Soft, Stretchable, Strain-Insensitive Biosensors from Dispensable Poroelastic Biomaterials

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- Materials and Manufacturing

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- Sensors

Researchers at Purdue University have developed a new soft, stretchable, strain-insensitive biomaterial to form dispensable poroelastic biosensors. Currently, stretchable biosensors are challenging to manufacture and are typically made of viscoelastic materials that undergo mechanical and electrical hysteresis under deformations. Further, there is a new type of cutting-edge printing, direct ink writing (DIW), that enables multidimensional and multifunctional architectures in a variety of shapes and sizes for biosensors. The porous, silicon-based, sponge-like material created by Purdue researchers can be integrated in DIW and 3D printing for making customized biosensors. In testing, the softness and stretchability of the biomaterial was found to be less than 30 kPa whereas current dispensable inks are greater than 1.11 MPa, human cardiac tissue has softness of 29-41 kPa. A biosensor printed with the new material remained durable over 1,000 load-unload cycles with strain upward of 30%. This new biomaterial shows promise to seamlessly couple with living tissues and allows for high-fidelity spatiotemporal electrophysiological activity in real-time, a type of ultra-sound imaging, for rapid visual analysis of organs. In vivo in mice, an acute myocardial infarction could be observed.

Advantages:
-Soft

-Stretchable
-Durable
-Adaptable with Dispensable Ink Printing or 3D Printing
-Rapid Real-Time Biosensing
-Biocompatible
-Strain-Insensitive
-Poroelastic

Potential Applications:
-Biosensors
-Dispensable Ink Printing or 3D Printing of Biosensors
-Biotechnology

Technology Validation:
The new biomaterial was found to be exceptionally stretchable (over 150% before first fracture), soft (less than 30 kPa elasticity), durable (over 1,000 load/unload cycles in 30% strain) and allows for rapid biosensor production in dispensable ink and 3D printing. Further, the new technology allows for seamless communication allowing researchers to observe a murine myocardial infarction in the form of an ultra-sound in real-time with accuracy and reliability.

Recent Publication:
"Rapid Custom Prototyping of Soft Poroelastic Biosensor for Simultaneous Epicardial Recording and Imaging"
Research Square
DOI: 10.21203/rs.3.rs-88291/v1

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