Biocompatible Strain Sensing Polymer Fiber

VTIP 20-062: "Thermal Drawing of Strain Sensing Polymer Fiber"

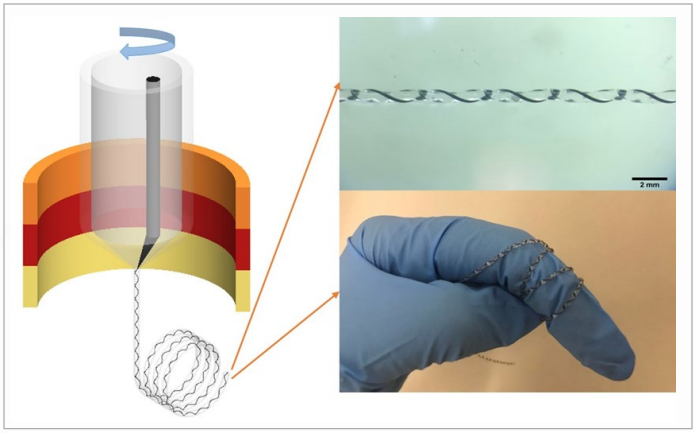
THE CHALLENGE

Strain sensing has the potential to revolutionize biomedicine and how we collect data regarding physiological conditions, but technologies available right now have notable limitations. Current metal or silicon-based strain sensors cannot sense small deformations (less than 5%) and are not biocompatible; as a result, they are not suitable for monitoring human health. These strain sensors are usually not very flexible and cannot be woven onto fabrics for use in wearable devices. They also have a comparatively low strain sensing range unless consumers opt for more expensive models.

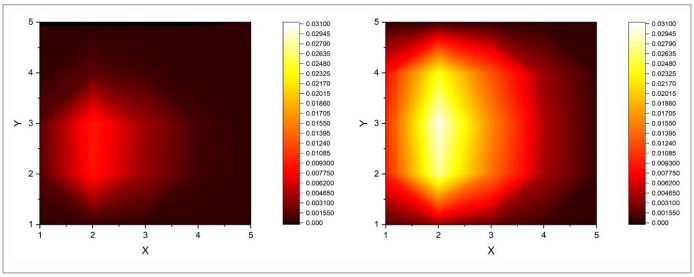
OUR SOLUTION

Xiaoting Jia and her team at Virginia Tech have developed a novel, stretchable polymer fiber that can measure strain, is biocompatible, and can be woven into fabrics or configured into a mesh to map strain distribution across multiple dimensions. By innovatively using the process of thermal drawing and doping, the inventors have created a polymer fiber that has multiple modes of operation to measure strain. It remarkably provides a strain sensing range of 400% and is stable over one thousand cycles.

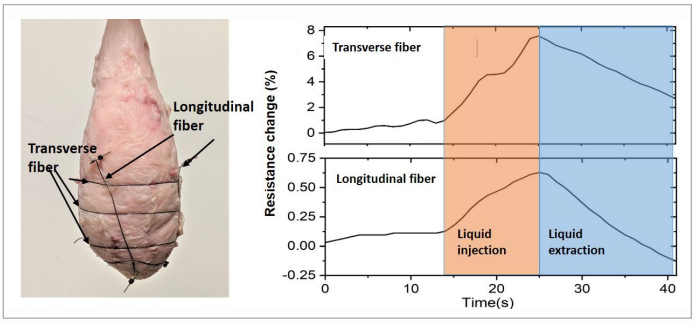
The biocompatibility of these fibers was tested by mounting the engineered mesh on a pig bladder to observe physiological function and measure any reactions, and those tests were quite successful. The strain sensor can be used for a wide variety of applications across biomedical devices and wearable devices. The fiber can also be attached to robotics and prosthetics and provide feedback control of its movement and interactions.



Example of a fiber sensor made with a spiral electrode.



A mesh woven from strain sensing fibers was used to measure pressure from steel balls of different diameters (25 mm, left and 31 mm, right), and the mesh could clearly differentiate between the two sizes.



The fiber strain sensor was used to measure physiological changes in a pig bladder when liquid was extracted or injected.

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