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证　　明

经检索 Science Citation Index Expanded (SCI-EXPANDED)数据库、Journal Citation Reports (JCR) 数据库，同济大学化学科学与工程学院向双飞的 2 篇论文被 SCI 收录，并附最新（2018）期刊影响因子。

详细如下：

第 1 条，共 2 条

标题: Strain sensor based on a flexible polyimide ionogel for application in high- and low-temperature environments

作者: Xiang, SF (Xiang, Shuangfei); Chen, SS (Chen, Shuangshuang); Yao, MT (Yao, Mengting); Zheng, F (Zheng, Feng); Lu, QH (Lu, Qinghua)

来源出版物: JOURNAL OF MATERIALS CHEMISTRY C 卷: 7 期: 31 页: 9625-9632 **DOI:** 10.1039/c9tc02719j 出版年: AUG 21 2019

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地址: [Xiang, Shuangfei; Chen, Shuangshuang; Yao, Mengting; Zheng, Feng; Lu, Qinghua] Tongji Univ, Sch Chem Sci & Engn, Shanghai 200092, Peoples R China.

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MATERIALS SCIENCE, MULTIDISCIPLINARY	**44/293**	**Q1**
PHYSICS, APPLIED	**20/148**	**Q1**

数据来自第 2018 版 Journal Citation Reports

第 2 条，共 2 条

标题: A facile method to fabricate tough hydrogel with ultra-wide adjustable stiffness, stress, and fast recoverability

作者: Xiang, SF (Xiang, Shuangfei); Li, T (Li, Ting); Dong, WF (Dong, Weifu); Lu, QH (Lu, Qinghua)

来源出版物: JOURNAL OF POLYMER SCIENCE PART B-POLYMER PHYSICS 卷: 56 期: 21 页: 1469-1474 **DOI:** 10.1002/polb.24737 出版年: NOV 1 2018

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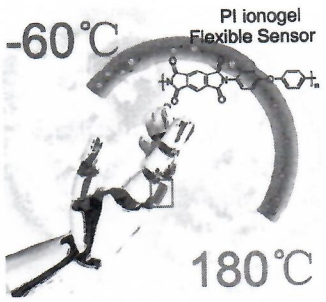
COMMUNICATION

Xuechuan Hong, Yuling Xiao *et al.*

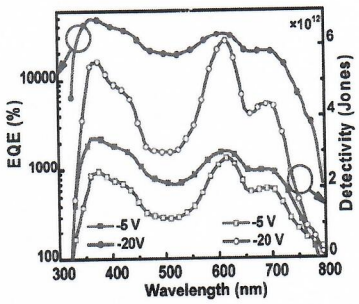
Mn-Loaded apolactoferrin dots for *in vivo* MRI and NIR-II cancer imaging

PAPERS



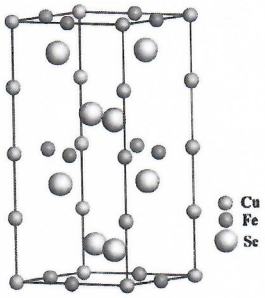
Strain sensor based on a flexible polyimide ionogel for application in high- and low-temperature environments

Shuangfei Xiang, Shuangshuang Chen, Mengting Yao, Feng Zheng and Qinghua Lu*



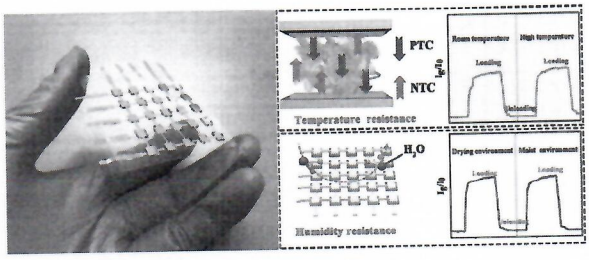
All-polymer photodetectors with photomultiplication

Kaixuan Yang, Jian Wang, Jianli Miao, Jian Zhang and Fujun Zhang*



The p–n transformation and thermoelectric property optimization of $Cu_{1+x}FeSe_2$ (x = 0–0.05) alloys

Jinze Zhai, Hongchao Wang,* Wenbin Su, Teng Wang, Fahad Mehmood, Xue Wang, Tingting Chen, Taichang Huo, Kaiqi Zhang and Chunlei Wang*



Water-proof and thermally inert flexible pressure sensors based on zero temperature coefficient of resistance hybrid films

Zhiyi Gao, Kai Jiang, Zheng Lou, Wei Han* and Guozhen Shen*

Journal of Materials Chemistry C

PAPER

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Strain sensor based on a flexible polyimide ionogel for application in high- and low-temperature environments†

Shuangfei Xiang, Shuangshuang Chen, Mengting Yao, Feng Zheng and Qinghua Lu *

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Ionogels possess an inherent conductivity, flexibility and outstanding mechanical properties. They have attracted increased attention because of their potential as mechanical transductors, flexible devices and artificial skins for modern electronics. However, the use of reported ionogels is limited to mild conditions with weak performance under thermal fluctuation. We prepared a novel polyimide ionogel by a facile one-step solvent displacement method using the ionic liquid (IL) [BMIm][BF_4] to replace the native organic solvent in the polyimide organic gel. The resultant PI ionogel maintained excellent mechanical properties (tensile strength ~7.1 MPa and elongation at break ~320%), and high thermostability, and exhibited high ionic conductivity (1.9–5.2 mS cm^{-1}) and a linear temperature dependence on conductivity. As a strain sensor, the polyimide ionogel provided high sensitivity, long-term durability and stability in a wide thermal range (−60 to 180 °C). The polyimide ionogels provide an opportunity for the preparation of stress sensors for high- and low-temperature applications.

Introduction

Strain sensors that provide repeatable electronic signals that respond to mechanical deformations can be used in sports, robotics, health monitors and intelligent industrial controls.[1–3] Significant effort has been devoted to fabricating strain sensors with high sensitivity and excellent flexibility. The core aspect of the strain sensor is the development of deformation-responsive conductive materials. The usual practice is to embed electroactive nanomaterials, such as silver nanoparticles, carbon nanotubes and graphene derivatives, in a polymeric matrix.[1,4–6] Polydimethylsiloxane and polyurethane are the most commonly used substrates. Although these systems work well at room temperature, their performance, including their mechanical properties and repeatability, is influenced significantly by the environmental temperature,[7] which limits their application in some areas, especially in the industrial and aerospace fields.

Ionogels, which are a type of soft material, possess unique features, such as ionic conductivity, environmental stability and flexibility, and they have gained increasing interest in a wide range of electronic applications, including electrolytes, dielectric elastomer transducers and flexible electronics.[8–10] Therefore, they should be an ideal candidate for use as stress sensors. Ionogels are fabricated by incorporating electrolytes into polymeric matrices, such as polyacrylamide,[11,12] poly(ethylene oxide),[13,14] polyvinyl alcohol (PVA),[15,16] chitosan,[17,18] and P(2-acrylamido-2-methylpropane sulfonic acid) (PAMPS).[10] Because they are restricted by the thermal stability of the polymer matrices and solvent evaporation of the incorporated electrolytes (water solution), the operating temperature of ionogels is limited to a relatively narrow range below 100 °C.[19–22] For example, PAMPS-based double network ionogels that were designed by Liu and co-workers showed a high ionic conductivity (1.7–2.4 S m^{-1} at 25 °C); however, their end-use temperature cannot exceed 100 °C.[10] A tough ionogel derived from BMIMCl/CS/PHEMA, which was reported by Wang and co-workers, can be used only at room temperature because of the presence of water.[23] Despite their high ionic conductivity, these ionogels have a weak mechanical strength (fracture tensile stress <1 MPa) and a narrow operating temperature, which restricts their applications. Developments in artificial intelligence, smart robots and relative accessories are required to enable them to function in harsh environments for industrial data collection or even space-exploration missions. To the best of our knowledge, no report exists on stress sensors that are based on gels for use in extreme environments.

Polyimides (PIs) are used extensively in the aerospace and electronics industries because of their high thermal stability, excellent mechanical properties and chemical resistance.[24]

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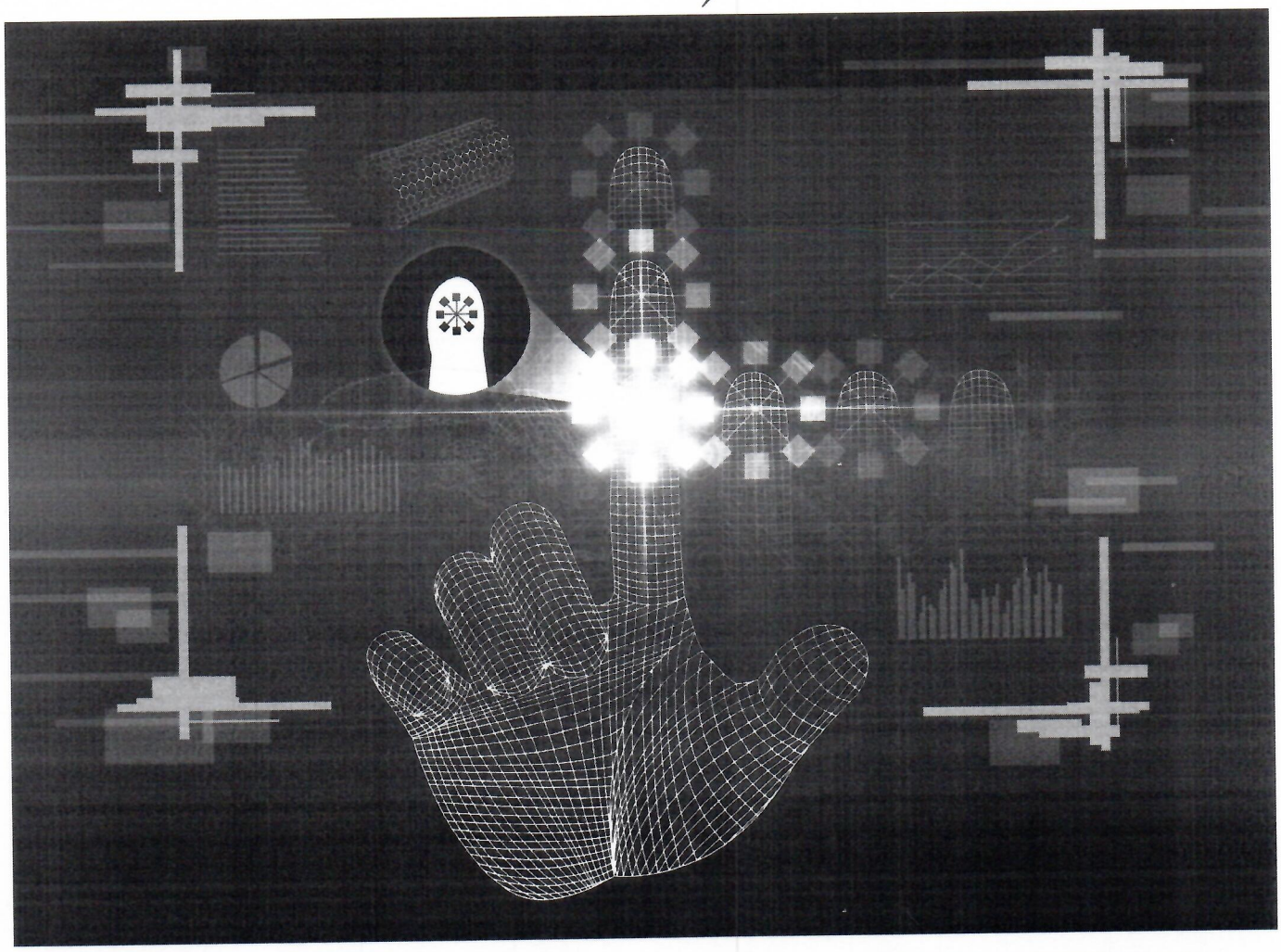
† Electronic supplementary information (ESI) available. See DOI: 10.1039/c9tc02719j



Showcasing research from the collaboration of Organic Electronics & Sensors Laboratory and Research Institute of Printed Electronics & 3D Printing, Hanbat National University, Daejeon, Republic of Korea

A highly sensitive and stress-direction-recognizing asterisk-shaped carbon nanotube strain sensor

To recognize the direction of an applied external stress, thereby overcoming some of the shortcomings of established sensors, asterisk-shaped CNT sensing electrodes are rationally designed and applied to omni-directionally detectable strain sensors.

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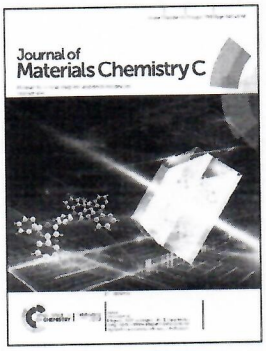

See Hyun-Il Kang, Yoonseuk Choi, Se Hyun Kim, Hwa Sung Lee *et al.*, *J. Mater. Chem. C*, 2019, **7**, 9504.

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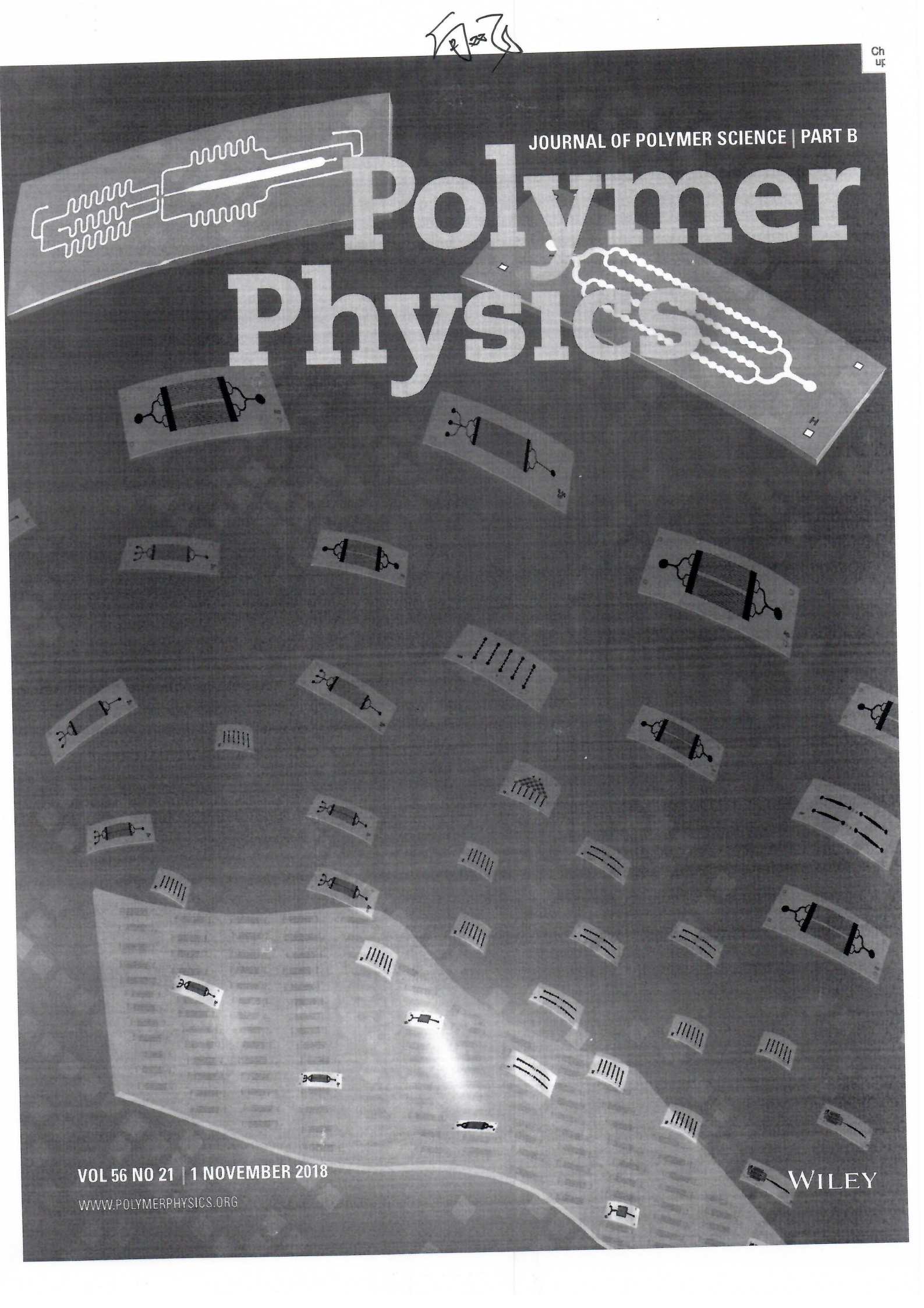
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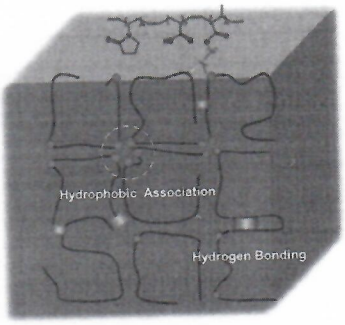

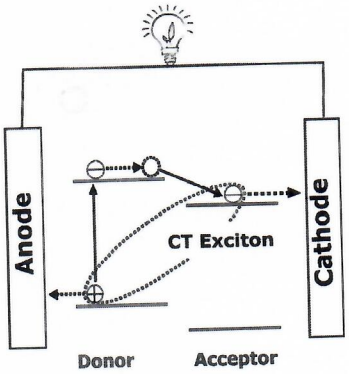

JOURNAL OF POLYMER SCIENCE Polymer Physics

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FULL PAPER

A Facile Method to Fabricate Tough Hydrogel with Ultra-Wide Adjustable Stiffness, Stress, and Fast Recoverability

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ABSTRACT: In this article, we report a synergistic strategy to develop dual physically cross-linked tough hydrogels *via* one-pot bulk copolymerization of N-vinyl-2-pyrrolidone, acrylic acid, and stearyl methylacrylate (SMA) without any adscititious surfactant. Due to synergic effects of hydrogen bonding and hydrophobic association, the resulted dual physically cross-linked hydrogels (DP Gel) with ultra-wide range adjustable Young's modulus (0.08–45.6 MPa), tensile stress (0.7–6.9 MPa), and toughness (3.3–23.1 MJ m^{-3}). Stretching to 300%, DP Gel exhibited fast recoverability that remained ~95% of initial dissipated energy after resting in 60 °C for 3 min. Finally, scanning electron microscopy revealed that the microstructure of hydrogel changed from phase separation structure to micro phase separation as SMA added, which accounted for excellent performance of DP Gel. © 2018 Wiley Periodicals, Inc. J. Polym. Sci., Part B: Polym. Phys. **2018**, *56*, 1469–1474

KEYWORDS: hydrogen bonds; hydrophobic association; mechanical properties; tough hydrogels

INTRODUCTION A hydrogel is a three-dimensional hydrophilic polymer network entrapping a high-content of water, which could keep a certain shape in water. Hydrogels as soft-wet materials could response to complex environments, which have promising applications in tissue engineering,[1] soft robot,[2] flexible electronics, and sensors.[3–5] However, there are several problems such as low mechanical properties and bad fatigue resistance hindering the wide application of hydrogel. Over the past decades, many hydrogels with various network structures have been designed to fabricate tough hydrogels, such as slide-ring hydrogels,[6] nanocomposite hydrogels,[7] double network hydrogels,[8,9] tetra-PEG hydrogels,[10] and macromolecular microsphere composite hydrogels.[11] However, these strategies for fabricating tough hydrogels usually depend on the complex molecular design and chemical modification, and most of these hydrogels need multistep to fabricate.

Hydrophobic association and hydrogen bonding widely exist in nature, such as phospholipid bilayer of cells, hydrogen bonding in DNA. As a result, skin, muscle, and blood vessels have a good trade-off between stiffness and extensibility.[12] These inspired us to take advantage of hydrophobic association and hydrogen bonding. Up to now, several strategies were applied to design hydrophobically associated hydrogels. One mechanism was based on amphiphilic polymeric surfactants (DGI, dodecyl glyceryl itaconate), which could form PDGI/PAAm lamellar hydrogel.[13] Lamellar bilayers serve as reversible sacrificial bonds, exhibiting large hysteresis as an energy dissipation mechanism.[14–16] Another mechanism was based on micellar copolymerization, such as surfactant-assistant micellar copolymerization.[17–19] However, large numbers of surfactants are added to maintain the solubility of the hydrophobic monomer in aqueous media leading to weak and soft hydrophobically associated hydrogels. To further improve the mechanical properties, a novel surfmer was copolymerized with acrylamide without any adscititious surfactant.[20] In addition, hydrophobic monomer was induced into hydrogel by copolymerizing acrylic acid (AAc) and stearyl acrylate in ethanol.[21] To some extent, the mechanical properties were improved. Although there was a limit in the choice of the monomer and the preparation process was complex.

Here, we developed a dual physically cross-linked tough hydrogel *via* one-pot bulk copolymerization of N-vinyl-2-pyrrolidone (NVP), AAc, and stearyl methylacrylate (SMA) without any adscititious surfactant. The choice of this

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