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PROCEEDINGS

3D Printing of Electrically Conductive and Degradable Hydrogel for Epidermal Strain Sensor

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ABSTRACT

Due to excellent electrical conductivity, stretchability, and biocompatibility, electrically conductive hydrogels have been widely used in flexible wearable strain sensors. Generally, conductive fillers need to be integrated with the hydrogel matrix to impart electrical conductivity. According to the method of composite formation between electronic conductive fillers and hydrogel matrix, conductive hydrogels can be classified into embedded conductive and coated conductive hydrogels. Additionally, due to the intrinsic chemical and physical crosslinking networks, traditional hydrogels are not degradable, resulting in severe environmental pollution problems. Herein, we designed electrically conductive and degradable hydrogels for the epidermal strain sensor through a facile digital light processing 3D printing technology. Regarding the embedded conductive hydrogel, a three-step strategy of surfactant-assisted dispersion, UV curing, and water spraying was developed. Regarding the coated conductive hydrogel, a three-step strategy of UV curing, ion sputtering, and water spraying was developed. Owing to the incorporation of conductive fillers, the electrical conductivities of filler-embedded and layer-coated hydrogels were 0.13 and 3.0 S cm^{-1}, respectively. Additionally, this study employed monofunctional monomers that only resulted in chain entanglements after free radical polymerization, without any physical or chemical crosslinking, thus potentially exhibiting biodegradability. The degradation time of filler-embedded and layer-coated hydrogels in soil were 40 and 10 days, respectively. This work has opened up a new avenue for the preparation of electronically conductive hydrogels and addressed the issue of environmental pollution caused by electronic waste.

KEYWORDS

3D printing; electrically conductive; degradable; hydrogel; strain sensor

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