

GRAPHENE OXIDE BASED HUMIDITY SENSOR

**Wirelessly sensing using
RFID technology allows
for low power systems
that have the potential
for high sensitivity**

BACKGROUND

Graphene oxide (GO) is responsive to changes in its environment, such as humidity and temperature. GO sheets spread further apart in the presence of moisture, which creates extra room between layers and allows water molecules and other compounds to fill the space. The electrical conductivity of the GO increases as water molecules enter the gaps between the layers, effectively sensing changes in humidity. GO has previously been shown to function as a humidity sensor, however this has not previously been shown wirelessly.

THE TECHNOLOGY

Passive radio-frequency identification (RFID) systems are currently being used as humidity sensors, and do not require a power source. This technology integrates GO and RFID systems to create a passive, wireless humidity sensor. This technology has the potential to simplify information gathering through its wireless system. The sensor itself is produced using printed graphene technology which has the potential to be scalable and customisable for the application. The sensor here is displayed to sense humidity but future iterations could be used to sense anything that has an effect on the electrical properties of the GO, such as temperature. Wirelessly sensing using RFID technology allows for low power systems that have the potential for high sensitivity.

KEY BENEFITS

There is a constant need for improvements in sensing capabilities for measuring environmental conditions, this technology provides the following benefits:

- High sensitivity
- Wireless
- Low power
- Potential for multiple applications – sensing different gases/compounds etc
- Mass production in the long-term through graphene screen printing
- Sensors have the potential to be very small
- The shape and size of the sensor allows for mounting on a wide range of surfaces
- Some passive RFID sensors have unlimited lifespans; a sensor could therefore have the potential to be left alone for years at a time

APPLICATIONS

- Any manufacturing technique that is sensitive to moisture/susceptible to leakage with difficult to reach areas for assessment e.g. automotive and aerospace
- Monitoring moisture in food products, building materials and in healthcare
- Electrical properties of GO are not only affected by moisture. Other potential GO sensing options that could be developed include:
 - Detection of carbon monoxide/dioxide
 - Other products of combustion processes
 - Smoke detectors
 - Unreacted monomer in plastics industry
 - Presence of biological matter

INTELLECTUAL PROPERTY

The technology has been protected by a patent application.

RELATED PUBLICATIONS

Graphene radio frequency and microwave passive components for low cost wearable electronics.

Xianjun Huang, Ting Leng, Kuo Hsin Chang, Jia Cing Chen, Kostya S Novoselov and Zhirun Hu. doi.org/10.1088/2053-1583/3/2/025021

Binder-free highly conductive graphene laminate for low cost printed radio frequency applications.

Xianjun Huang, Ting Leng, Xiao Zhang, Jia Cing Chen, Kuo Hsin Chang, Andre K. Geim, Kostya S. Novoselov and Zhirun Hu. <http://aip.scitation.org/doi/10.1063/1.4919935>

OPPORTUNITY

We are seeking a licensee or industrial collaborator/partner to further develop this technology with a view to licensing.

UMIP REFERENCE

20150153.

UMIP