Using Self Assembled Monolayers for the Fabrication of Implantable Strain Gauge Sensors

Hu, Justin (School: James Madison High School)

Strain gauges are electronics that measure applied force by monitoring changes in the resistance of a circuit. Gauges are produced when interdigitated circuits are placed on an adhesive that securely bonds the circuit to the experimental surface. Creating a stable circuit is thus crucial to evaluating the relationship between changes in resistance and change in strain. In biomedical applications for pressure sensing and fluid monitoring, creating stable circuits has posed a challenge as conventional adhesives are toxic and often lack the adhesion to securely morph to deformations in bone structures. In this paper, a self-assembled monolayer fabrication method is proposed to produce durable biocompatible circuits for strain sensing. The method relies on 3-Mercaptopropyltrimethoxysilane (MPTMS) and Perfluorodecyltrichlorosilane (FDTS) to effectively bond gold circuits to biocompatible surfaces by patterning circuits onto a rigid FDTS-treated wafer and transferring the circuits onto biocompatible Polydimethylsiloxane substrates with MPTMS. The adhesion between the contact layers of gold and Polydimethylsiloxane was evaluated using an adhesion tape test, while the circuit's electrical/resistive stability was assessed in various strain conditions. The research found an improvement to the quality of the circuit-Polydimethylsiloxane bond when the surface modifications were employed, and the strain sensitivity remained comparable to conventional strain gauges.

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