

Decision Letter (TC-ART-06-2026-001996.R1)

From: MaterialsC@rsc.org

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CC:

Subject: Decision on submission to Journal of Materials Chemistry C - TC-ART-06-2026-001996.R1

Body: 13-Aug-2026

Dear Professor Guo:



Manuscript ID: TC-ART-06-2026-001996.R1

TITLE: Tough and fatigue-resistant hydrophobic associative hydrogels reinforced by polydopamine-modified carbon nanotubes for wearable strain sensors

Thank you for submitting your revised manuscript to Journal of Materials Chemistry C. After considering the changes you have made, I am pleased to accept your manuscript for publication in its current form. I have copied any final comments from the reviewer(s) below.

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Thank you for publishing with Journal of Materials Chemistry C.

With best wishes,

Unyong Jeong

Associate Editor, Journal of Materials Chemistry C

REVIEWER REPORT(S):

Referee: 2

Recommendation: **Accept**: suitable for publication without modification

Comments:

This is a revision. The authors have made necessary improvements. It can be recommended to be published.

Additional Questions:

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Impact: **High - Top 20%**



Cite this: DOI: 10.1039/d6tc01996j

Tough and fatigue-resistant hydrophobic association-based hydrogels reinforced by polydopamine-modified carbon nanotubes for wearable strain sensors

Shaoyu Luan, Rongzhe Yang, Yan Zhao, Yican Wang and Weihong Guo *

Conductive hydrogels for wearable strain sensing often suffer from trade-offs among mechanical robustness, electrical conductivity, sensitivity, adhesion, and long-term durability. Here, a hydrophobic-association-based PASS/PDA@CNTs/Ca²⁺ double-network hydrogel was developed by integrating a reversible poly(AM-co-SMA) hydrophobic association network, an SA-Ca²⁺ ionic coordination network, and PDA@CNTs-enabled interfacial reinforcement and electron transport. The optimized hydrogel exhibited a tensile strength of 957.56 kPa, an elongation at break of 2057.58%, a toughness of 11.54 MJ m⁻³, and an elastic modulus of 175.52 kPa, demonstrating a favorable balance among strength, stretchability, and toughness. It also showed a high conductivity of 41.41 mS cm⁻¹, a maximum gauge factor (GF) of 4.12, and good adhesion to different substrates. Benefiting from the dynamic crosslinked network and stable ionic/electronic conductive pathways, the hydrogel maintained its mechanical integrity over 2000 tensile cycles at 100% strain and generated stable and distinguishable resistance responses over 5000 cycles at 50% strain. Moreover, the hydrogel exhibited good biocompatibility, supporting its suitability for direct skin contact. As a wearable strain sensor, it enabled reliable monitoring of large joint movements and subtle physiological activities, as well as Morse-code information transmission. These results demonstrate the competitive overall performance and promising potential of the hydrogel for wearable health monitoring, human-computer interaction, and emergency communication.

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1. Introduction

Hydrogels have attracted extensive research interest in various fields, including wound healing,¹ environmental monitoring,² and chemical sensing,^{3,4} owing to their highly hydrated networks and tunable physicochemical properties. With the rapid development of flexible electronics and smart wearable devices,^{5–8} flexible strain sensors have attracted considerable attention in human motion monitoring, health management, electronic skin,^{9–11} and human-computer interaction.^{12–14} Conductive hydrogels are regarded as promising materials for flexible sensors because of their high water content, excellent flexibility and stretchability, and tissue-like mechanical properties.^{15,16} Nevertheless, conventional conductive hydrogels still suffer from low mechanical strength, insufficient fatigue resistance, unstable conductive networks, and poor interfacial adhesion. These limitations hinder their ability to maintain stable sensing performance under long-term use, large deformation, and complex motion conditions.^{17–19} Therefore,

developing conductive hydrogels that integrate high mechanical strength, stable conductivity, self-adhesion, and high sensitivity remains highly important.

To improve the mechanical performance of hydrogels, various strategies have been proposed, including double-network structures, nanocomposite reinforcement, ionic crosslinking, hydrogen-bonding interactions, dynamic covalent bonds, and hydrophobic-association crosslinking.^{20–24} Among these strategies, hydrophobic-association-based hydrogels have emerged as an effective platform for enhancing toughness and fatigue resistance because of their dynamic and reversible physical crosslinking networks. Typically, long alkyl chains of hydrophobic monomers are solubilized within the hydrophobic cores of surfactant micelles, thereby forming hydrophobic association domains in the polymer network. Under external stress, these domains preferentially dissociate to redistribute stress and dissipate energy; upon unloading, they can reassociate, thereby endowing the hydrogels with high extensibility, toughness, self-healing ability, and fatigue resistance.^{25–30} For example, Shen *et al.*³¹ incorporated branched starch and ionic liquids into hydrophobic-association-based hydrogels to obtain an HA-AMY-IL double-network hydrogel with an elongation of 2540%, an elastic modulus of 12.0 kPa, and a

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