



# Graphene Formaldehyde Sensor (20150354, Dr. Tianhong Cui)

Technology No. 20150354

**IP Status:** Issued US Patent; **Application #:** 14/840,694

## Graphene-Based Formaldehyde Gas Sensor

A micro-fabricated, layered graphene sensor detects formaldehyde gas based on an electrochemical method. A layer-by-layer method using poly(diallyldiamine chloride) (PDDA) immobilizes formaldehyde dehydrogenase to a single layer sheet of graphene, where an enzymatic reaction links formaldehyde to the graphene sheet, changing the graphene's electrical resistance in proportion to formaldehyde concentration. The sensor detects concentrations of gas-phase formaldehyde of <10ppb in under 60 seconds. The new technology could be used in indoor applications (wood preparation, home/housing detection and medical preservation), chemical industry, oil and gas industry, and transportation.

## Detects Formaldehyde using Electrochemical Detection

Previous formaldehyde detection methods are expensive and time consuming and required bulky instrumentation and trained operators. In addition, they rely on either physical adsorption of formaldehyde gas molecules onto sensing materials or optical methods that require sophisticated light sources and light detectors. This new sensor, a micro-fabricated graphene chip, uses electrochemical detection to detect formaldehyde concentration in the air by sensing hydrogen ions produced by the specific enzymatic reaction. The technology is compact, fast, easy to use, and may be less inexpensive than traditional formaldehyde detectors.

### **BENEFITS AND FEATURES:**

- Graphene-based
- Electrochemistry-based gaseous formaldehyde detection
- Detects gas-phase formaldehyde concentrations of > 10ppb
- Layer-by-layer method immobilizes formaldehyde dehydrogenase to single layer graphene sheet
- Poly(diallyldiamine chloride) (PDDA)
- Enzymatic reaction links formaldehyde to graphene sheet, changing electrical resistance

- Fast (under 60 seconds)
- Potential for a small, portable device
- Compact, portable
- Easy to use
- May be less inexpensive than other methods

## **APPLICATIONS:**

- Formaldehyde sensor
- Electrochemical sensor
- Portable formaldehyde sensor
- Small and portable gas sensors
- Volatile Organic Compound (VOC) detection
- Manufacturing plants
- Personal/environmental safety markets
- Indoor wood preparation, individual housing detection
- Home/housing or community-wide environmental detection
- Medical preservation
- Chemical and oil industry
- Gas and transportation industry
- Laboratories

**Phase of Development** - High-fidelity prototype and proof of concept.

## **Researchers**

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