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GRAPHENE PRESSURE SENSOR

The atomic thickness of graphene dramatically increases the sensitivity of the pressure sensor and reduces the overall size

BACKGROUND

Pressure sensors are important components used within a multitude of systems. By converting very small changes in pressure into larger, significant changes in an electrical current, pressure sensors have a wide range of applications. Applications include personal devices, industrial monitoring, navigation, ultrasonic imaging and biomedical devices. As such, there is a high demand for the development of smaller, more sensitive and more reliable pressure sensors that may be incorporated into emerging technologies.

Pressure sensors are able to work in a similar manner to variable capacitors. The relative position of one conductive surface to another, which is affected by changes in pressure, results in a varying electrical output. Typically, the conductive surfaces used in pressure sensors are metal-polymer or metal-ceramic composites.

As such, the size and sensitivity of pressure sensors using metal plates is limited by the thickness and stiffness of the material. Therefore, to meet the demand for improved pressure sensors, alternative ultra-thin conductive materials should be used. One such material is graphene, an ultra-thin nanomaterial with extraordinary physical and electrical properties that make it ideal for incorporation into pressure sensors with significantly improved sensitivity and reduced size.

THE TECHNOLOGY

This technology uses a graphene membrane as the top surface in the sensor structure. The atomic thickness of graphene dramatically increases the sensitivity of the pressure sensor and reduces the overall size. Moreover, this technology offers further enhancement when compared to traditionally used pressure sensors by including a dielectric coating, which further increases the sensitivity and facilitates improved performance and reliability in all conditions. As such, this improved sensor represents a significant advancement in pressure sensing technology which may be incorporated into a wide range of products.

KEY BENEFITS

Benefits of this technology include:

- Greater accuracy and sensitivity due to the nanometer thickness of the graphene membranes used
- Improved reliability and maintained performance under high pressures due to the incorporation of an ultra-thin dielectric
- Significantly improved capacitance response; achieved by nano-scale engineering of the graphene membrane

APPLICATIONS

Potential applications of this technology include:

- Air or water flow sensors that may be used for aircraft or underwater navigation
- Accelerometers used for motion sensing, orientation detection and free fall sensing
- Acoustic sensors that may be used for ultrasonic imaging
- Miniaturised biosensors used in medical applications or the development of triboelectric nano-generators used to harvest energy from body movement and power medical devices within the body
- Vibro-tactile systems used to restore or provide alternative sensations to patients with health conditions in which their tactile senses are diminished
- Ultra thin touchscreens
- Ultra sensitive microphones
- Early warning earthquake detection systems

INTELLECTUAL PROPERTY

A patent application has been filed to protect this technology.

RELEVANT PUBLICATIONS

Ultra-thin graphene–polymer heterostructure membranes.
C. N. Berger, M. Dirschka and A. Vijayaraghavan DOI:10.1039/C6NR06316K

OPPORTUNITY

There are opportunities for partnership and collaboration regarding this technology.

UMIP REFERENCE

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UMIP
Core Technology Facility, 46 Grafton Street, Manchester M13 9NT, United Kingdom
T: +44 (0)161 603 7600 / F: +44 (0)161 606 7307 / E: graphene@umip.com / www.umip.com