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


# Supporting Information

## Highly Stretchable, Self-adhesive, Ambient-stable, and Wide-temperature Adaptable Hydrophobic Ionogels for Wearable Strain Sensor

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**Table S1 Composition of the ionogels**

| Samples | Amount of DAAM/*wt*% | Amount of BMIMTFSI/*wt*% | Amount of HP-A in DAAM/*wt*% |
|---|---|---|---|
| 10%-Ionogel-1 | 10 | 90 | 0.2 |
| 10%-Ionogel-2 | 10 | 90 | 0.5 |
| 10%-Ionogel-3 | 10 | 90 | 1 |
| 10%-Ionogel-4 | 10 | 90 | 2 |
| 10%-Ionogel-5 | 10 | 90 | 5 |
| 15%-Ionogel-1 | 15 | 85 | 0.2 |
| 20%-Ionogel-1 | 20 | 80 | 0.2 |
| 20%-Ionogel-2 | 20 | 80 | 0.5 |
| 20%-Ionogel-3 | 20 | 80 | 1 |
| 20%-Ionogel-4 | 20 | 80 | 2 |
| 20%-Ionogel-5 | 20 | 80 | 5 |

**Table S2 Mechanical properties of the ionogels**

| Samples | Elongation at break (%) | Tensile strength (kPa) | Young's modulus (kPa) | Toughness ($kJ/m^3$) |
|---|---|---|---|---|
| 10%-Ionogel-1 | 1090 | 98.9 | 15 | 420.5 |
| 15%-Ionogel-1 | 1120 | 126.9 | 25 | 761.2 |
| 20%-Ionogel-1 | 1170 | 142.1 | 38 | 872.6 |
| 20%-Ionogel-2 | 830 | 158.5 | 188 | 745.7 |
| 20%-Ionogel-3 | 330 | 119.1 | 255 | 206.0 |
| 20%-Ionogel-5 | 85 | 59.1 | 365 | 26.9 |

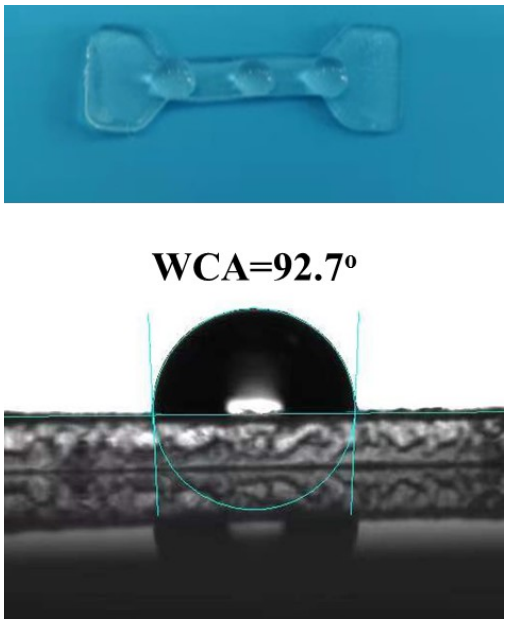


**Fig. S1** Photographs showing the WCA of the surface of hydrophobic ionogel.

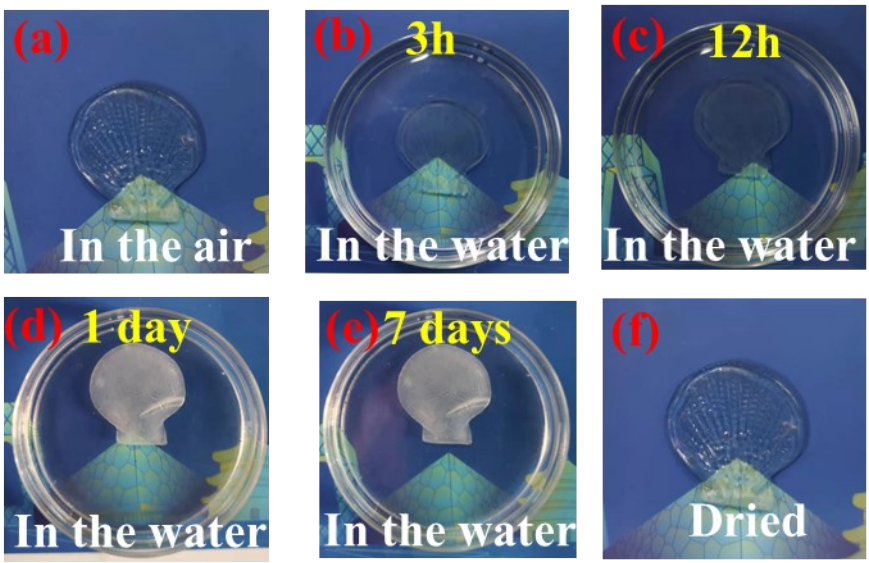


**Fig. S2** Digital pictures of the ionogels in air (a), under water with different time (b-e), and the dried sample (f).

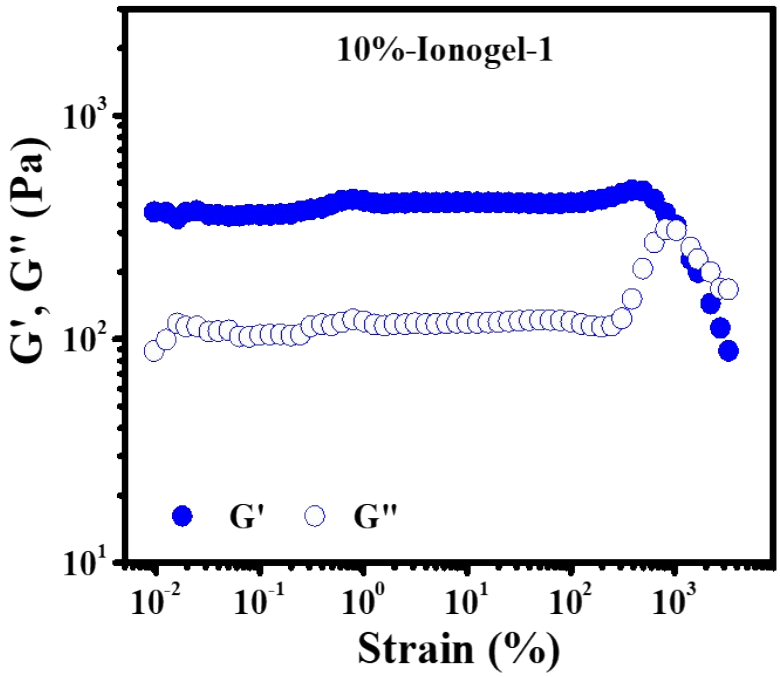


**Fig. S3** Strain sweep curve of the sample 10%-Ionogel-1.

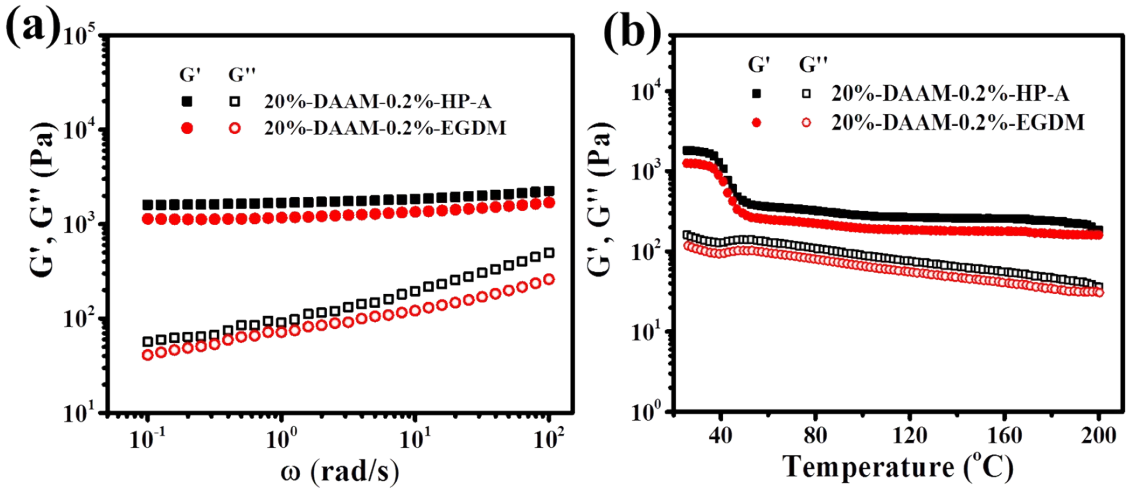


**Fig. S4** (a) Changes of $G'$ and G″ with frequency for the 20%-Ionogel with HP-A and EGDM. (b) Changes of $G'$ and G″ with temperature for the 20%-Ionogel with HP-A and EGDM.

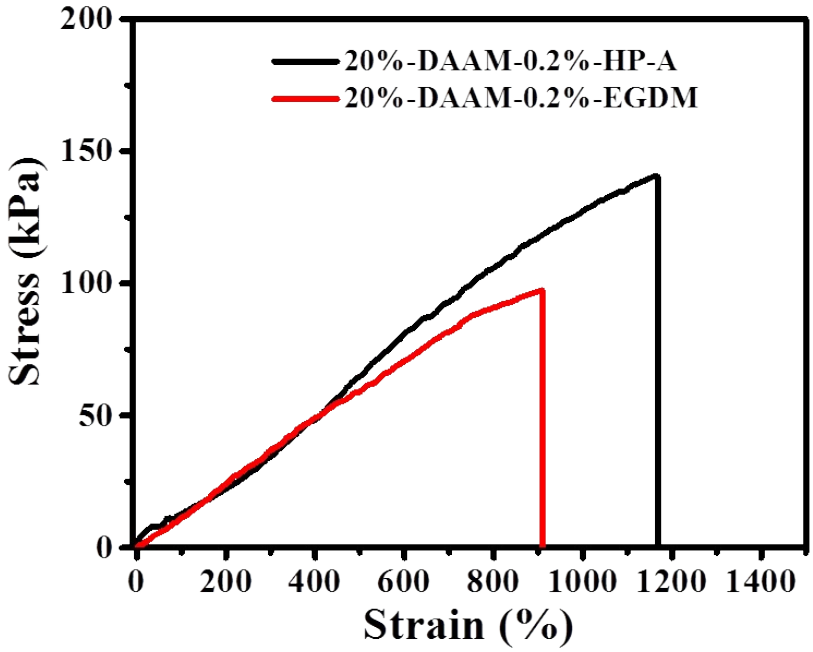


**Fig. S5** Typical monotonic tensile stress-strain curves of the ionogel with HP-A and EGDM.

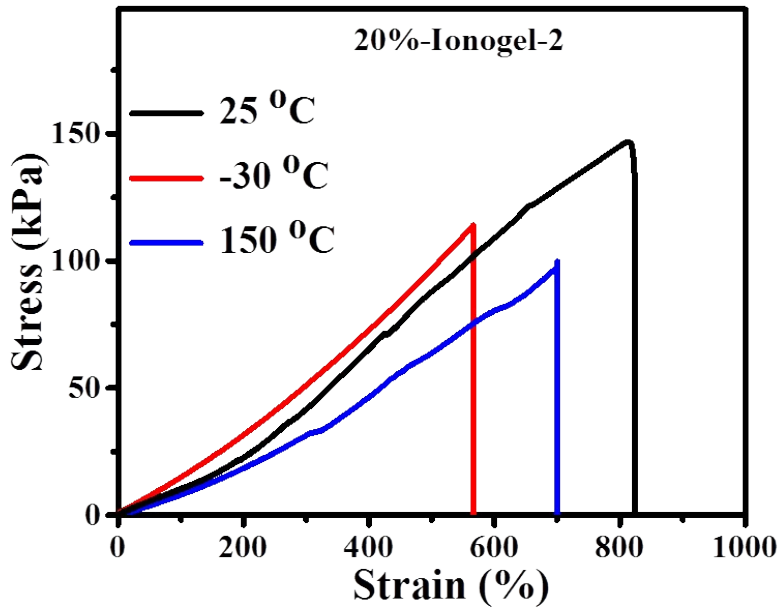


**Fig. S6** Monotonic Tensile stress-strain curves of 20%-Ionogel-2 at -30 °C, 25 °C, and 150 °C.

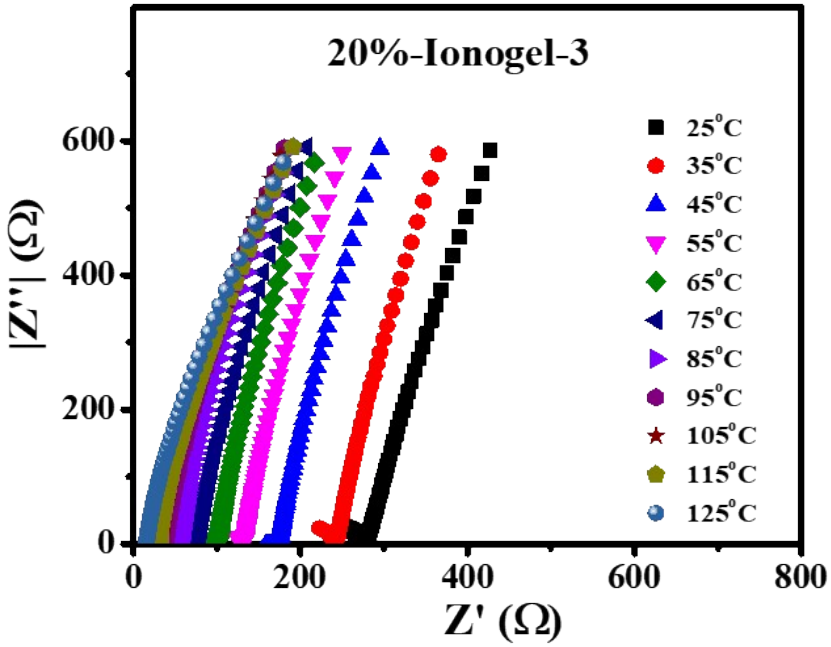


**Fig. S7** The temperature dependence of impedance for 20%-Ionogel-3.

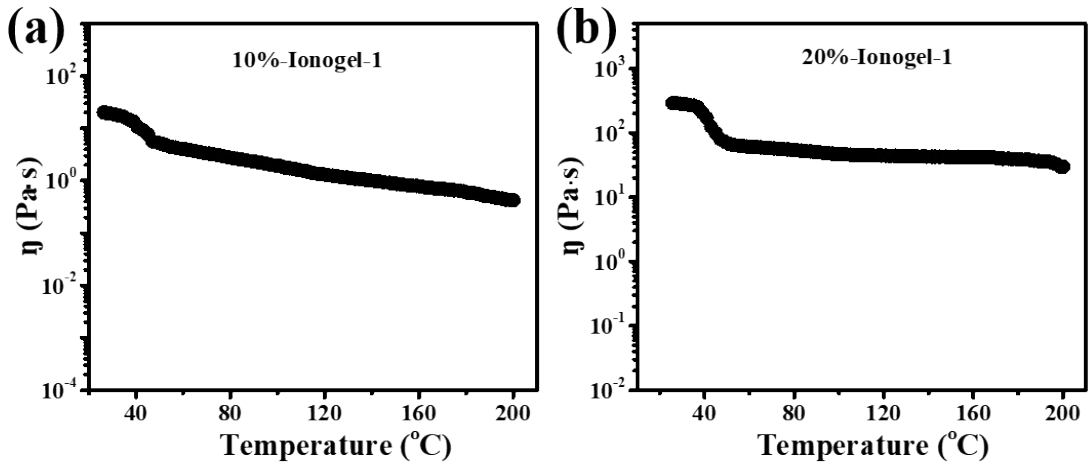


**Fig. S8** The temperature dependence of viscosity for (a) 10%-Ionogel-1 and (b) 20%-Ionogel-1.

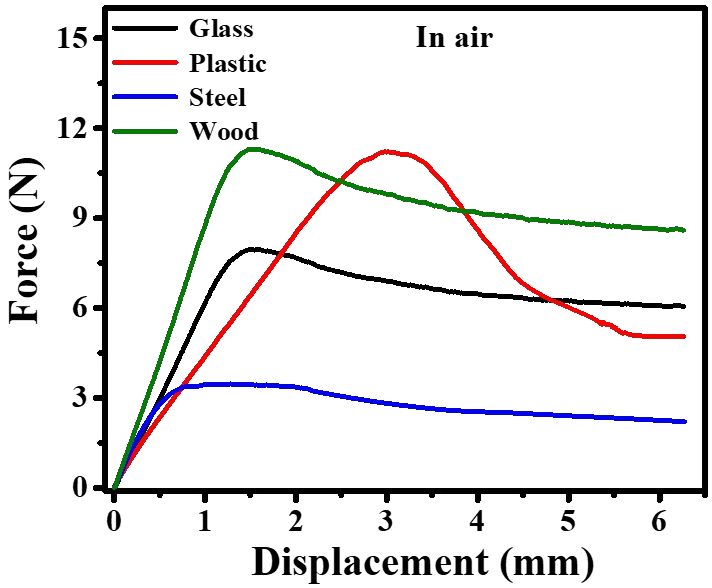


**Fig. S9** Typical lap shear curves of ionogel with various substrates in air.

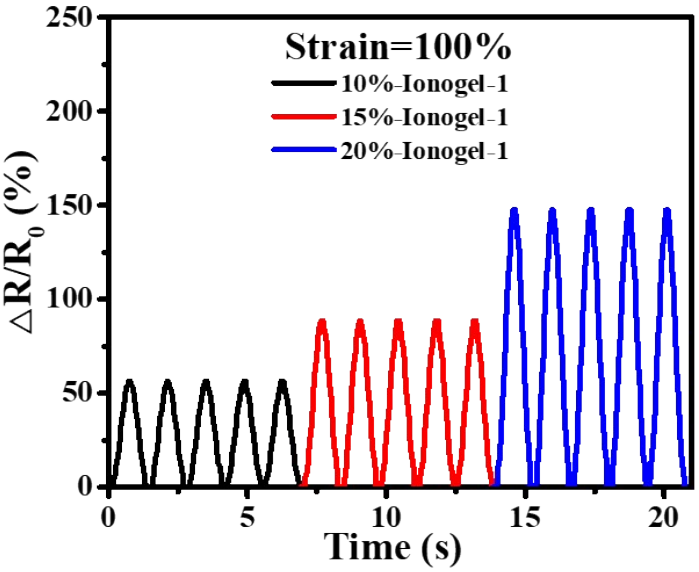


**Fig. S10** The relative resistance ($\triangle R/R_0$) of the sensors with different content of DAAM (strain=100%).

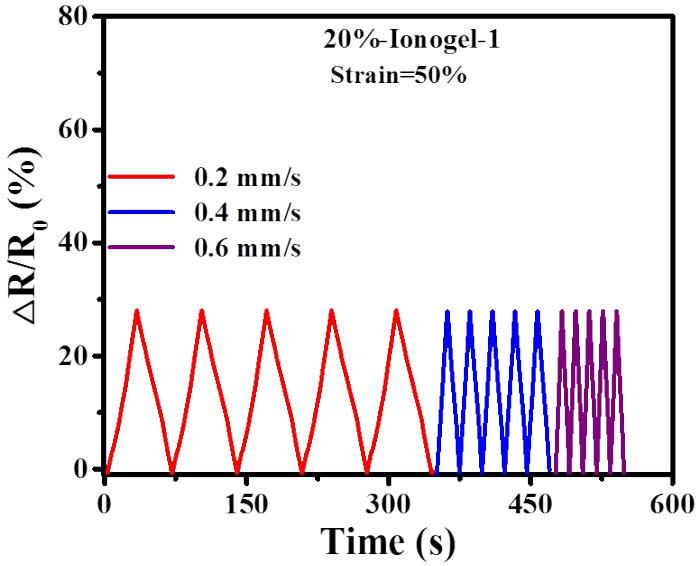


**Fig. S11** The relative resistance variations ($\triangle R/R_0$) of the sensor at various loading rates.