Dry Electrodes for Vital Sign Monitoring Overcomes Limitations of Wet and Gel-based Electrodes

Traditional electrodes for EEG, EKG and other medical monitoring applications have relied on liquid or gel to maintain the required electrical contact with skin. These are prone to drying over time, which results in a loss of effectiveness when extended monitoring is required. Dry electrodes have recently become available, but these have low surface connectivity with skin or low conductivity resulting in higher interfacial noise and susceptibility to micro-movements. Researchers in Electrical and Computer Engineering at the University of Memphis have invented a dry electrode on a flexible substrate that will overcome these drawbacks. This novel platform technology will give healthcare providers a more robust tool that can be used for several applications and should find uses in in-patient and home-based settings. This novel technology is available for exclusive licensing.

Applications

Wired and wireless electrodes for bio-impedance and bioelectricity measurements, such as:

- Electroencephalogram
- Electrocardiogram
- Galvanic Skin Response, and
- Electromyography

Advantages

Dry electrodes allow longer monitoring without the need to replenish the sensors or replacing them.

Lower impedance leads to lower interfacial noise for reliable and robust data collection.

Better surface connectivity results in less skin preparation requirement and ability to monitor through thin layer of hair.

Flexible and breathable electrodes increase patient comfort.

The dry electrodes also allow low-level electrical stimulation without degradation of the interface.

The Technology

This invention is based on a novel dry interfacing electrode utilizing patterned vertical carbon nanotube (pvCNT) for impedimetric sensing. The electrodes are fabricated on flexible substrates. Electrically conductive multiwalled carbon nanotubes were then grown in pillar formation with various inter-pillar spacing. The heights of the carbon nanotube pillars can be as high as 1.5 mm. A comparative in vitro study with commercial wet and gel electrodes showed pvCNT electrode has lower interfacial impedance, comparable signal capture quality, and ability to be used for stimulation. Long duration study showed minimal impedance degradation for pvCNT electrodes over a week. The results demonstrate pvCNT is a promising dry electrode for impedimetric sensing and stimulation of neurological and physiological signals over a prolonged duration.