ACHIEVEMENTS

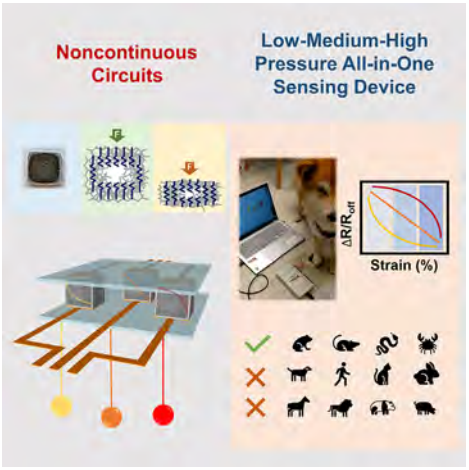
Interface-Mediated Flexible and Disposable Sensing Device Designs

As demand for human-machine interface designs has been on the rise in recent years, the appearance of flexible and disposable new sensing devices has attracted great attention. Reaching the goals of economical supply, environmental concern minimization, and user friendliness, as well as optimal device material selection and integration strategy are key issues to consider in innovating the designs.

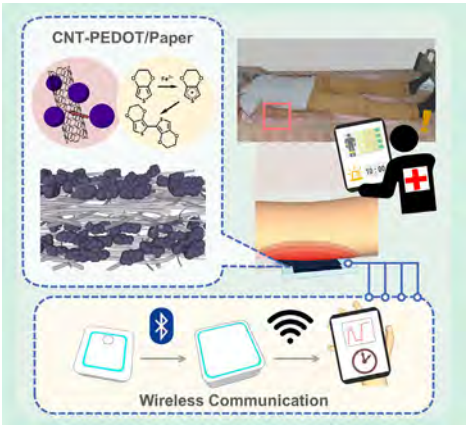
The Wei-Ssu Liao group of NTU's Department of Chemistry has been devoted to fabricating chemical and biomedical sensors over the years. Recently, their projects have focused on developing flexible and disposable pressure-sensing devices.

The group has selected polymeric and paper-based materials as supporting matrices in their recent work. In the case of a porous polymeric matrix, a melamine sponge is used to capture conductive carbon nanotubes (CNTs) from the suspension solution through a rotational vortexing operation. This results in three-dimensionally distributed nanomaterials in the porous matrix with various gradient profiles. The unique conductive matrix system behaves in a manner like noncontinuous on/off switch circuits and is highly sensitive to a wide range of pressure stimuli. For medical care, this pressure-sensitive piezoresistive device can be applied to pulse detection, finger bending, and body posture detection. Multiple sensing units also have been parallelly integrated on a single device to monitor continuous pressure stimulations, for example the blind test recognition of different animals with various weights. The advantageous breakthrough of this setup is that it enhances the current human-machine interface design to achieve more precise and easier detection in real-life applications.

Another porous matrix, paper, is applied to fabricate wireless, flexible, and disposable sensing devices for medical care. This collaborative effort between the Chemistry Department and the Nursing School was aimed to design disposable devices for monitoring long term stress and pressure preventing injury to the human body. The porous paper matrix is embedded with CNT poly(3,4-ethylenedioxythiophene), CNT PEDOT, composites to establish compressible conducting networks, that enable sensitive external pressure detection through



The use of multiple elastic pressure-sensing units containing noncontinuous circuits to innovate a pressure-sensing device with ultra-wide rang



The CNT-PEDOT composite gradient distributed paper-based pressure sensing device with the combined function of remote monitoring for long-term PI prevention.

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piezoresistive effects. A multilayer design achieved through selective drop-casting and preferential stacking forms alternating conductive/nonconductive interfaces, effectively modulating the device's electrical properties. When integrated with a Bluetooth module, the multichannel wireless detection system allows for posture recognition with excellent sensitivity, specificity, and high accuracy of nearly 100%. The group expects that the newly introduced sensor will provide significant support for caregivers in hospitals, long term care facilities, and community home-care settings.

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NATIONAL TAIWAN UNIVERSITY
+886-2-3366-2577
No.1, Sec. 4, Roosevelt Road Taipei, 10617 Taiwan
ntuhighlights.ntu.edu.tw

National Taiwan University 國立臺灣大學