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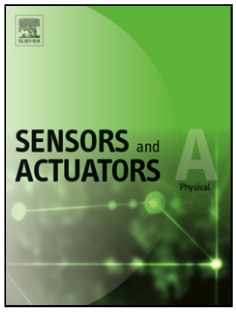

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ACCEPTED MANUSCRIPT

Large area and ultra-thin compliant strain sensors for prosthetic devices

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Highlights

- Piezoresistive sensors were applied to the surface of a monolithic 3D printing finger
- The chemical affinity between the different polymer and solvents were matched
- Outstanding linearity between the electrical resistance and the strain during the finger bending
- Excellent repeatability and stability (> 10,000 cycles), fast response and low creep,
- Negligible mechanical and electrical hysteresis; and ideal candidate for prosthetic devices

Abstract

There is an increasing need to establish skin-like ultra-thin sensors which can directly be deposited (e.g. sprayed) on a soft active structure representing the limbs (e.g. fingers) of prosthetic devices such as a prosthetic hand. Such sensors are essential to control the actuation behaviour of the soft structure, and to obtain information about temperature of an object which the finger is touching. This study employed an inexpensive and scalable technique to place elastomeric sensors directly onto a monolithic structure representing the finger of a soft robotic prosthetic hand. The chemical affinity between the solvent used, and the soft elastomers (thermoplastic urethane, TPU, and styrene-butadiene-styrene, SBS) allowed the blending of the TPU and the SBS at the finger interface, creating a highly compliant piezoresistive sensor, that was directly deposited in the desired place.

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