Electronic Supplementary Material (ESI) for Nanoscale.

Supporting information for:

High-voltage quasi-solid-state flexible supercapacitor with wide operational temperature based on a low-cost "water-in-salt" hydrogel electrolyte

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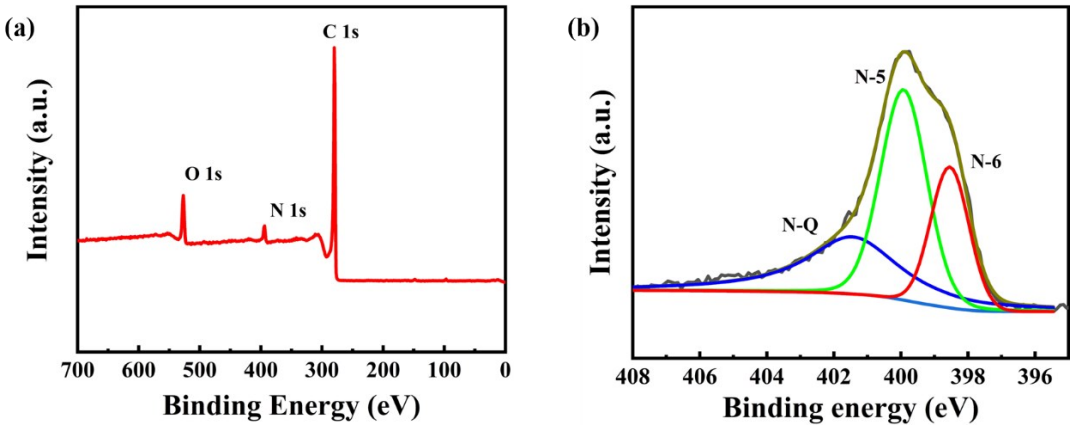

Figure S1. XPS survey spectra (a), N 1s pattern (b) of NG.

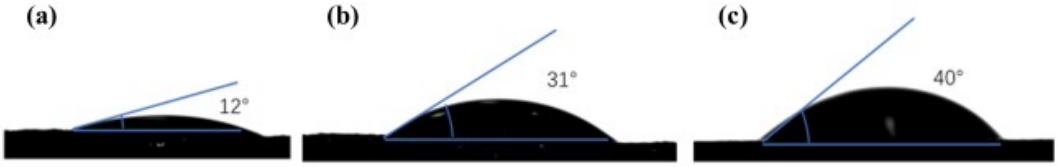

Figure S2. The contact angle between NG and 1M CH_3COOK (a), 24M CH_3COOK (b), and between AC and 24M CH_3COOK (c).

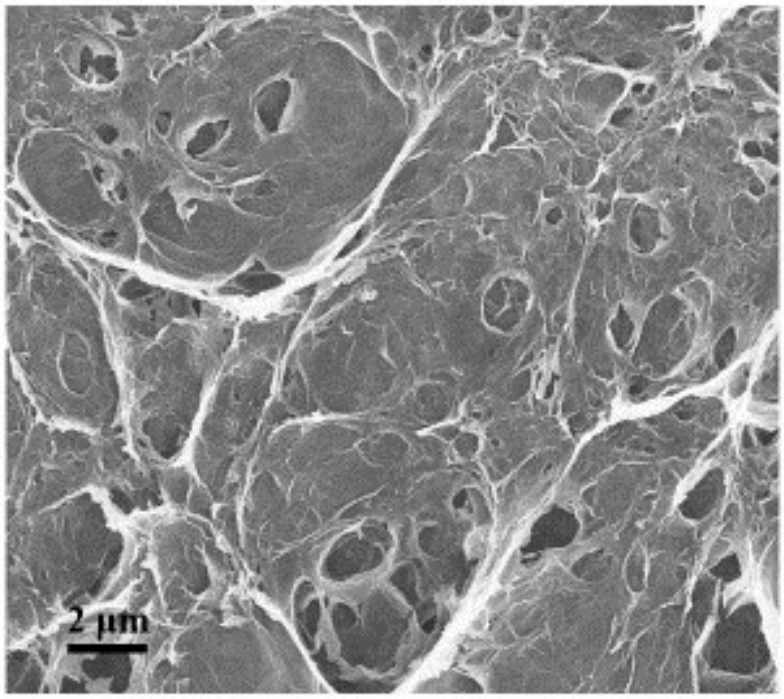

Figure S3. SEM image of freeze-dried NG.

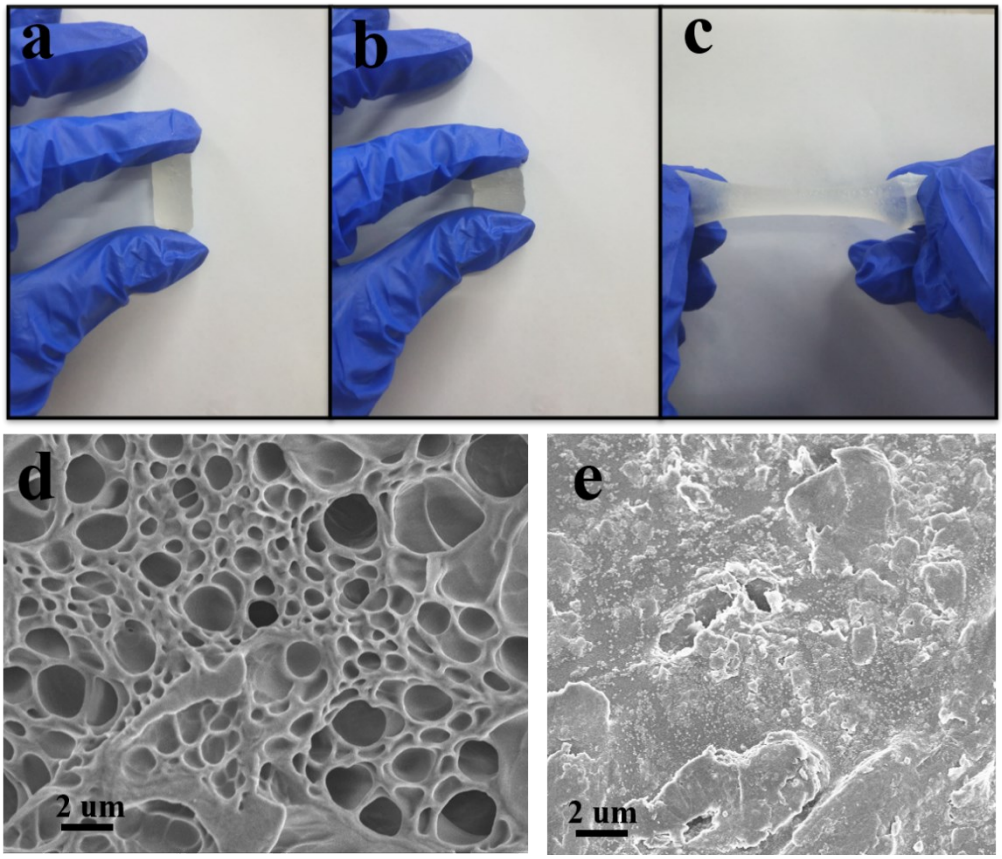

Figure S4. Digital photos of the hydrogel electrolyte PAAK/CMC-24M (a, b, c); SEM image of the polyelectrolyte hydrogel PAAK/CMC-water (d) and PAAK/CMC-24M.

Figure S5. Optical image of the stretched PAAK/CMC-24M in the universal tensile testing machine.

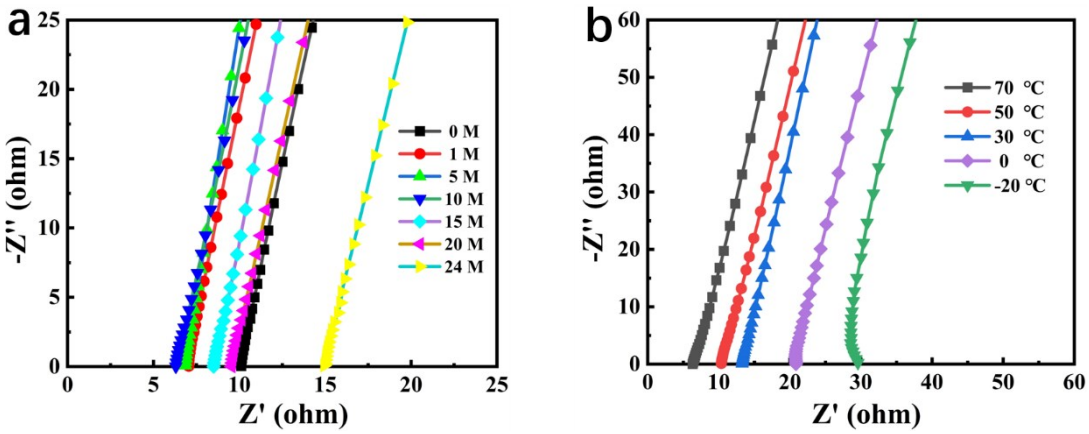

Figure S6. The AC impedance spectroscopy of different concentrations of CH_3COOK (a) and PAAK/CMC-24M from -20 ℃ to 70 ℃ (b).

Table S1. Comparison of the ionic conductivity between the hydrogel electrolyte in this work and the reported references.

Hydrogel electrolyte	Electrolyte concentration	Ionic conductivity	Ref
PVA/LiTFSI	21 m	6.52 mS cm^{-1}	26
PAAm/$LiClO_4$	1 m	31.1 mS cm^{-1}	31
PAA-g-EG/KOH	6 m	6.28 mS cm^{-1}	32
PAAM-$LiSO_4$	1 m	8 mS cm^{-1}	30
Chitosan/LiTFSI	4 m	13.7 mS cm^{-1}	29
AG/PAAm/LiCl	1 m	13.0 mS cm^{-1}	33

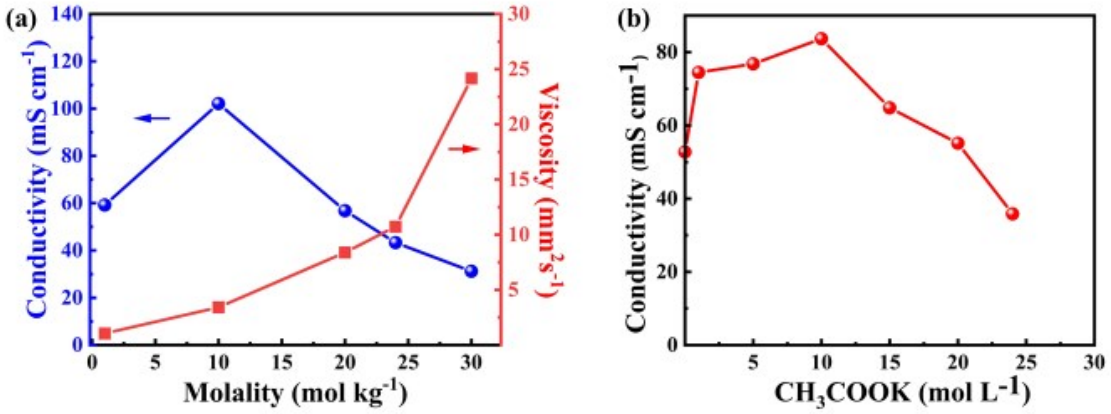

Figure S7. The viscosity and ionic conductivity of different concentrations of CH_3COOK (a), PAAK/CMC gel conductivity at different concentrations of CH_3COOK (b).

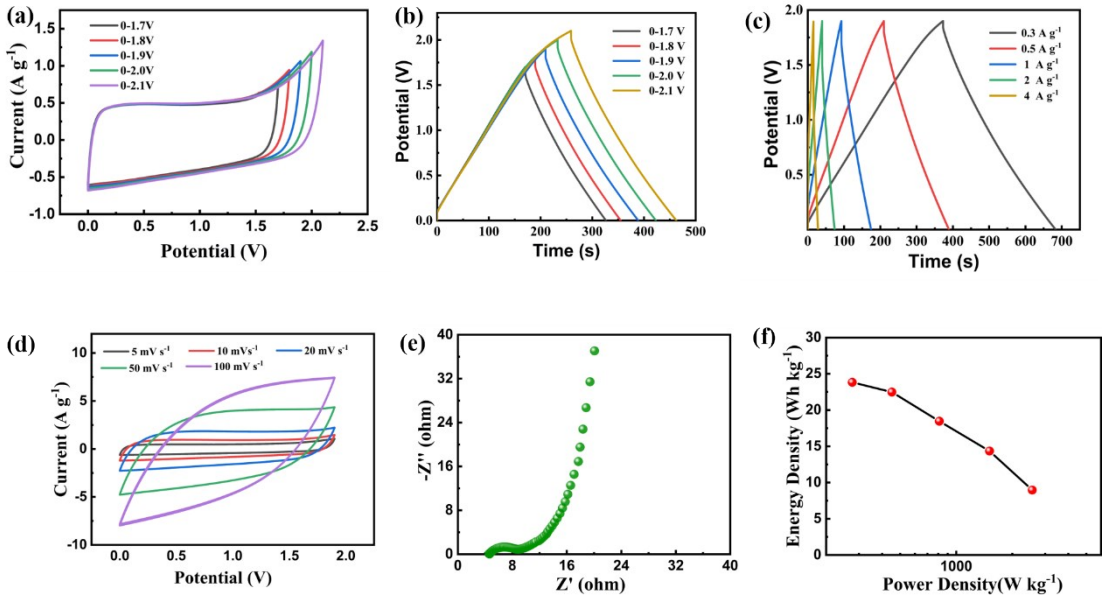

Figure S8. CV curves at various voltage windows (a), GCD profiles from1.7 V -2.1 V at 0.5A g^{-1} (b), GCD profiles from 0.3 A g^{-1} to 4 A g^{-1} (c), CV curves from 5 mV s^{-1} to 100 mVs^{-1} (d), EIS (e) and Ragone plot (f) of the assembled aqueous NG//NG EDLC using 24M CH_3COOK electrolyte.

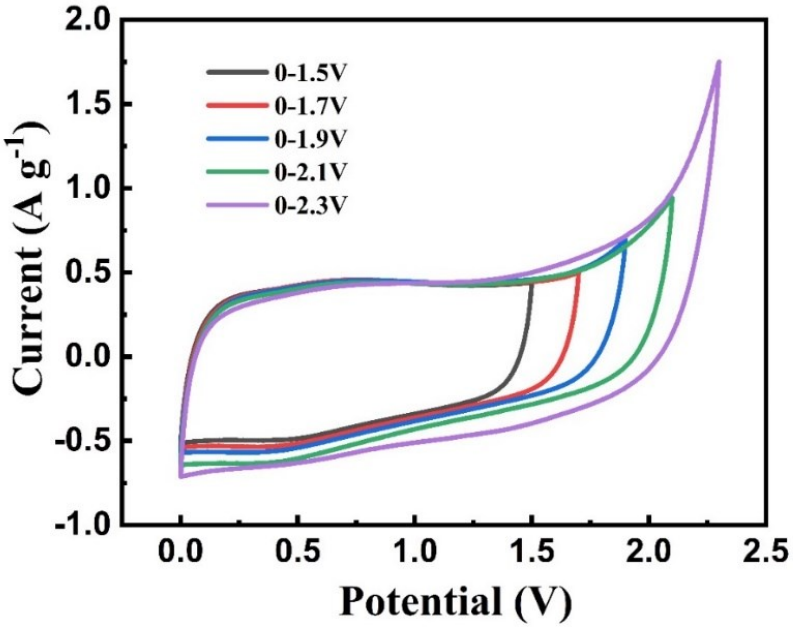

Figure S9. Various voltage windows at 5 mV s^{-1} of NG//NG all-solid-state supercapacitor with PAAK/CMC-24M polyelectrolyte gel.

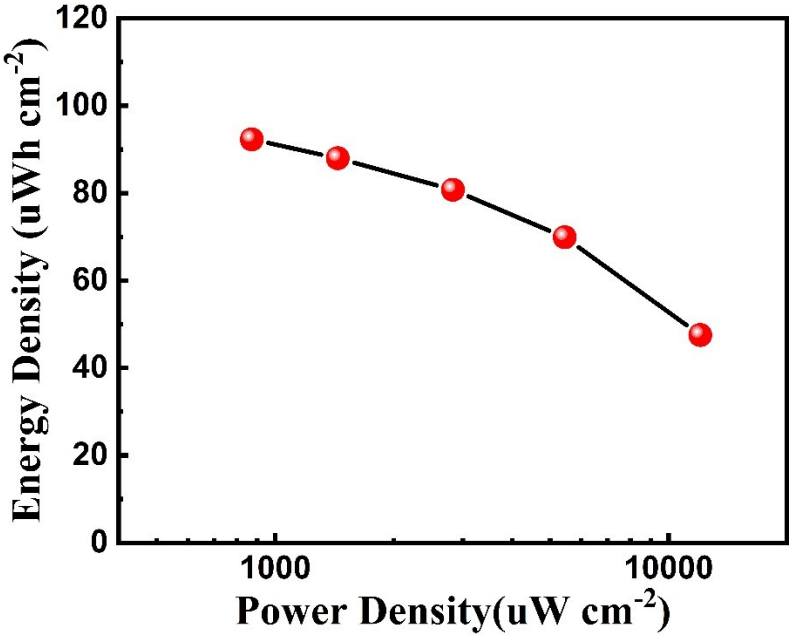

Figure S10. Ragone plot based on area of the NG//NG supercapacitor using PAAK/CMC-24M.

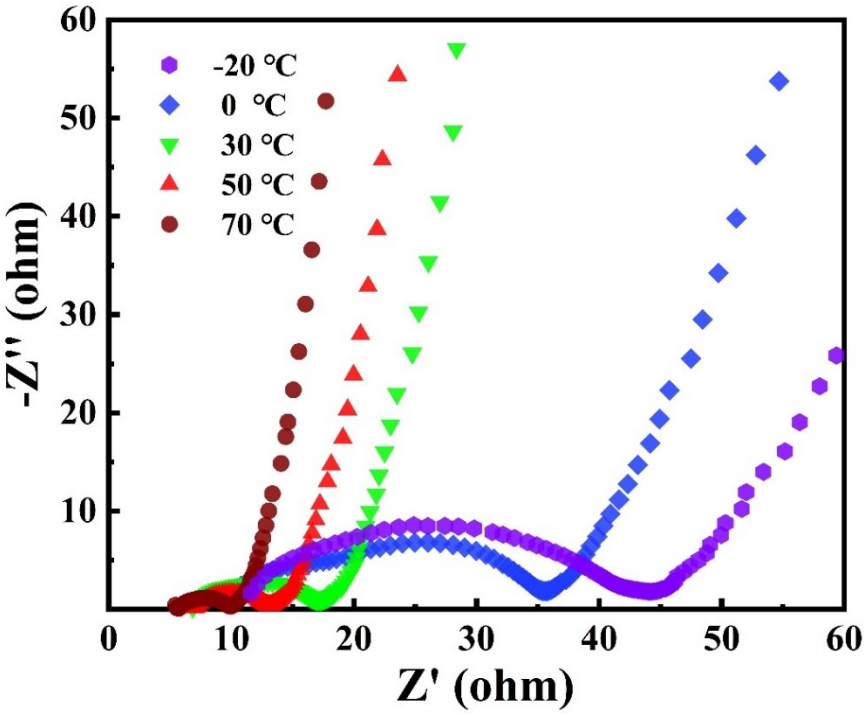

Figure S11. Electrochemical impedance spectroscopy of the NG//NG all-solid-state supercapacitor with PAAK/CMC-24M polyelectrolyte hydrogel working at different temperature

Table S2. Comparison of the energy densities between our work and the reported references.

Positive/ Negative electrode	**Electrolyte**	**Voltage window (V)**	**Energy density (W h kg-1)**	**Power density (kW kg-1)**	**Ref**
Polyaniline-derived carbon nanorods	21 m LiTFSI	2.2 V	29.6 W h kg-1	1100 W h kg-1	17
N-doped multi-scale porous carbon	20 m LiTFSI	2.4 V	33 W h kg-1	300 W h kg-1	32
Activated carbon	17 m $NaClO_4$	2.3 V	23.7 W h kg-1	1170 W h kg-1	13
Activated carbon	30 m CH_3COOK	2.0 V	19.8 W h kg-1	500 W h kg-1	20
N/S/O-doped cabon	7 m (gel) LiTFSI	2.3 V	20.6 W h kg-1	1150 W h kg-1	29
Activated carbon	10 m (gel) LiTFSI	2.2 V	23.5 W h kg-1	110 W h kg-1	25