Electronic Supplementary Material (ESI) for Journal of Materials Chemistry B.

Supporting Information

Highly Stretchable, Supersensitive, and Self-Adhesive Ionohydrogel using Waterborne Polyurethane Micelles as Cross-linker for Wireless Strain Sensor

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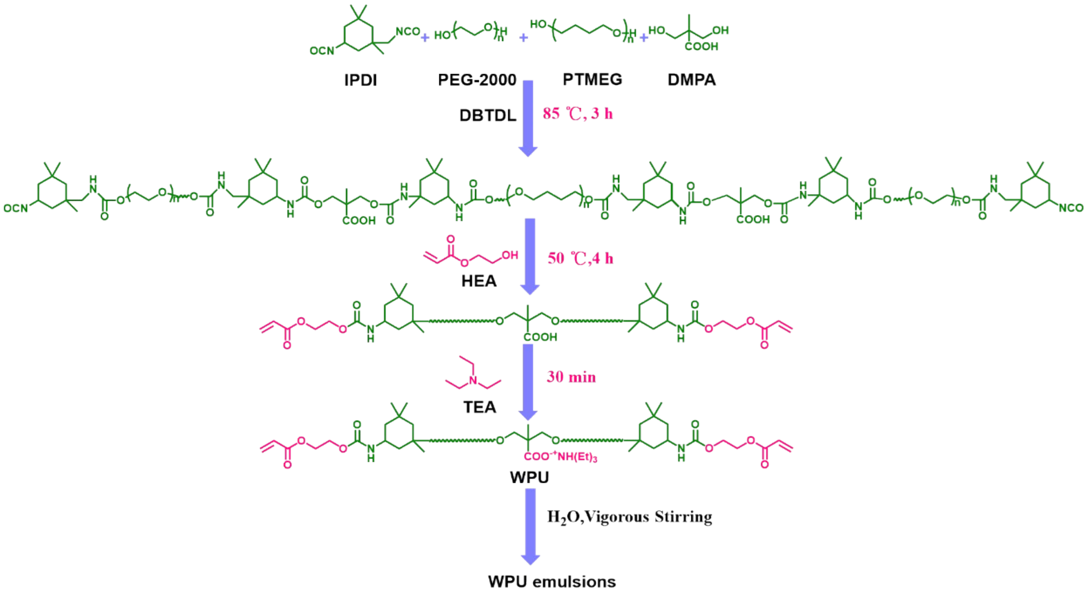

Scheme S1. Synthetic route to WPU micelles.

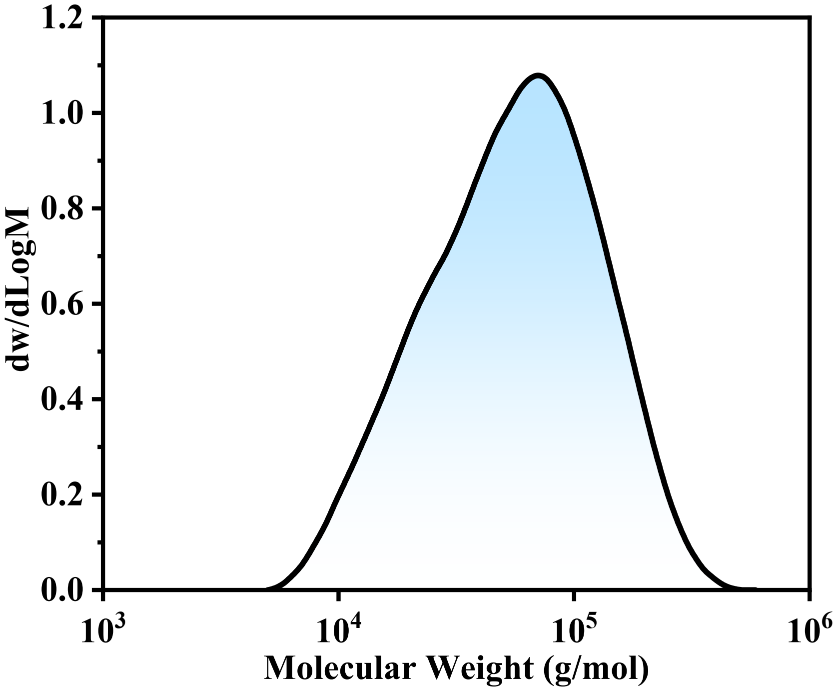

Fig. S1. Gel permeation chromatography results for WPU.

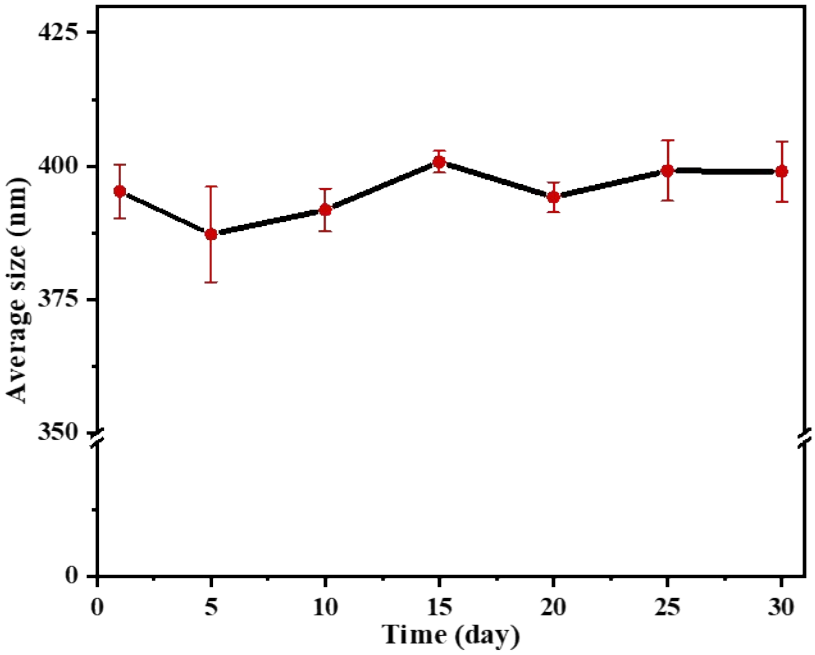

Fig. S2. Average size of WPU emulsions.

Table S1. Performance summary of representative hydrogel-based sensors.

Gel network	Gauge	Elongation at	Fracture	Adhesion	Resilience	Refs

components	factor	break (%)	toughness (MJ/m^3)	strength (kPa)	(%)	
Acrylic acid/AlCl$_3$/Cellulose	1.34	1100%	7.5	/	42.9% (300% strain; Waiting 15 min)*	S1
AAm/PGlu	~2.35	>1800%	>10	41.5 kPa (on copper)	~91.0% (First cycle; 500% strain; Immediately)**	S2
PVA/NaCl	~2.1	550%	4.7	/	/	S3
PVA-GL-PANI	/	460%	12	/	/	S4
Gelatin	/	320%	0.13	/	~92.5% (165% strain)**	S5
MXene/PHMP	7.17	667%	/	16 kPa	/	S6
CS-PHEAA	6.9	692%	23.13	/	78.3% (20℃; Waiting 20 min)*	S7
PVA/PANI	7.7	242%	/	/	/	S8
Aa（Ta）/AAm	/	2153%	1.5	/	76.2% (Waiting 10 min)*	S9
PAA-HACC	11.65	~1600%	5.06	/	/	S10
Acrylic acid/PEGDA	5	1200%	/	/	~80% (100% strain;	S11

					Waiting 1 min)***	
PAM-WPU/IL	35	2927%	0.3	46.01kPa	80.01%	This work

*, ** and *** denote the resilience represented by energy dissipation, strain or stress, respectively.

S1 C.-W. Lai & S.-S. Yu. 3D printable strain sensors from deep eutectic solvents and cellulose nanocrystals. ACS Appl. Mater. Interfaces 12, 34235-34244 (2020).

S2 Zhang, Y., et al., Peptide-enhanced tough, resilient and adhesive eutectogels for highly reliable strain/pressure sensing under extreme conditions. Nature Communications, 2022. 13(1): p. 6671.

S3 Wang, Q., et al., Muscle-Inspired Anisotropic Hydrogel Strain Sensors. ACS Applied Materials & Interfaces, 2022. 14(1): p. 1921-1928.

S4 Ma, Y., et al., Skin-Contactable and Antifreezing Strain Sensors Based on Bilayer Hydrogels. Chemistry of Materials, 2020. 32(20): p. 8938-8946.

S5 H. Qin, R. E. Owyeung, S. R. Sonkusale & M. J. Panzer. Highly stretchable and nonvolatile gelatin-supported deep eutectic solvent gel electrolyte-based ionic skins for strain and pressure sensing. J. Mater. Chem. C 7, 601-608 (2019).

S6 He, S., et al., Bio-Inspired Instant Underwater Adhesive Hydrogel Sensors. ACS Applied Materials & Interfaces, 2022. 14(40): p. 45869-45879.

S7 Yang, Y., et al., Anti-freezing, resilient and tough hydrogels for sensitive and large-range strain and pressure sensors. Chemical Engineering Journal, 2021. 403: p. 126431.

S8 Zhou, H., et al., Capacitive Pressure Sensors Containing Reliefs on Solution-

Processable Hydrogel Electrodes. ACS Applied Materials & Interfaces, 2021. 13(1): p. 1441-1451.

S9 Zhang, Q., et al., Ultra-stretchable wearable strain sensors based on skin-inspired adhesive, tough and conductive hydrogels. Chemical Engineering Journal, 2019. 365: p. 10-19.

S10 Wang, T., et al., Adhesive and tough hydrogels promoted by quaternary chitosan for strain sensor. Carbohydrate Polymers, 2021. 254: p. 117298.

S11 G. Li, et al. A stretchable and adhesive ionic conductor based on polyacrylic acid and deep eutectic solvents. npj Flex. Electron. 5, 23 (2021).