Supplementary Information (SI) for Journal of Materials Chemistry A.

Supporting Information

Moisture-driven electric power generation using graphene-based hydrogels for sustained power output and self-powered sensing

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Table S1. Comparison of recent MEG materials and our graphene based MEG

Material/System	Output volage (V)	Power Density (mW m^{-2})	Duration	Fabrication	Ref.
Gradient GO film (moisture-electric annealing)	0.035	~4.2	Continuous	Multi-step thermal annealing	1
Gradient 3D polypyrrole framework (EeA)	0.060	6.9	Continuous	Electrolyte-electric annealing	2
GO/PAAS laser-irradiated composite	0.6	~25	Continuous	Directional laser irradiation; high energy input	3
LiCl/cellulose-carbon black bilayer	0.78	~N/R	Continuous	LiCl impregnation + plasma treatment; multi-step	4
This work: Graphene-templated PAA hydrogel	0.78	62	>120 h continuous	Single-step shake-and-polymerize; scalable to series/parallel arrays	This work

(1) Zhao, F.; Cheng, H.; Zhang, Z.; Jiang, L.; Qu, L. Direct Power Generation from a Graphene Oxide Film under Moisture. *Adv. Mater.* **2015**, *27* (29), 4351–4357. https://doi.org/10.1002/adma.201501867.
(2) Xue, J.; Zhao, F.; Hu, C.; Zhao, Y.; Luo, H.; Dai, L.; Qu, L. Vapor-Activated Power Generation on Conductive Polymer. *Adv. Funct. Mater.* **2016**, *26* (47), 8784–8792. https://doi.org/10.1002/adfm.201604188.
(3) Huang, Y.; Cheng, H.; Yang, C.; Li, C.; Qu, L. All-Region-Applicable, Continuous Power Supply of Graphene Oxide Composite. *Energy Environ. Sci.* **2019**, *12* (6), 1848–1856. https://doi.org/10.1039/C9EE00838A.
(4) Tan, J.; Fang, S.; Zhang, Z.; Yin, J.; Li, L.; Wang, X.; Guo, W. Self-Sustained Electricity Generator Driven by the Compatible Integration of Ambient Moisture Adsorption and Evaporation. *Nat. Commun.* **2022**, *13* (1), 3643. https://doi.org/10.1038/s41467-022-31221-7.

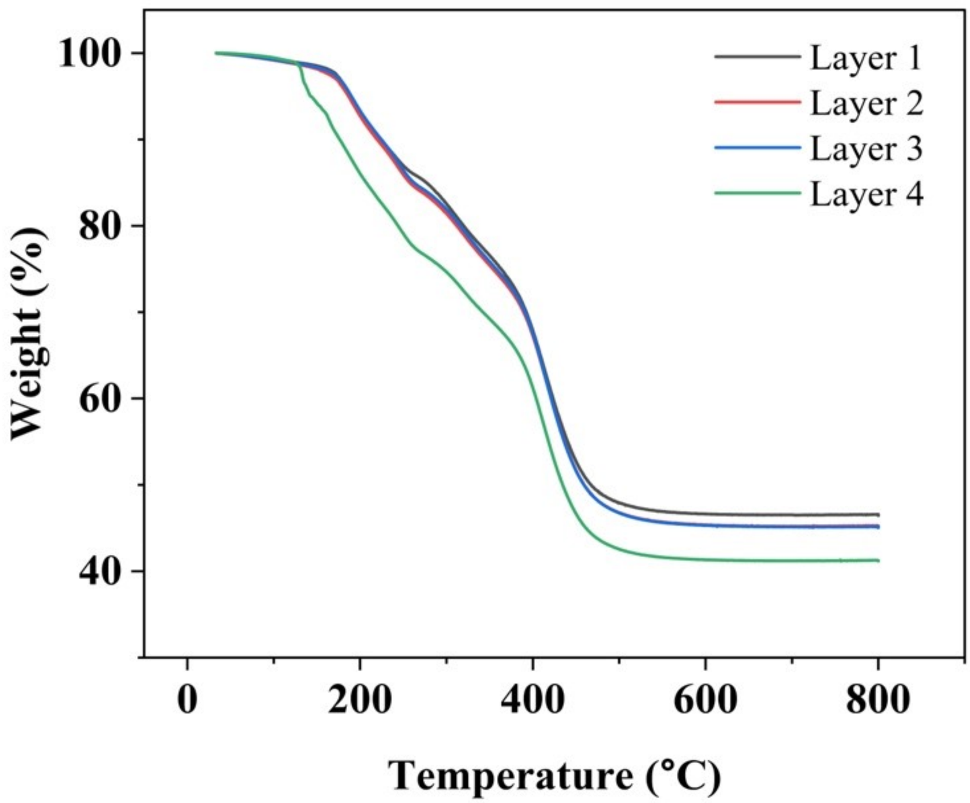

Figure S1. TGA curves of layers 1, 2, 3, and 4 from the top to the bottom of the hydrogel.

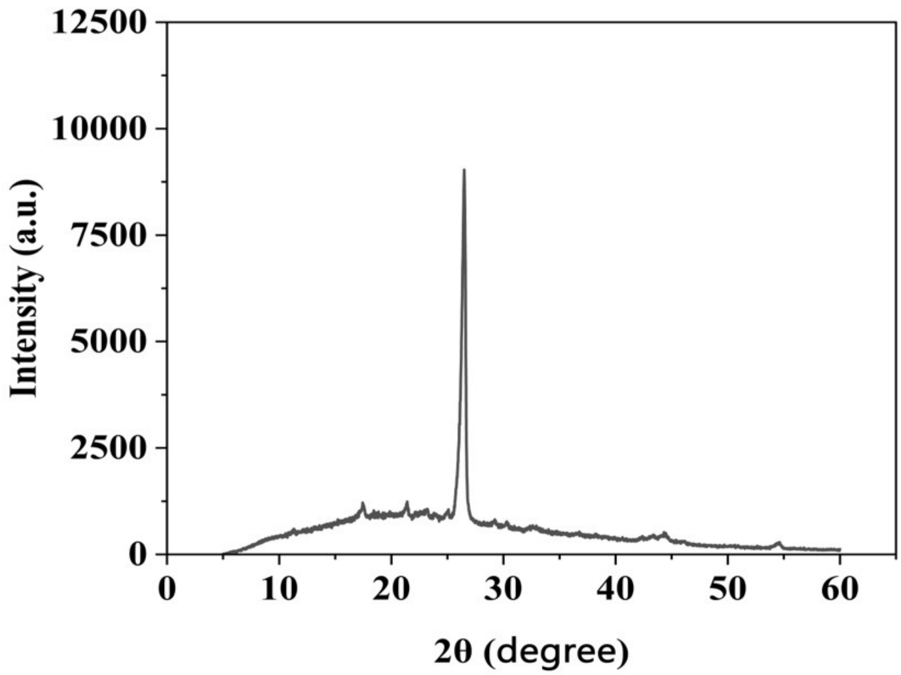

Figure S2. The XRD pattern of the graphene-based PAA hydrogel.

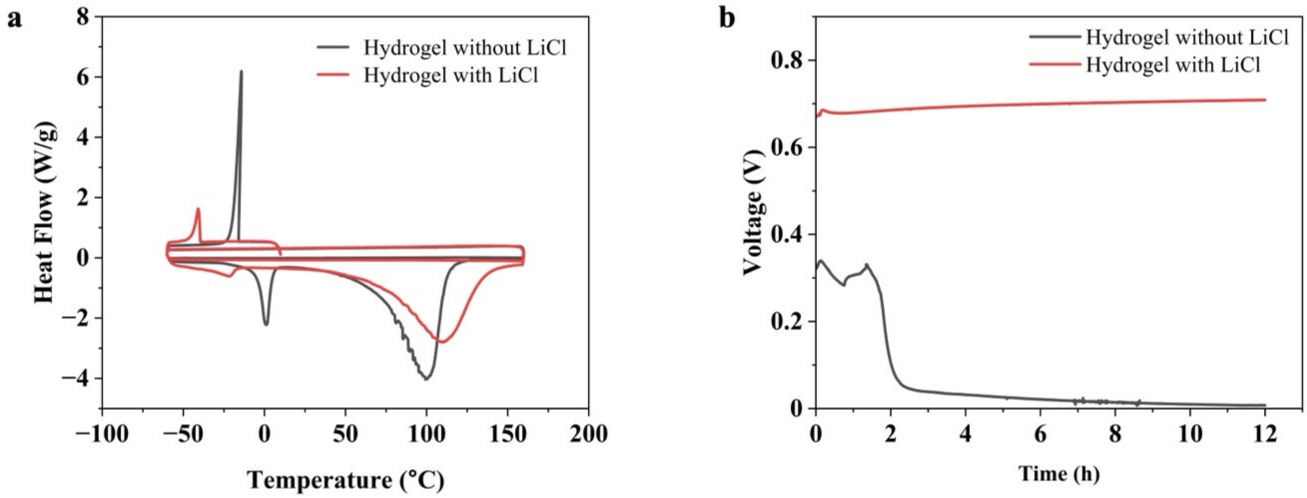

Figure S3. a. DSC thermograms of hydrogels prepared with and without LiCl. **b.** Voltage output of the hydrogels with and without LiCl over 2 hours at −5 °C.

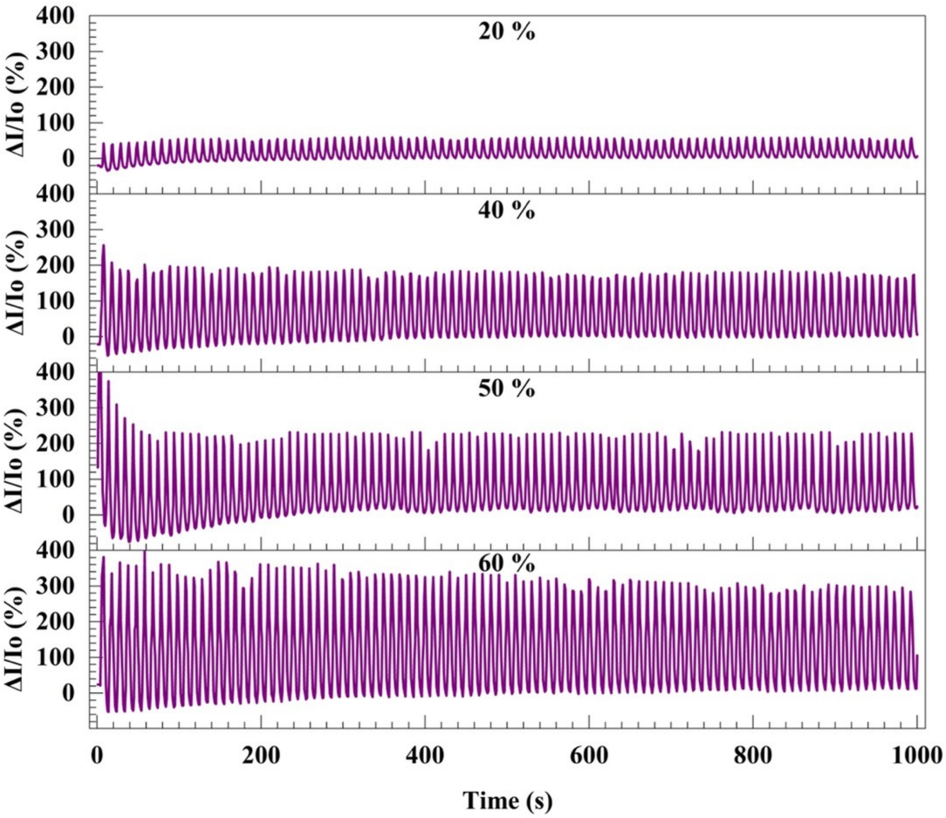

Figure S4. The MEG maintained stable performance over 400 compression cycles, with 100 cycles conducted at each of 20%, 40%, 50%, and 60% strain levels.