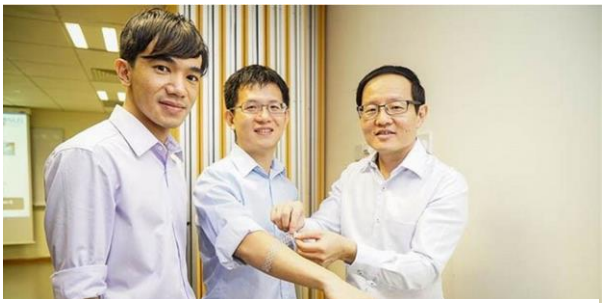
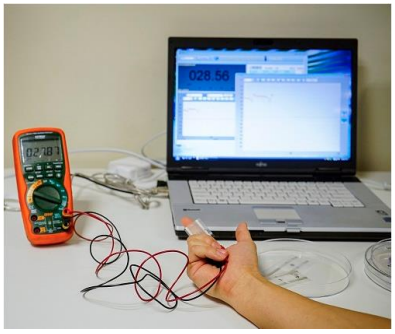
NUS National University of Singapore | Centre for Advanced 2D Materials

# JOINT DEVELOPMENT OPPORTUNITY

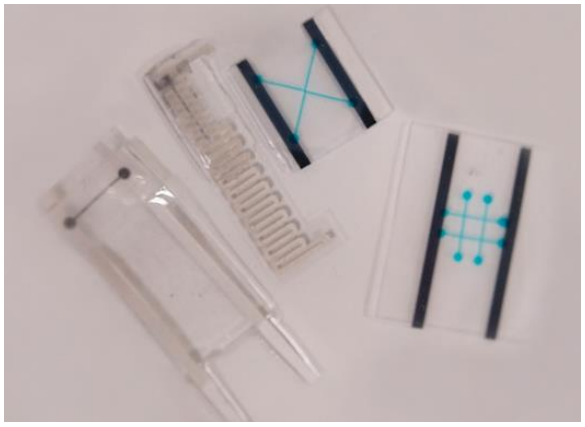
## Highly Wearable Flexible Liquid Graphene Oxide-Based Microfluidic Resistive Pressure Sensor



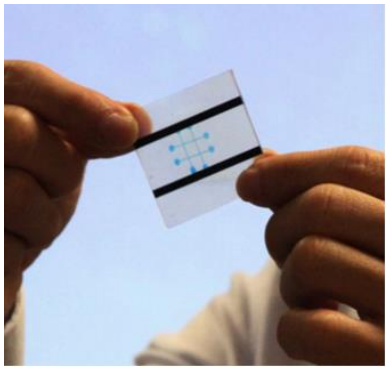
Demonstrating the wearable microfluidic pressure sensor



Data captured by sensor are uploaded to an interconnected intelligent system



Different types of microfluidic pressure sensors



Skin patch with two channels: (i) for the microfluidic tactile sensors and (ii) micro needles for drug delivery

## TECHNOLOGY BACKGROUND

Tactile sensors are data acquisition devices that detect and transmit information from physical interaction to an interconnected intelligence system.

Particles of graphene suspended in liquid across each small, thin strip, all of which make up a flexible substrate. The pressure sensing element is made up of graphene oxide. It senses changes induced by external forces, such as temperature, force, vibrations and hydration on the skin. Ruggedness is the

hallmark of its design as attested by rigorous tests like pressing, bending, stretching and even rolling pressure of a car's tyres.

## Application Areas

- Soft robotics, wearable electronics, medical prosthetic devices, real-time healthcare monitoring
- Monitoring of skin conditions, e.g. e-skins
- Physiotherapy to monitor proper execution of exercises by patients for optimal effectiveness
- Safety devices for patients who have lost all sense of touch, e.g. avoidance of hot surfaces/liquids
- Finely calibrated delivery of precise dose of drugs at a touch, e.g. through skin patches
- Cosmetics product development testing processes

## Benefits Offered

- Allows for natural body movements in use as a result of its small size, thinness and flexibility;
- Non-corrosive, non-toxic 2D nanomaterials perfectly safe for use by human patients;
- Ultra-sensitive to changes in temperature, force (min. 0.7 g), vibrations and hydration;
- Restores the same outcomes as natural touch sensations, e.g. fingertips mounted with these sensors can replicate and restore signals telling the brain what the fingers have touched;
- Microneedles based on the microfluidic mechanisms on skin patches activated by simple finger pressure to deliver painless and convenient drugs like insulin through the skin;
- Allows for test subjects to have skin conditions monitored before and after administering a product like moisturizers to find out their effectiveness in alleviating drying conditions.

## Solutions to Problems

- Conventional sensors are solid and inflexible, restrictive of body movements;
- Conventional sensors crack under pressure;
- Uniformity in electrical output under physical or mechanical stress;
- Plastic deformation and failure issues are overcome;
- Circumvents the need for pneumatic mechanisms which exist in current liquid-based sensors

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