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MARKET SHEET

Enhanced Electronic Sensors

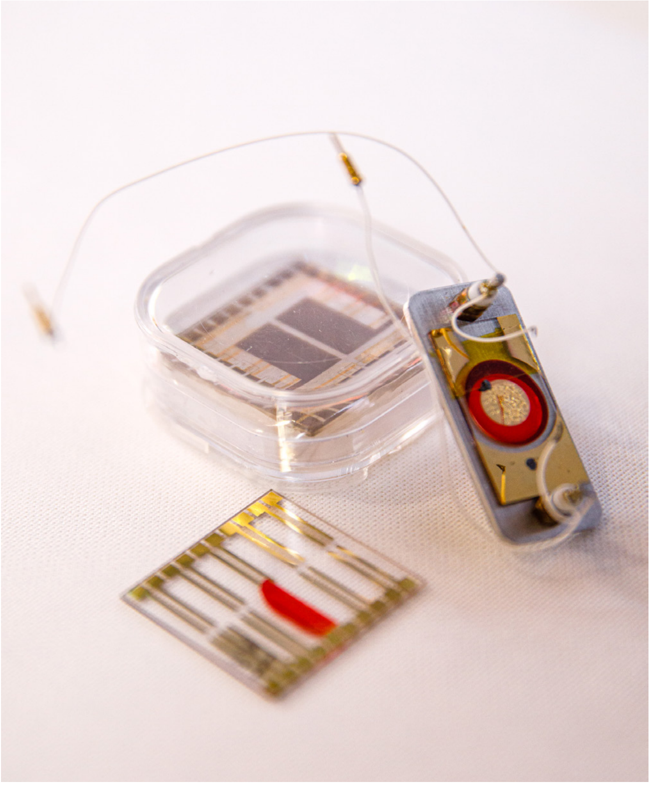
Sandia National Laboratories

A new embedded electrode structure can enable enhanced electronic sensing for medical diagnostic and curative measures

US Patent Pending

Technology Readiness Level 4

Conventional planar electrodes face significant challenges when dealing with bulk materials with dispersive transport. Due to restricted electric field distributions and limited charge transport, their surface electrode structures often struggle to effectively sense signals within bulk resistive films. When paired with bulk materials, these electrodes can hinder contact with target analytes in the sensitive direction or within anisotropic bulk materials, resulting in insufficient electric fields.



An electronic dosimeter for radiotherapy, constructed using Sandia's enhanced electronic sensors.

Consequently, devices using conventional electrode designs lack the capacity to linearly scale dispersive materials, leading to less accurate signal read-outs. Thus far, materials with promising potential for bulk sensing applications due to their selective interaction with specific analytes have not been widely adopted due to the poor electronic transport facilitated by conventional planar electrodes.

Researchers at Sandia have developed an embedded electrode structure that overcomes current challenges by providing independent control over sensitive material thickness, area, electric field intensity, and direction, enabling enhanced electronic sensing in bulk resistive materials with dispersive charge transport. This three-dimensional micro-structured electrode not only enhances sensitivity but also improves signal-to-noise ratios for electronic sensors requiring bulk or thick film materials, thus facilitating their broader adoption in commercial applications. Moreover, Sandia's embedded electrode technology is versatile, applicable across various sensor geometries, including but not limited to charged particle sensors, chemiresistive sensors, voltage division position sensing particle detectors, and fast neutron radiography linear arrays. Its application also extends to a broad range of critical industries such as biological and chemical sensing, humidity sensing, multiplexing or simultaneous

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testing for viral, bacterial, and humidity levels, medical diagnostics and treatments including a real-time detection of radiation in current or high magnitude radiotherapy measures, pathogen detection, and pre-treated blood detection for conditions like diabetes, stroke, and heart attack, food quality and impurity testing, alcohol and drug detection, thermoplastics, as well as in space and air exploration using coatings on spacecraft exteriors.

Technical Benefits

- Enhanced electronic sensing in bulk resistive materials with adequate electric field distribution and disruptive charge transport.
- Improved sensitivity and signal-to-noise for electronic sensors that require bulk or thick film materials.
- Allows for the widespread use of sensors with materials that have an affinity for bulk sensing applications.
- Can be engineered for different sensor geometries, paving the way for use in various applications and industries.

Industries & Applications

- Medical diagnostic and curative measures including more accurate and real-time radiation detection in current radiotherapy measures and emerging high magnitude radiotherapies, medical imaging, pathogen detection, and pre-treated blood detection of diabetes, stroke, and heart attack
- Food quality and impurity testing
- General biological and chemical sensing
- Humidity sensing
- Thermoplastics
- Multiplexing, i.e. simultaneous testing
- Space and air exploration

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