Electronic Supplementary Material (ESI) for Polymer Chemistry.

Highly transparent, self-healing and adhesive wearable ionogel as strain and temperature sensor

Jianfei Tie[a], Zhiping Mao[a, b*], Linping Zhang[a], Yi Zhong[a], Xiaofeng Sui[a], Hong Xu[a*]

a Key Lab of Science and Technology of Eco-textile, Ministry of Education, College of Chemistry, Chemical Engineering and Biotechnology, Innovation Center for Textile Science and Technology, Donghua University, Shanghai 201620, People's Republic of China.

b National Manufacturing Innovation Center of Advanced Dyeing and Finishing Technology, Taian City, Shandong Province, 271000, People's Republic of China.

[*] *Corresponding authors:*

Address: No.2999 North Renmin Road, Shanghai 201620, People's Republic of China.

Tel: +86-21-67792720; Fax: +86-21-67792707

E-mail addresses: hxu@dhu.edu.cn (H. Xu); zhpmao@dhu.edu.cn (Z. Mao)

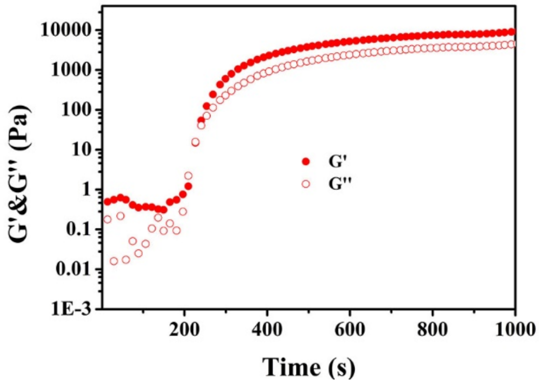

Fig. S1 The gelation time of the ionogel triggered by UV light.

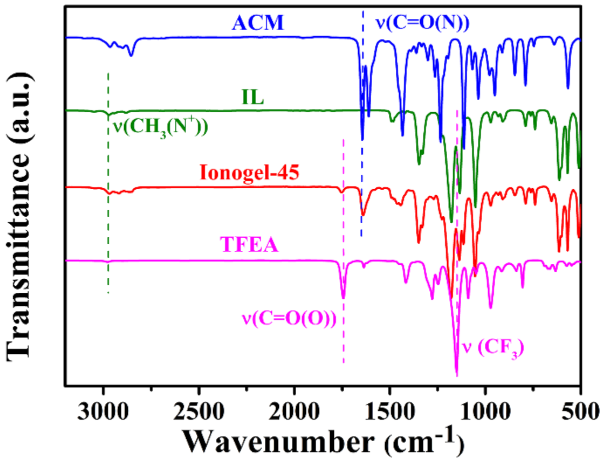

Fig. S2 FTIR spectra of the IL, TFEA, ACM and Ionogel-45.

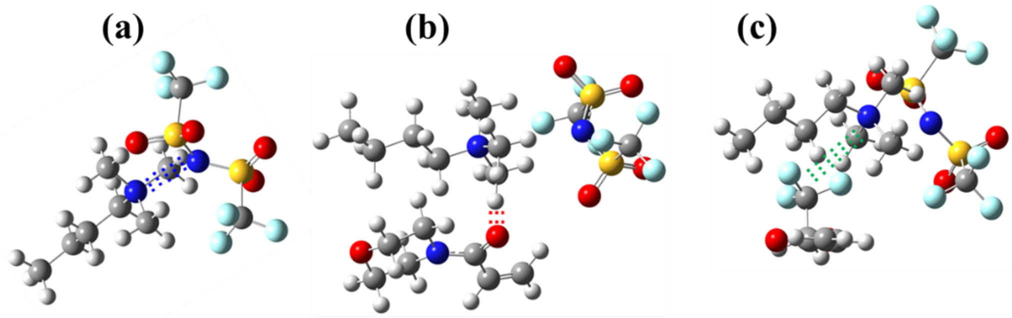

Fig. S3 DFT calculations of molecule structures and binding energies. **(a)** Intramolecular interaction of one $[N_{4111}]$ $[NTf_2]$ molecule with the calculated attractive binding energy of 125.81 kcal mol^{-1}; **(b)** One monomer of ACM interact with one monomer of $[N_{4111}]$ $[NTf_2]$, and the attractive binding energy was calculated as 15.15 kcal mol^{-1}; **(c)** One monomer of TFEA interact with one monomer of [N_{4111}] [NTf_2], and the attractive binding energy was calculated as 9.43 kcal mol^{-1}.

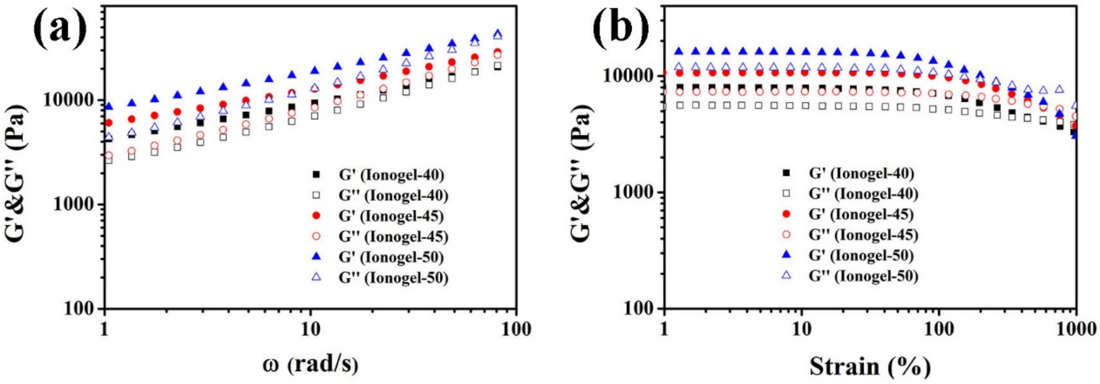

Fig. S4 **(a)** Rheology analyses of the storage modulus G′ (filled symbols) and loss modulus G″ (empty symbols) on frequency sweep (25 °C, frequency = 1.0 Hz); **(b)** G′ and G″ versus strain for the ionogel (25 °C, strain: 1%).

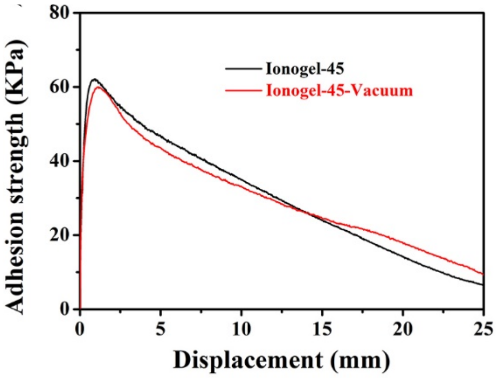

Fig. S5 The adhesion strength between silicone and the ionogel-45 placed in vacuum environment for 48 h.

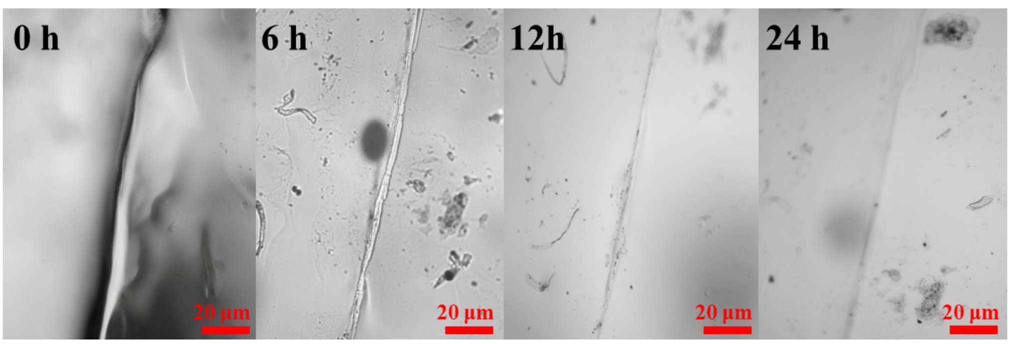

Fig. S6 The images of the self-healing process recorded by optical microscope at different time points.

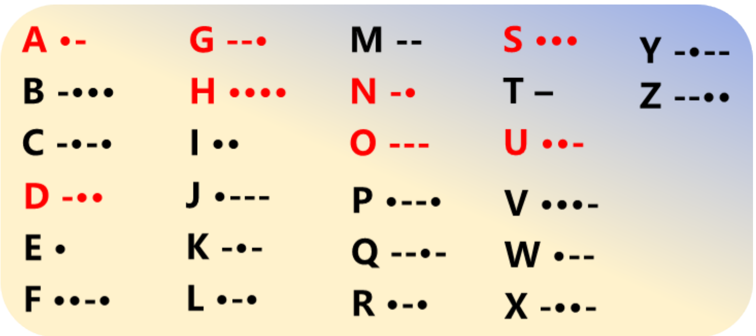

Fig. S7 Morse code.

Table. S1 Comparison of sensing properties and mechanical performance based on the ionogels

Sample	Performance					
	Tensile Strain (%)	Tensile Strength (MPa)	Self-healing efficiency (24 h, %)	Sensing range of temperature (°C)	Gauge Factor (GF)	Ref.
MIS	1213	1.29	-	25-95	2.31	13
P(TFEA-co-AAM)	2066	0.11	99	-40-40	1.38	21
PAA-Zn/ZnO/IL	660	5.42	39	-	-	43
IE	300	0.17	-	30-140	1.98	44
DN	700	0.37	-	-30-60	1.1	52
Fe_3O_4@PAA/PAA	2000	0.036	95	-	3.96	53
Ionogel	**1500**	**0.13**	**100%**	**-20-120**	**5.3**	**This work**