Supporting Information

Highly reversible Mg metal anodes enabled by interfacial liquid metal engineering for high-energy Mg-S batteries

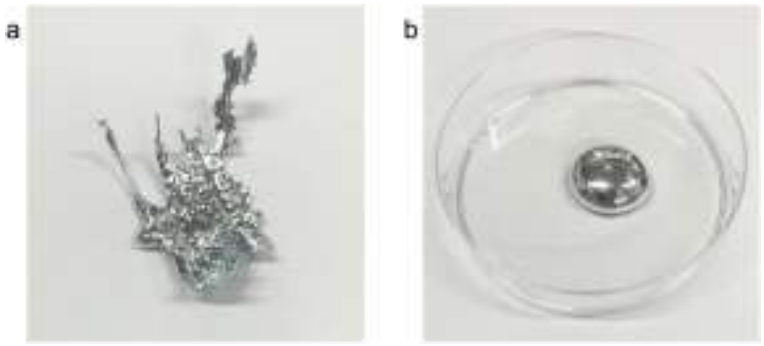

Fig. S1. (a, b) Photographs of solid Ga and liquid-state Ga, respectively.

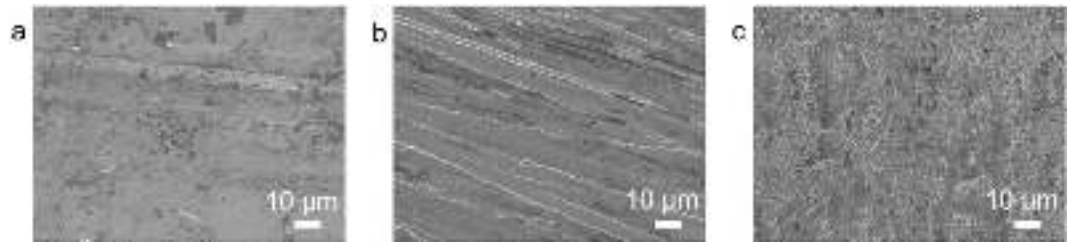

Fig. S2. (a–c) Top-view SEM images of unpolished Mg foil, polished Mg foil, and Ga_5Mg_2-Mg, respectively.

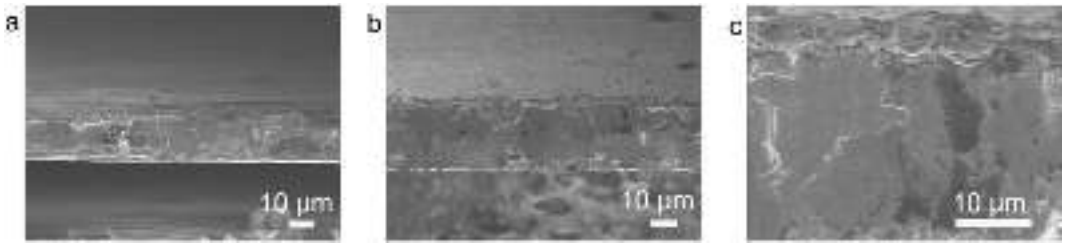

Fig. S3. (a) Cross-sectional SEM image of polished Mg foil. (b, c) Cross-sectional SEM images of Ga_5Mg_2-Mg.

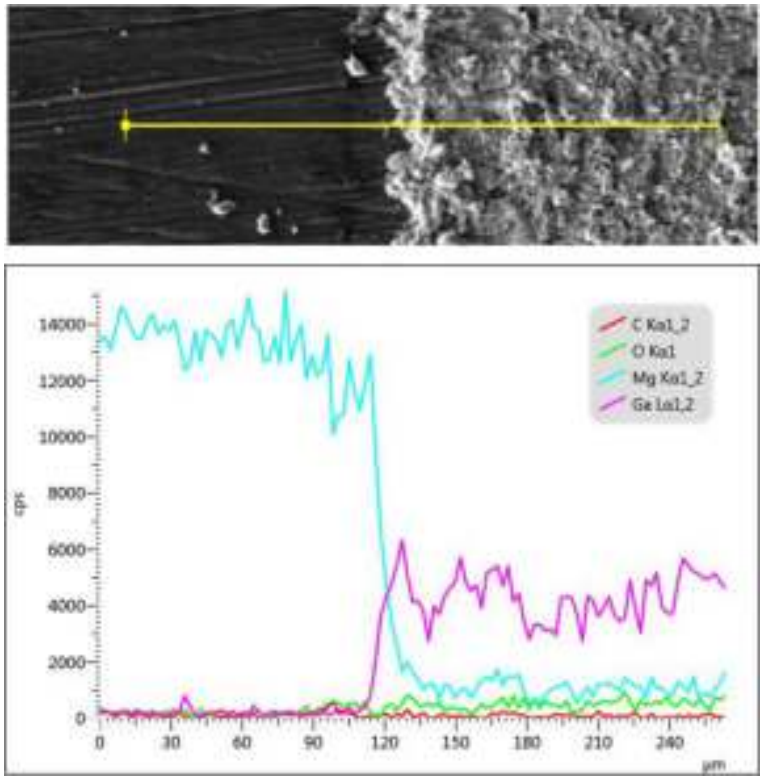

Fig. S4. Top-view SEM image of Ga_5Mg_2-Mg and corresponding linear scanning showing the elemental distribution.

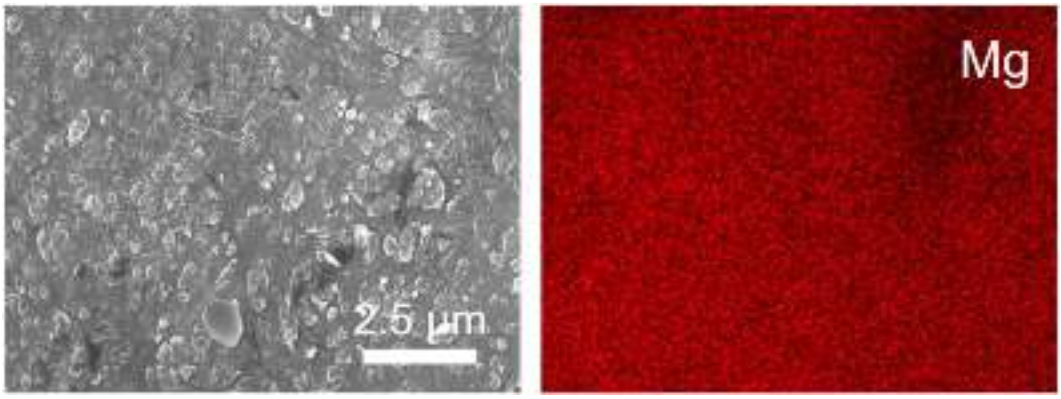

Fig. S5. Top-view SEM images after plating 0.5 mAh cm^{-2} of Mg on Mg electrode at 0.5 mA cm^{-2} and corresponding EDS mapping of Mg element.

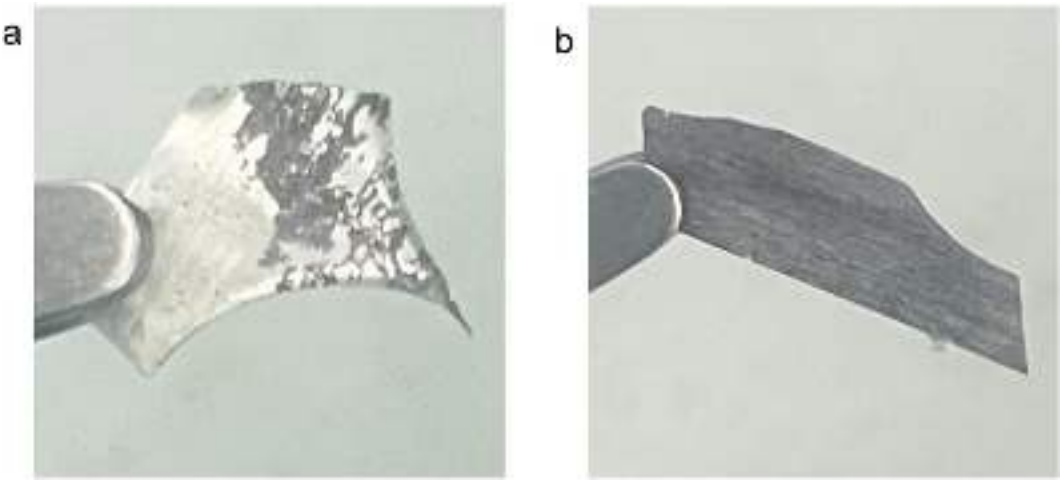

Fig. S6. (a, b) Photographs of Mg and Ga_5Mg_2-Mg electrodes after immersed in liquid electrolyte for 72 h, respectively.

Fig. S7. Photographs of Ga_5Mg_2-Mg electrodes after heated in an Ar atmosphere for 1 h at different temperatures.

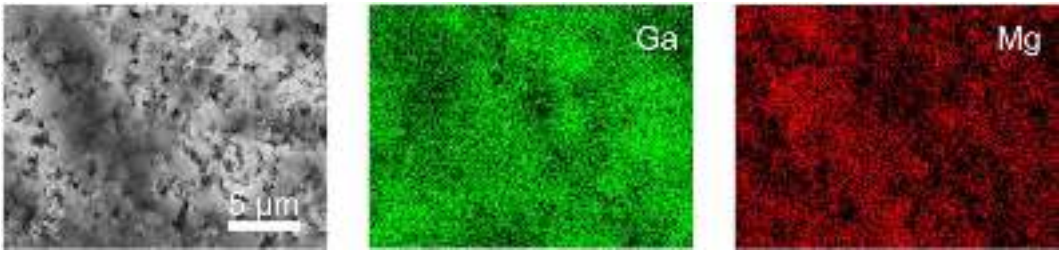

Fig. S8. Top-view SEM image after stripping 0.5 mAh cm^{-2} of Mg from Ga_5Mg_2-Mg electrode at 0.5 mA cm^{-2} and corresponding EDS mapping of Ga and Mg elements.

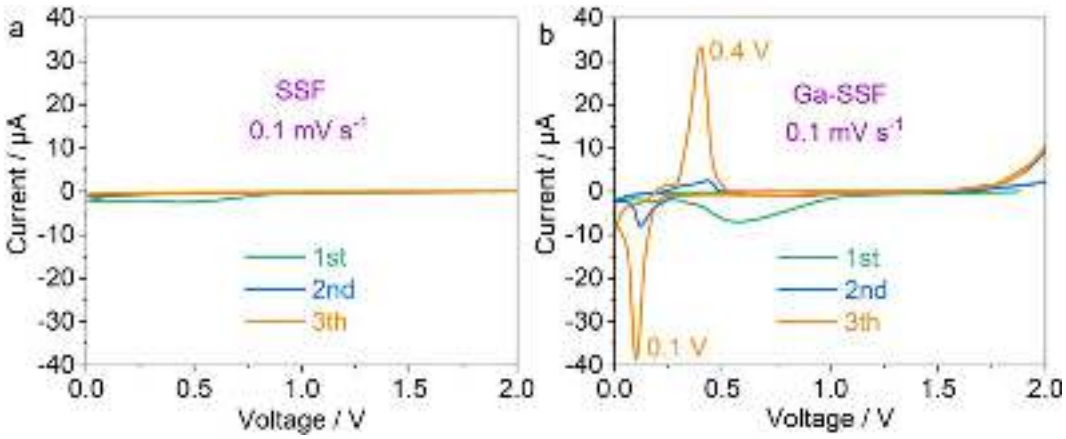

Fig. S9. (a, b) The first three cycles of CV curves of SSF and Ga-SSF at 0.1 mV s^{-1} in 0.01–2 V.

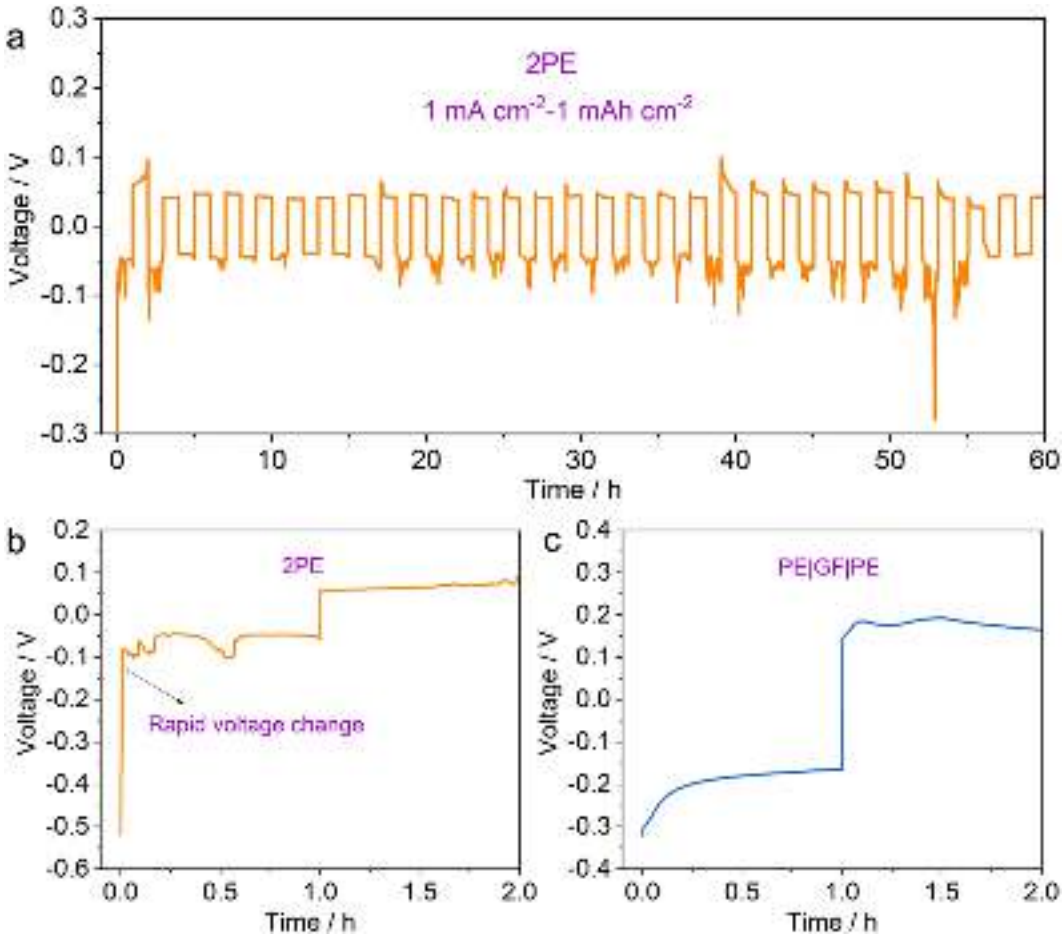

Fig. S10. (a) Voltage-time curves of Mg-Mg symmetric cells using two polyethylene separators (2PE). (b) The first-cycle plating/stripping curves of Mg-Mg symmetric cells using two 2PE. This image was got from (a). (c) The first-cycle plating/stripping curves of Mg-Mg symmetric cells using a piece of glass fiber film (Whatman) sandwiched between two pieces of polyethylene films (PE|GF|PE). This image was got from Fig. 6d.

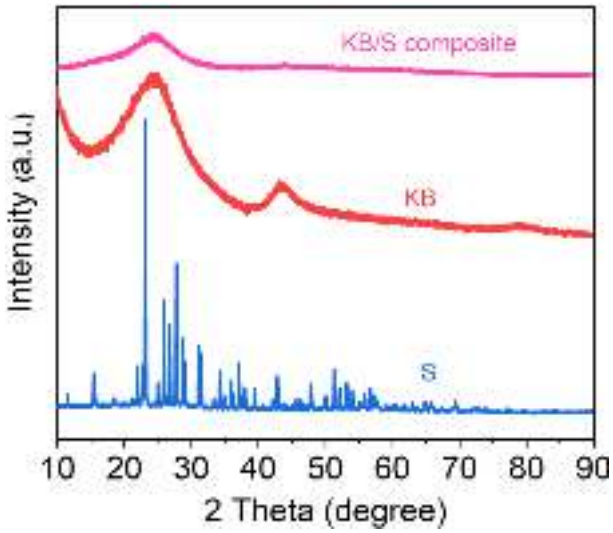

Fig. S11. XRD patterns of S powders, KB, and KB/S composite.

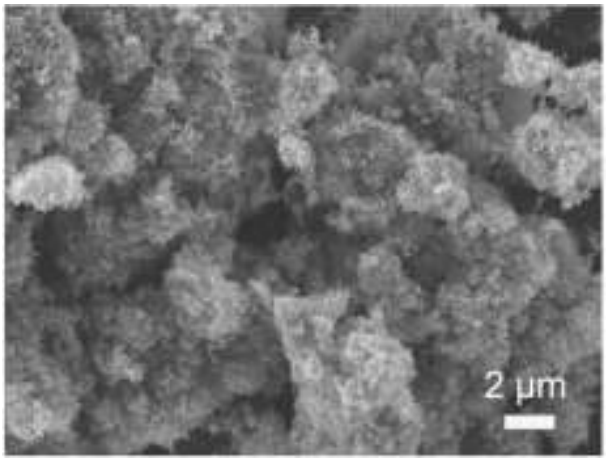

Fig. S12. SEM image of the KB/S composite.

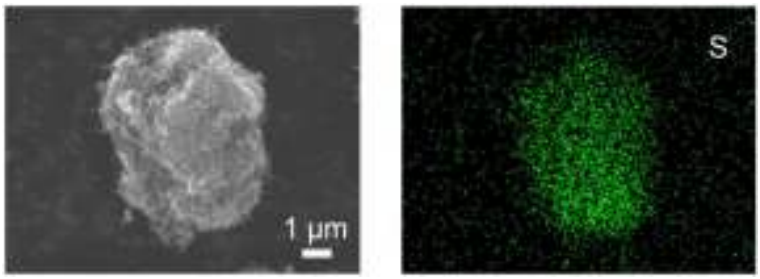

Fig. S13. SEM image of the KB/S composite and corresponding EDS mapping of S element.

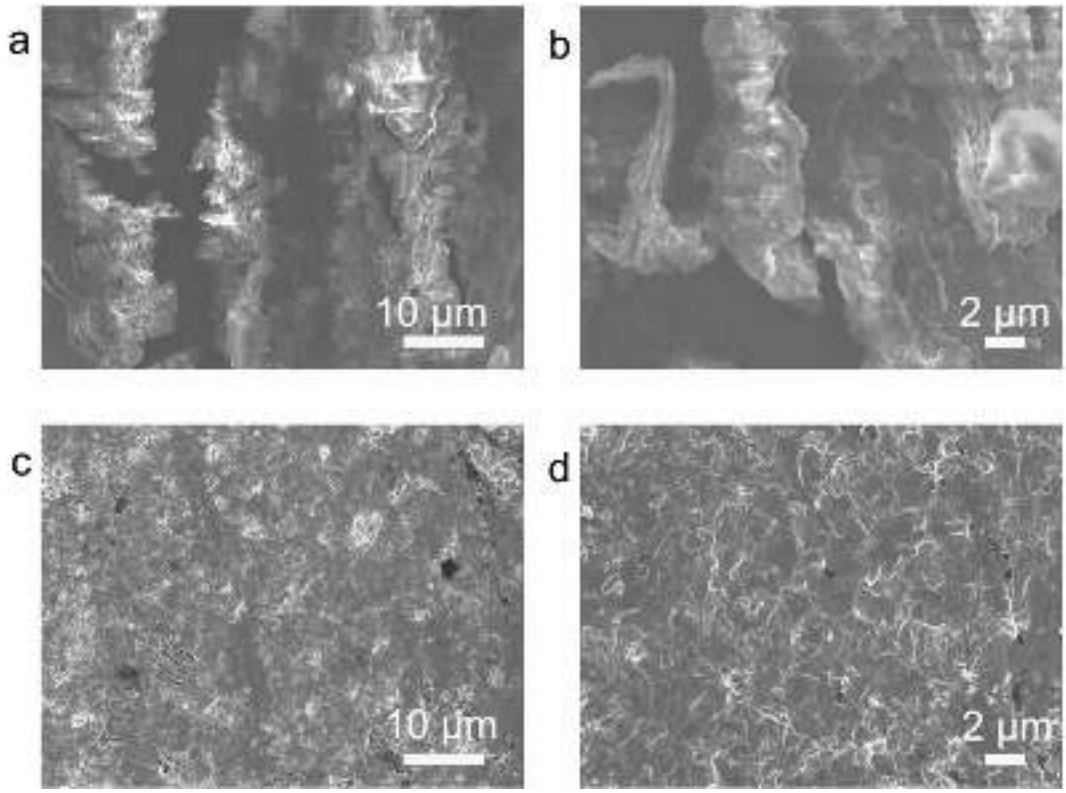

Fig. S14. (a, b) SEM images of Mg electrode after cycling in Mg/S cell. (c, d) SEM images of Ga_5Mg_2-Mg electrode after cycling in Ga_5Mg_2-Mg/S cell. The cells were first cycled for one time at 0.2 C in 0.1–2.5 V. Then the cells were discharged to 0.1 V at 0.2 C. After resting for 24 h, the cells were disassembled in a glove box. After washing with DME solvent, the Mg-based electrodes for SEM test were obtained.

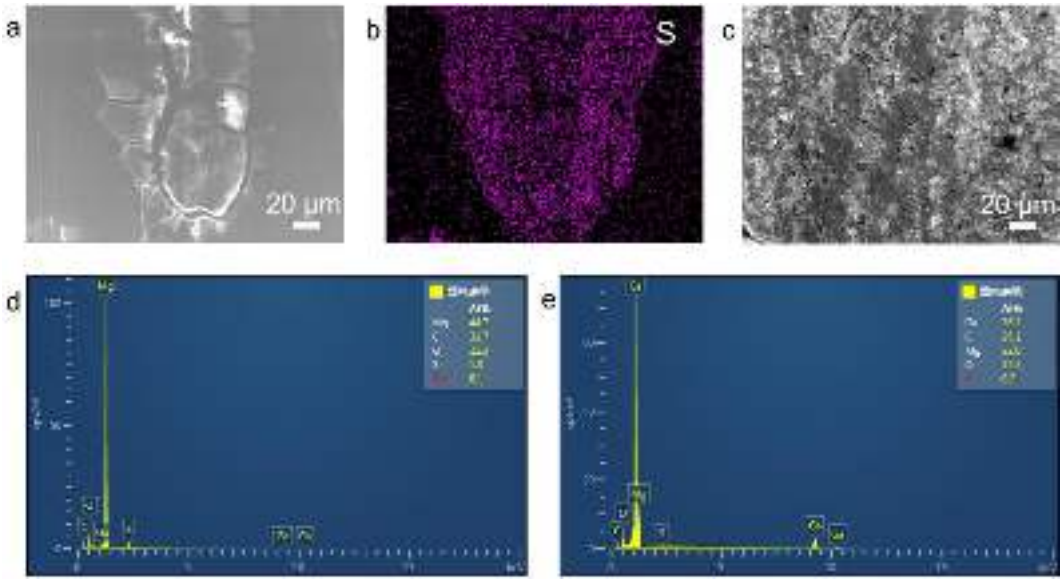

Fig. S15. (a, b) SEM image of Mg electrode after cycling in Mg/S cell and corresponding EDS mapping of S element. (c) SEM image of Ga_5Mg_2-Mg electrode after cycling in Ga_5Mg_2-Mg/S cell. (d) The content of elements in (a). (e) The content of elements in (c).

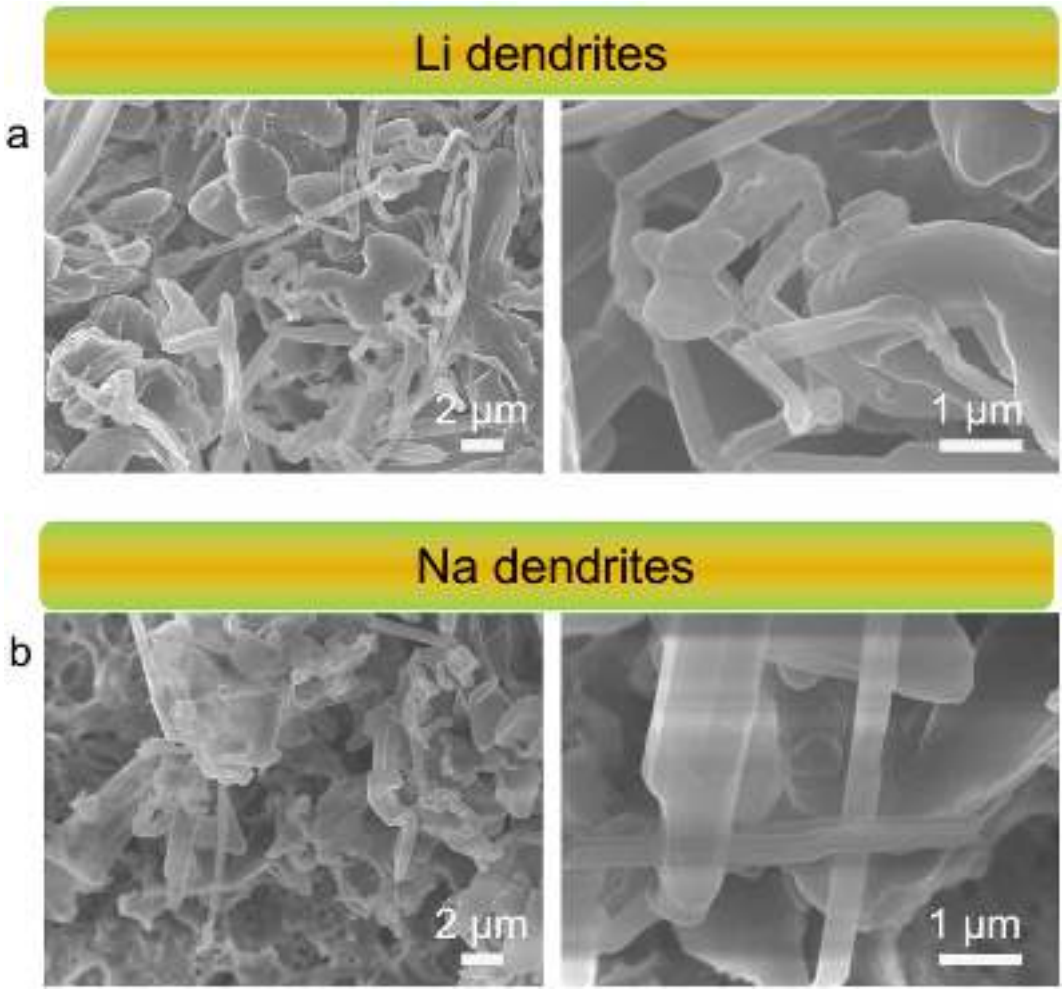

Fig. S16. (a, b) Top-view SEM images after depositing 2 mAh cm^{-2} of Li and Na on Li and Na electrodes at 0.5 mA cm^{-2}, respectively.

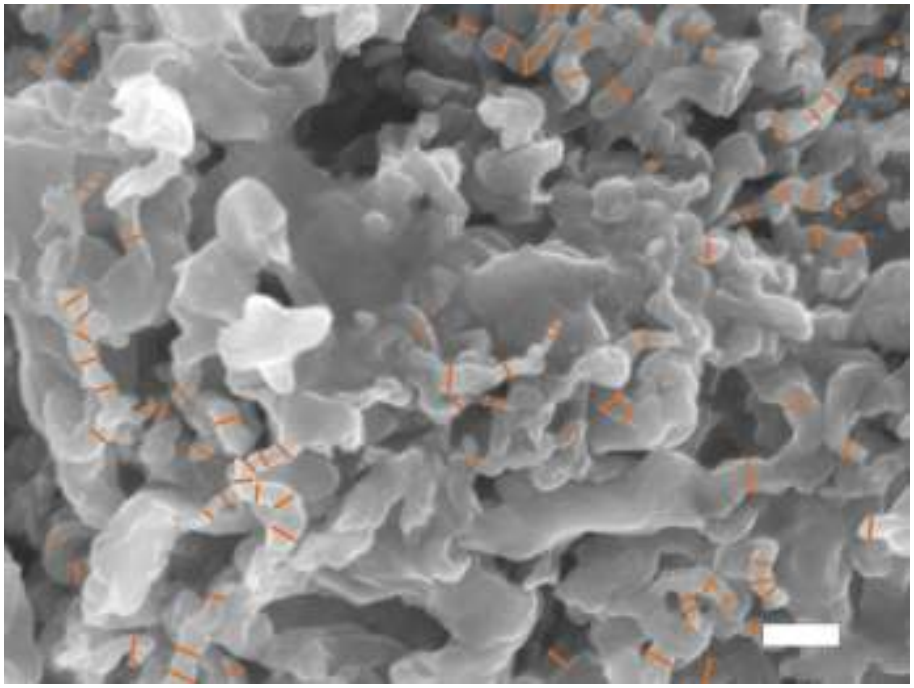

Fig. S17. Top-view SEM image after depositing 2 mAh cm^{-2} of Mg on Mg electrodes at 0.5 mA cm^{-2}. The orange marks were labeled to measure the diameter of Mg dendrites.