Conductive Dual-Network Hydrogel for Flexible Sensing Motif

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A dual-network hydrogel was prepared for smart sensing application. Tannic acid (TA) and polyvinyl alcohol (PVA) was gelated as the first network and sodium alginate (SA) was further cross-linked by Ca^{2+} as the second network. The dual-network structure of the SA/PVA/TA hydrogel was proofed by SEM and XRD, The dual-network composed of multiple hydrogen bonds between PVA, SA and TA as well as the ion bonds between SA and Ca^{2+}. A large number of hydroxyl groups of TA are combined with the network structure of PVA and the chain structure of SA, which improves the toughness and strength of the hydrogel. Further characterization showed that the conductive hydrogel can adhere well to iron, glass, plastic and finger joints. In terms of mechanical properties, the hydrogel with TA showed better mechanical properties. After crosslinking in $CaCl_2$ solution, the tensile strength and conductivity increased of the SA/PVA/TA hydrogel with the increase of immersion time. The SA/PVA/TA hydrogel soaked for 30 min produced strain with the extension of external force, and its sensitivity also changed accordingly. Such conductive hydrogel showed good adhesive and tensile properties adhered to iron, glass, plastic and finger joints. Then, the hydrogel was deformed while the impedance curve is recorded. The results showed that the dual-network hydrogel can be used as strain sensors, which provides a new idea that SA/PVA/TA conductive hydrogel can be used as conductive flexible sensors.

Keywords: dual network structure; conductive hydrogel; flexible sensors