National Aeronautics and
Space Administration

technology solution

Sensors

# Printable chemical nanosensor

## An integrated nanosensor printed on a daughter board using 3-D printing techniques.

NASA Goddard Space Flight Center has developed a printable nanosensor and leads using 3-D printing techniques on a silicon daughter board that can be connected to a self-contained pre-amp PCB. The sensor contains a graphene sensor array (a printed CNT or MoS2 could also work) and a PCB with pre-amplifier circuit connected to the daughter board with mechanical clips, and also wire bonded together. The sensor dimensions are typically from microns to 100s of microns. This innovation increases the sensitivity of gas sensors, enabling detection of ppb level concentration (and possibly single molecules).

## BENEFITS

- High surface to volume ratio with all atoms exposed to the surface
- High sensitivity
- Radiation hardness due to minute cross section.
- High chemical, mechanical, and thermal stability
- High mobility (in the case of graphene)

## THE TECHNOLOGY

These sensors use field effect transistors based on 2-dimensional materials to sense the surface potential of a graphene channel exposed to an analyte. When analyte molecules adsorb onto the sensor surface, they act as electron donors or acceptors, inducing a local change in electrical resistance in graphene. This effect is very pronounced in 2-D materials due to high surface area, high electrical conductivity (in the case of graphene), and inherent low noise, making it possible to detect the changes in resistance. Different gases have different effects on the resistivity. The selectivity among target gases can be improved further through functionalization of the 2-D materials. The sensors are microfabricated on a suitable substrate as arrays. Different sensors on the array can have different functional groups targeting different analytes.

## APPLICATIONS

The technology has several potential applications:

- Planetary science
- Earth science
- Contamination control
- Heliophysics

## PUBLICATIONS

Patent Pending

More Information

National Aeronautics and Space Administration

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