

Electronic Supplementary Information:

**Self-healing liquid Ga-based anodes with regulated wetting and
working temperatures for advanced Mg ion batteries**

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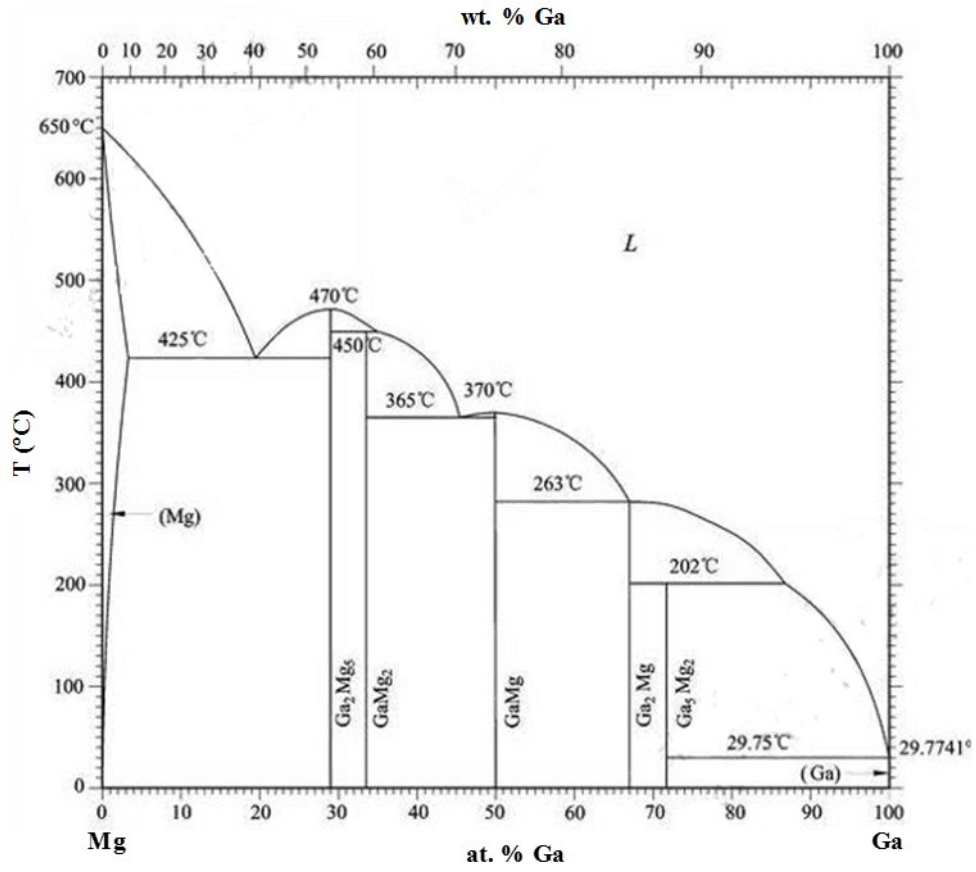


Figure S1 Binary alloy phase diagram of Mg-Ga system.¹

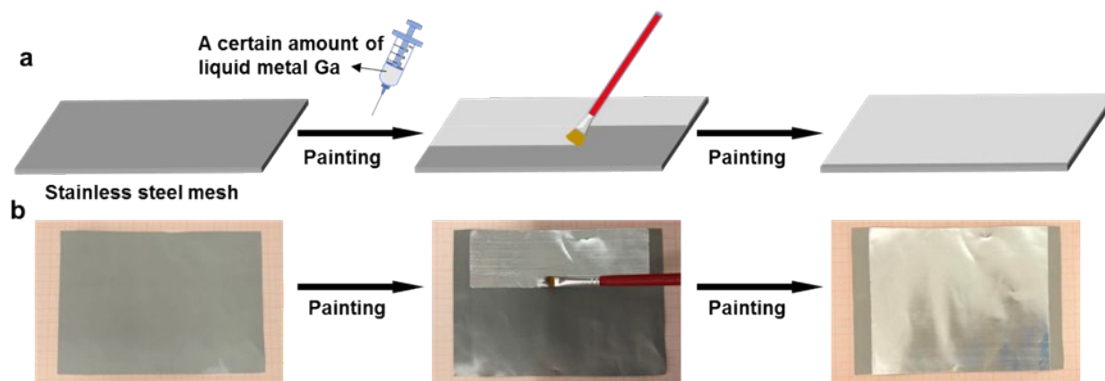


Figure S2 (a) Schematic illustration and (b) the corresponding photographs of the preparation process of liquid Ga electrodes.

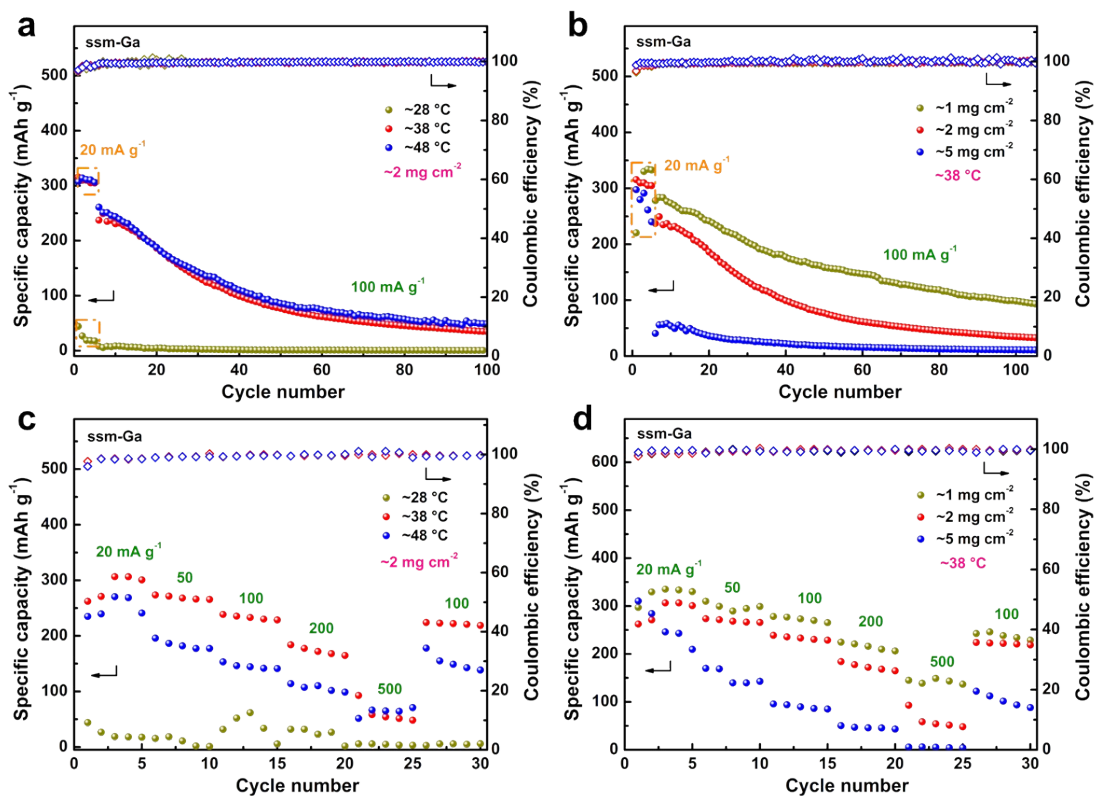


Figure S3 (a, b) Cyclic stability and (c, d) rate performance of the liquid ssm-Ga electrodes at various temperatures and mass loadings. Five cycles were performed at a current density of 20 mA g⁻¹ prior to the cyclic stability tests.

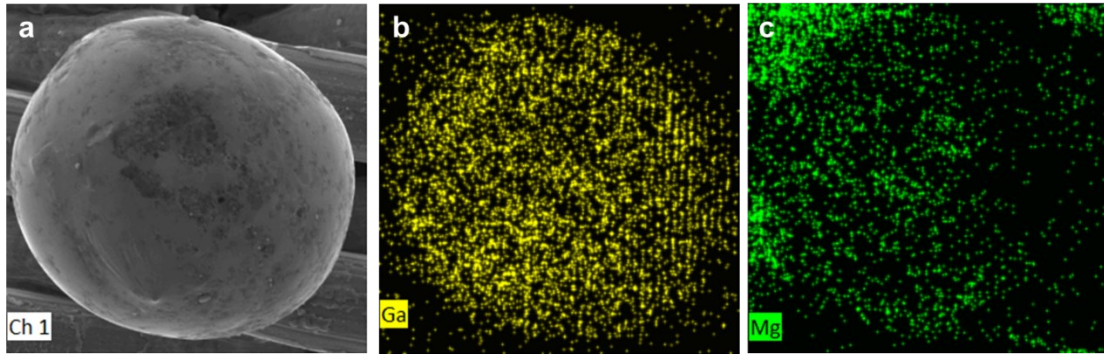


Figure S4 (a) The SEM image of the liquid Ga electrode after the 1st charge. (b,c) The elemental distributions of Ga and Mg corresponding to (a).

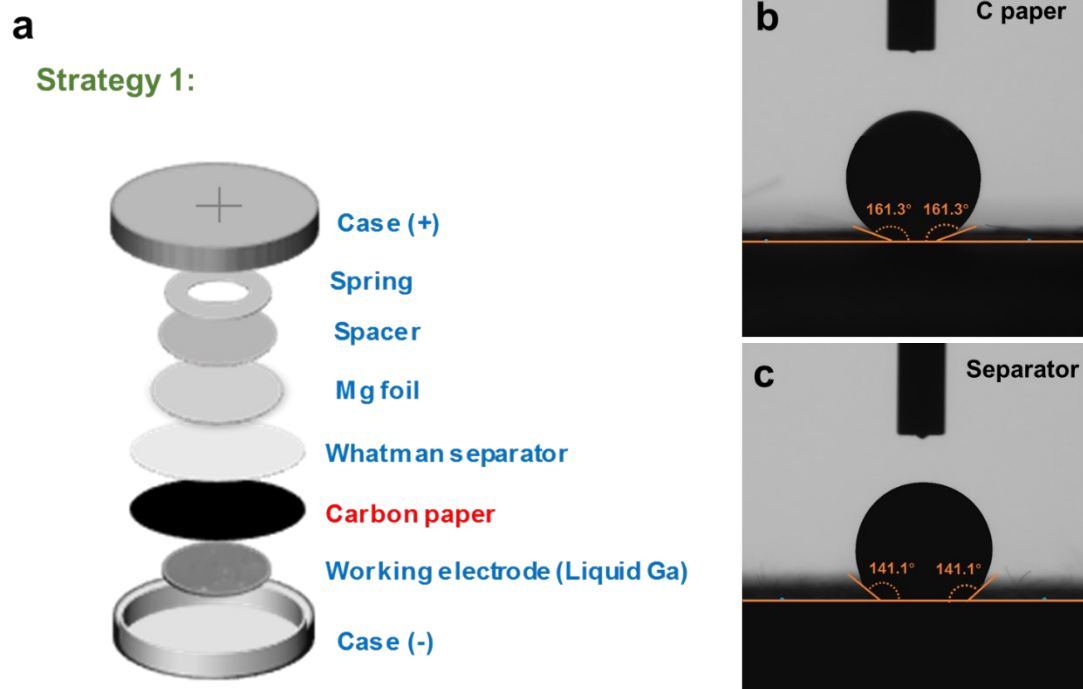


Figure S5 (a) Schematic illustration of coin cell configuration with adding a piece of carbon paper. Contact angles of liquid Ga droplet on (b) C paper and (c) separator.

Strategy 2:

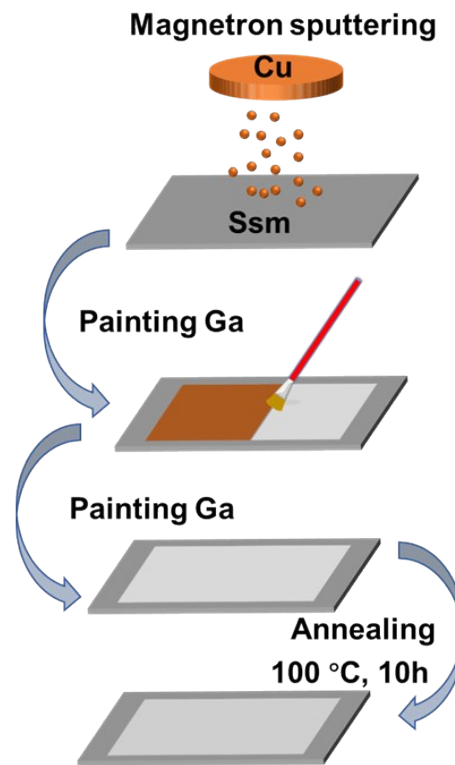


Figure S6 Schematic illustration of the preparation process of the ssm-CuGa₂-Ga electrode.

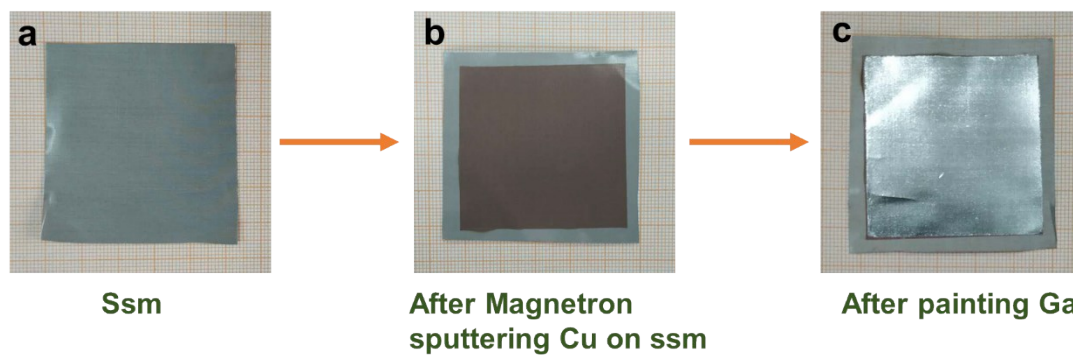


Figure S7 The photographs of the ssm-CuGa₂-Ga electrode during the preparation process.

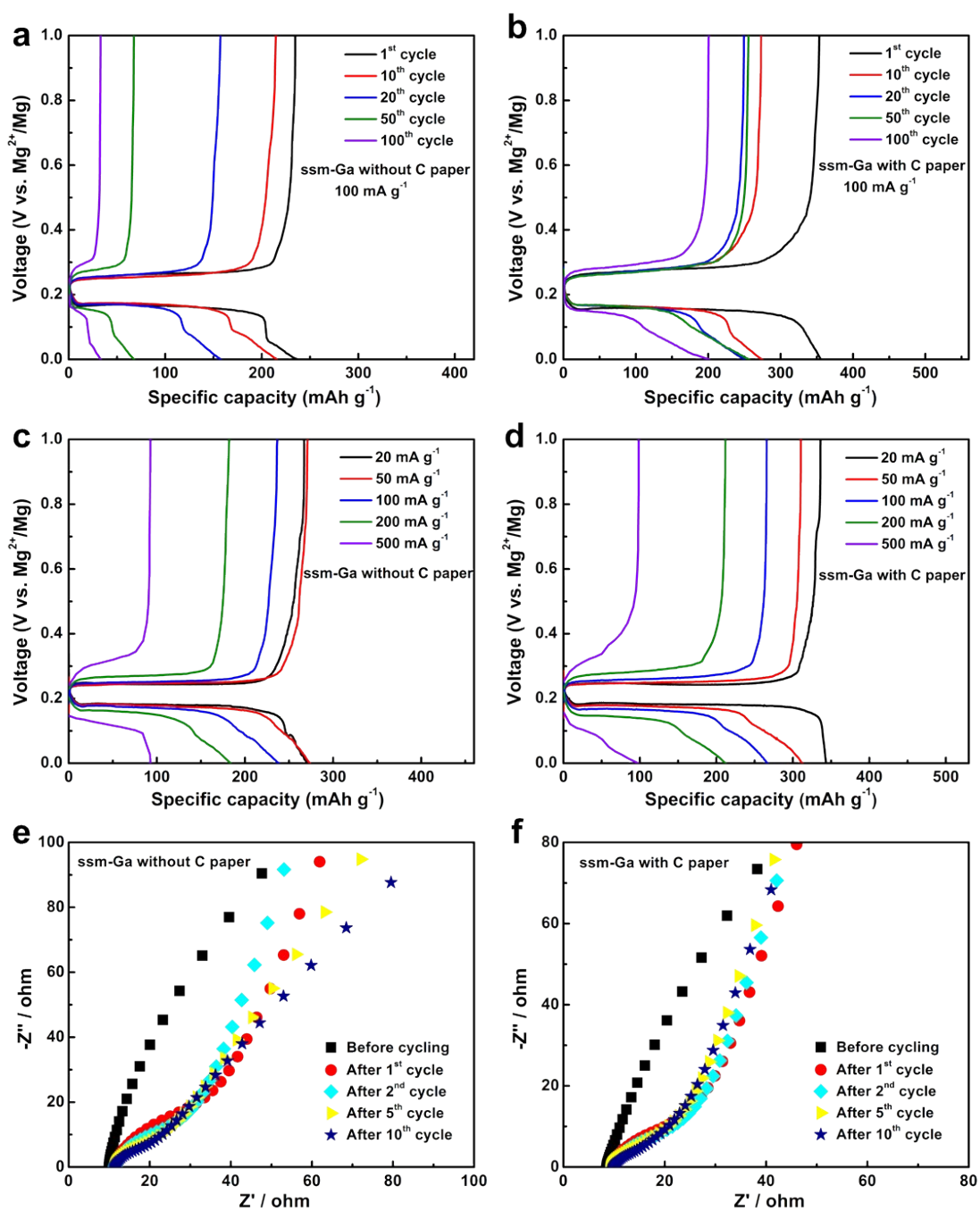


Figure S8 The discharge/charge curves of (a) the ssm-Ga electrode without C paper and (b) the ssm-Ga electrode with C paper in different cycles at 100 mA g⁻¹. The discharge/charge curves of (c) the ssm-Ga electrode without C paper and (d) the ssm-Ga electrode with C paper at various current densities. The Nyquist plots of (e) the ssm-Ga electrode without C paper and (f) the ssm-Ga electrode with C paper at OCV and the charged states.

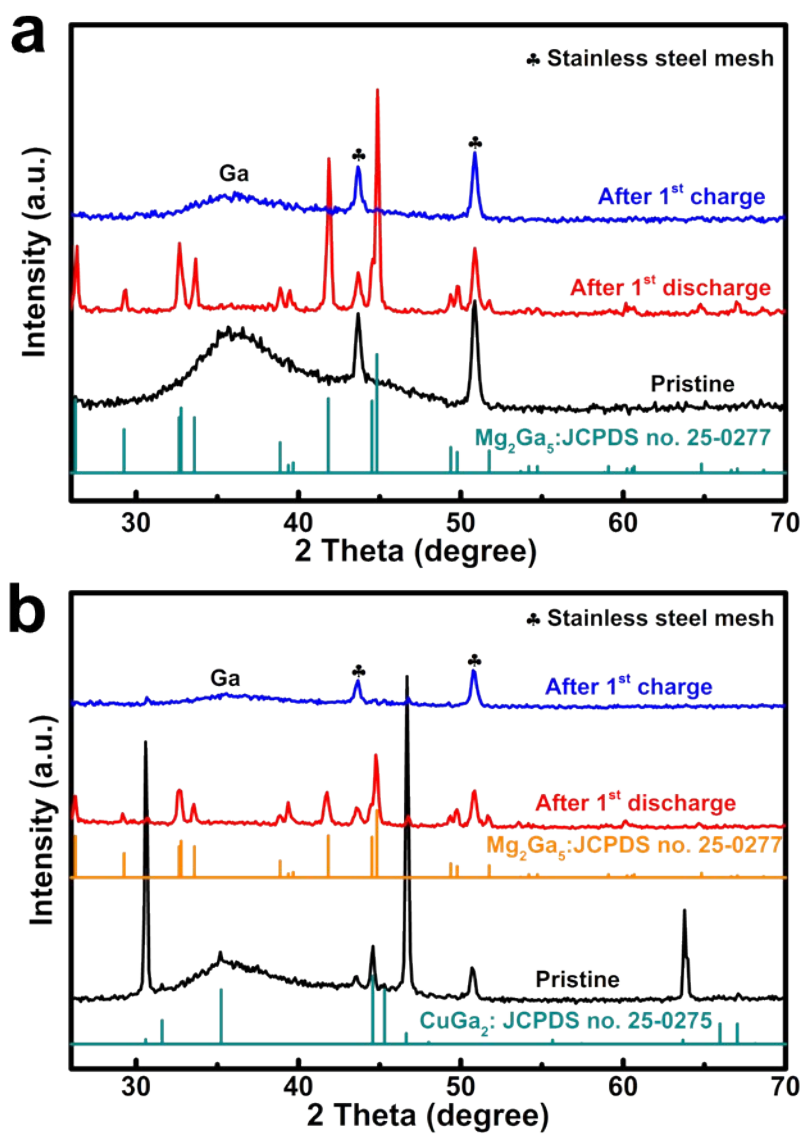


Figure S9 The ex-situ XRD patterns of (a) the ssm-Ga electrode with C paper and (b) ssm-CuGa₂-Ga electrode during the first cycle.

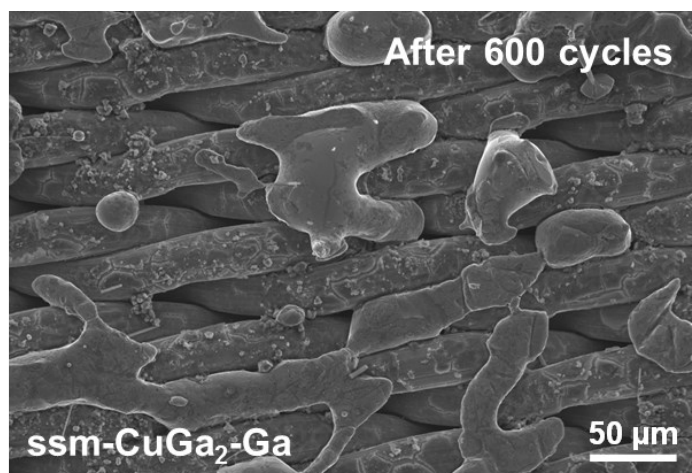


Figure S10 SEM image of the ssm-CuGa₂-Ga electrode after 600 cycles at the high current density of 500 mA g⁻¹.

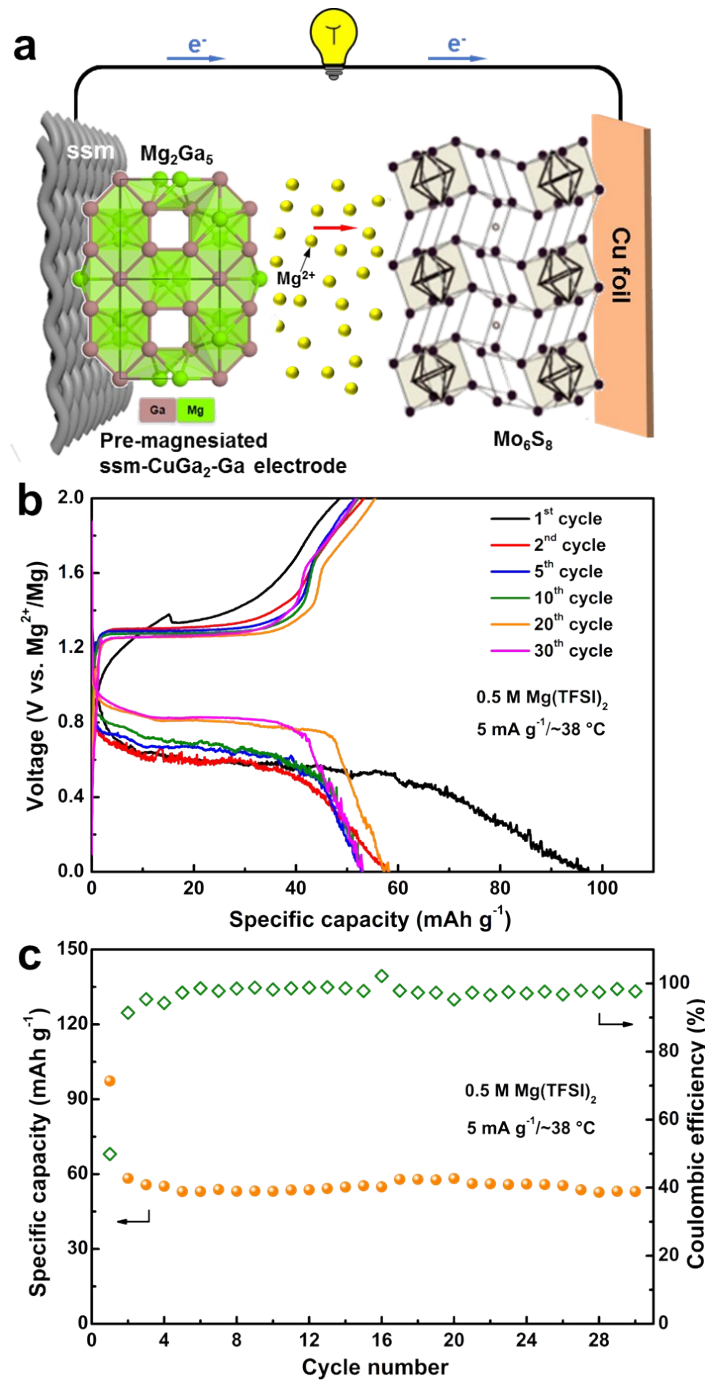


Figure S11 Electrochemical performance of full cells consisting of the pre-magnesiated ssm-CuGa₂-Ga anode and the Mo₆S₈ cathode in the 0.5 M Mg(TFSI)₂ electrolyte at ~ 38 °C. (a) Schematic illustration of the full cell. (b) Discharge/charge curves and (c) cyclic stability during the first thirty cycles of this full cell.

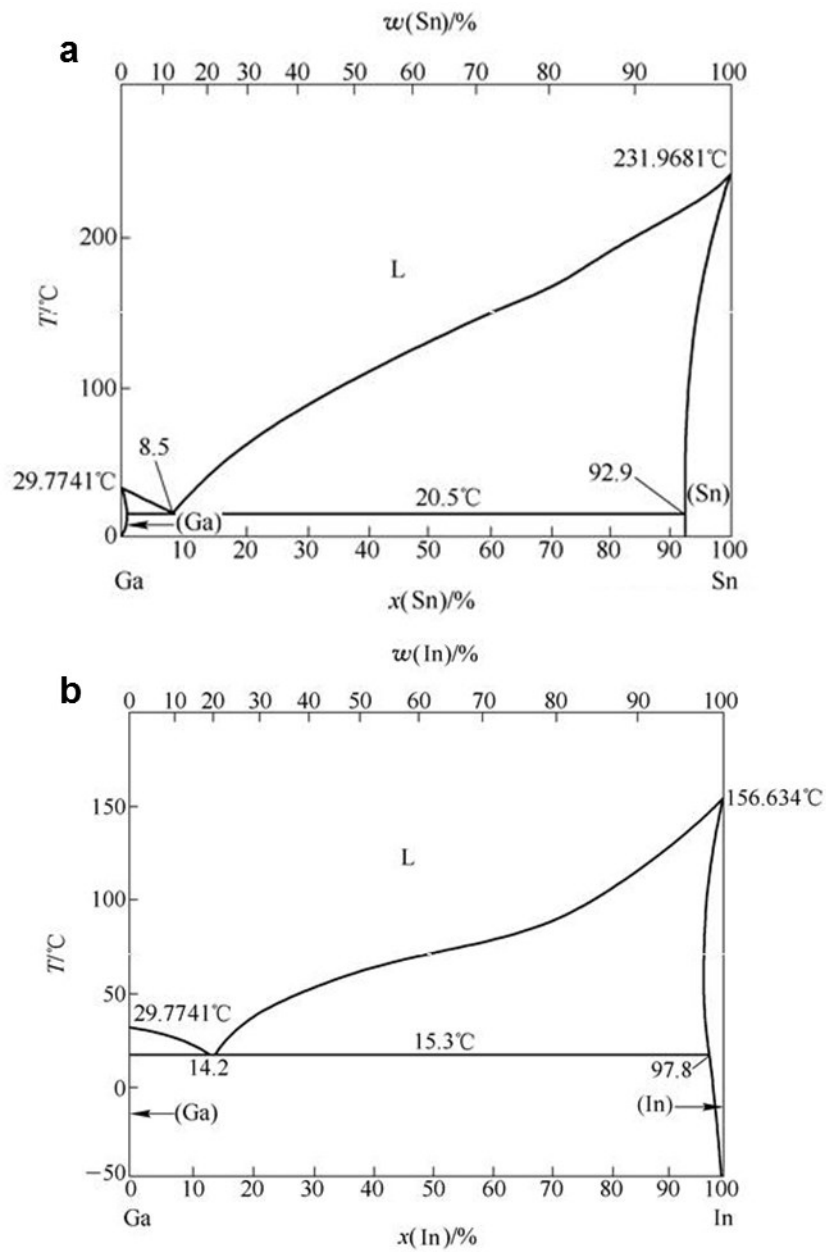


Figure S12 Binary alloy phase diagrams of (a) Ga-Sn² and (b) Ga-In³.

References

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