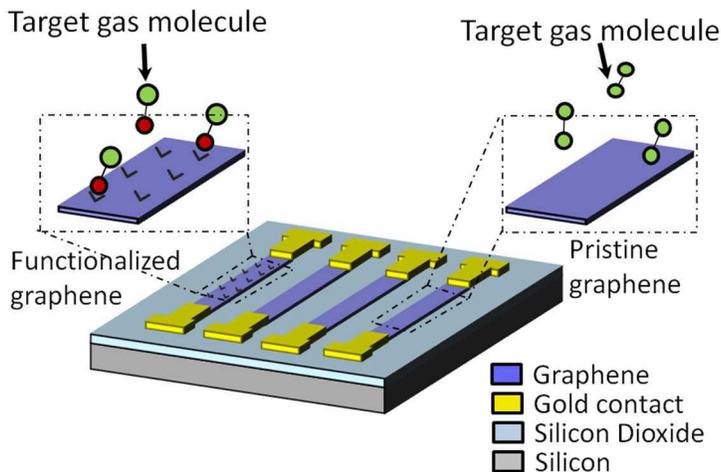
BENEFITS

- Ultrasensitive: can detect traces of neutral atoms that mass spectrometers cannot
- Simplified design: eliminates the need to ionize samples to run through a mass spectrometer
- Remote applications: a wireless card can be added to enable remote data collection
- Radiation hard: Graphene is radiation hard due to its minute cross section
- Low-mass, low-power, and portable

technology solution

THE TECHNOLOGY

The Graphene Chemical Sensor chip measures roughly 1cm x 1cm and has an array of 10 sensor elements. The chip also has on-chip temperature sensors and heaters to heat up the sensors, which resets them. Graphene is a two-dimensional crystalline material with the carbon atoms packed in a honeycomb lattice. It is not only the thinnest and lightest material, but also the strongest material ever measured. It has the highest surface to volume ratio with all the atoms exposed to the surface and is optically transparent, yet impermeable to even hydrogen. Graphene is radiation hard and stable at extreme temperatures, making it ideal for many different applications. The sensors have been optimized to measure traces of oxygen atom, hydrogen, ammonia, and water vapor.



A drawing of the Graphene Chemical Sensor

APPLICATIONS

The technology has several potential applications:

- Trace gas sensing
- Contamination control
- Neutral atom imaging

PUBLICATIONS

Patent Pending

Sultana, Mahmooda, Fred Herrero, and George Khazanov. "Graphene Chemical Sensors for Heliophysics Applications." *Radiation Effects and Defects in Solids: Incorporating Plasma Science and Plasma Technology* 168.10 (2013): 805-11

