Mar 22nd, 9:20 AM - 10:40 AM

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A Comparative Analysis of Capacitive Based Flexible Pressure Sensors

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This paper presents the material characterization of a flexible polymer for potential biomedical pressure sensing applications. The emergence of flexible, capacitive based pressure sensors with similar tactile sensing properties as human skin are highly desirable in many applications such as continuous cardiovascular monitoring, electronic skin and rehabilitation technologies \cite{2,3}. Most of these sensors require high sensitivity, fast response time, flexibility and low cost. Due to flexible and foldable nature of the sensor, it can be integrated to artificial skin or imposed on the body surface. Among different sensing technologies, one promising method is through the use of micro-structured, flexible, dielectric polymers, for example PDMS (Polydimethylsiloxane). Micro-structures increase the sensitivity of the device.

Current methods for constructing micro-patterns into the PDMS requires expensive and labor intensive methods such as photolithographic techniques and chemical etching, which lack low-cost and large-area compatible alternatives. The objective of this work is to construct and characterize a flexible capacitor pressure sensing device by using a simple, cost effective method of PDMS microstructuring as described by previously by Grzybowki \textit{et al.} \cite{1}. The PDMS was prepared by mixing 20 parts elastomer and 1 part curing agent. The rough structured PDMS is prepared by simply curing the polymer within an epoxy mold that incorporates a micro – pattern like design found within a commercially available tape. The sample was placed in a vacuum for one hour at room temperature and then cured for another 24 hours at room temperature. Flexibility of the sensors is a key parameter related to sensor sensitivity. Flexibility can be measured by measuring the modulus of elasticity. Our test reveals the rough structured PDMS modulus to be 1.29 MPa whereas the non-structured PDMS modulus was found to be 2.90 MPa. The difference in moduli was not determined to be significant as expected since the structures are not changing the material property of PDMS. Through characterization and preparation of rough structured capacitive based PDMS pressure sensors, we hope to produce a capacitive sensing device with excellent detection sensitivity at a low cost and with a simple method of production.
References:

