

## Supporting Information

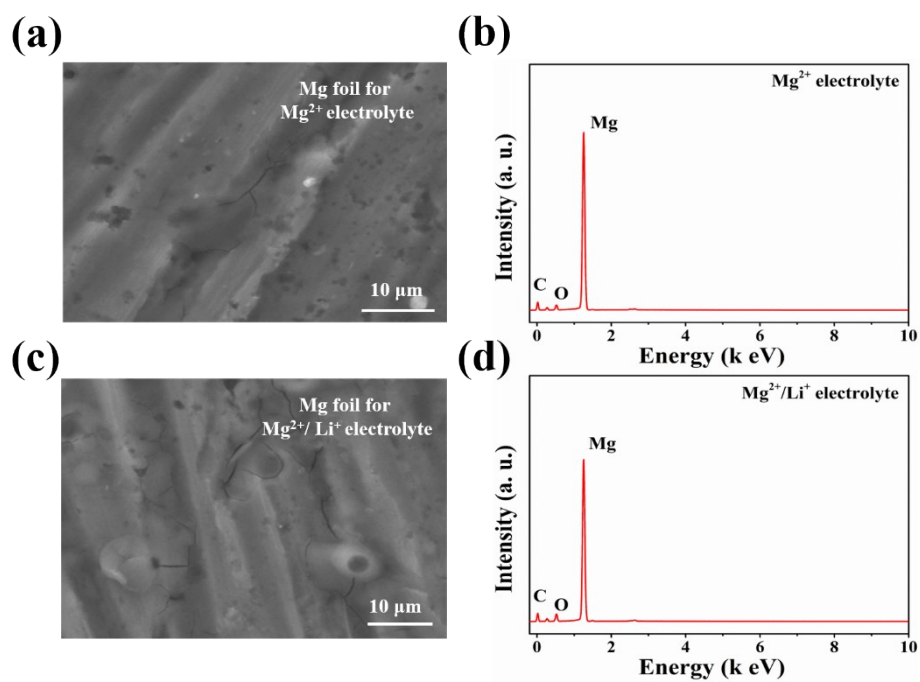
### **Effect of $Mg^{2+}$ and $Mg^{2+}/Li^+$ electrolytes on rechargeable magnesium batteries based on erythrocyte-like CuS cathode**

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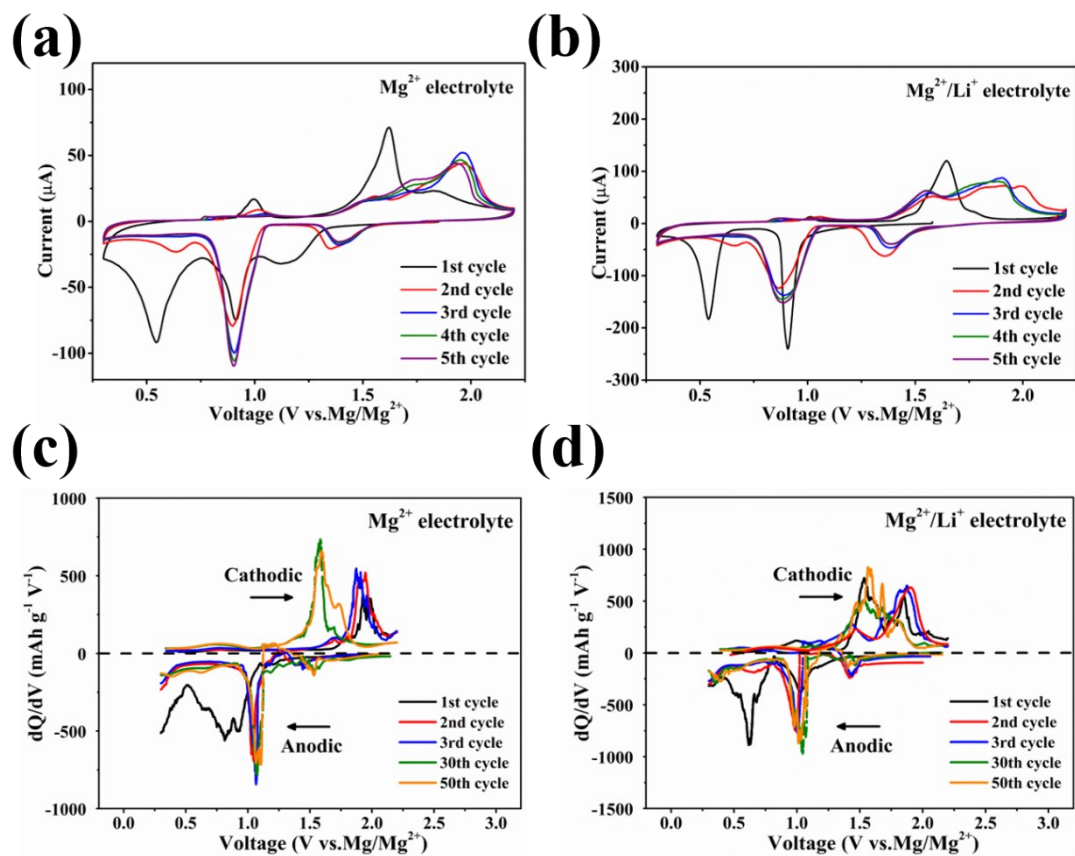
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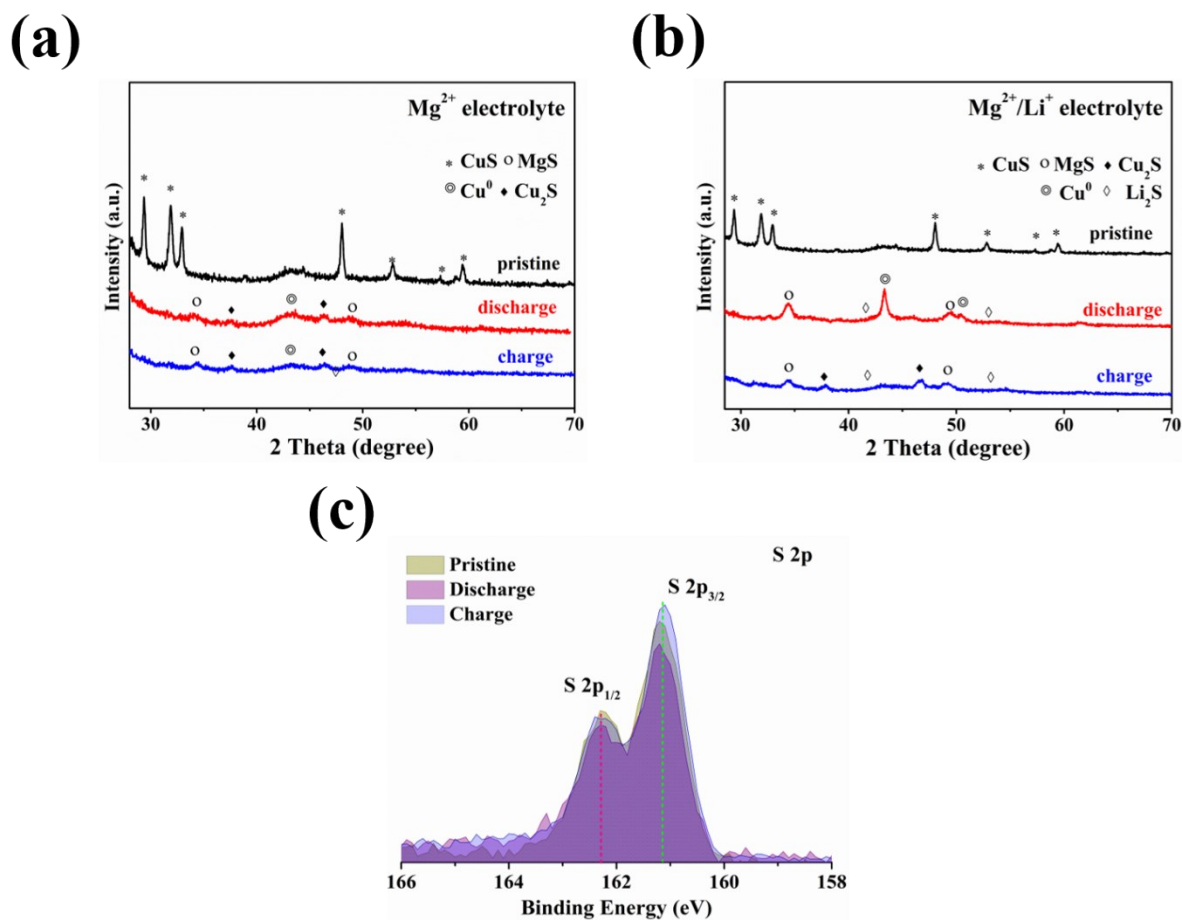
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**Fig. S1** (a) SEM image and (b) corresponding EDS spectra of Mg foils for Mg<sup>2+</sup> electrolyte after stripping/deposition for 100 cycles. (c) SEM image and (d) corresponding EDS spectra of Mg foils for Mg<sup>2+</sup>/Li<sup>+</sup> complex electrolyte after stripping/deposition for 100 cycles.



**Fig. S2** Cyclic voltammograms (CV) for the erythrocyte-like CuS for initial five cycles in (a)  $Mg^{2+}$  electrolyte and (b)  $Mg^{2+}/Li^+$  complex electrolyte. Differential capacity vs. voltage ( $dQ/dV$ ) curves of erythrocyte-like CuS in (c)  $Mg^{2+}$  electrolyte and (d)  $Mg^{2+}/Li^+$  complex electrolyte.



**Fig. S3** (a) XRD spectra of erythrocyte-like CuS in (a)  $\text{Mg}^{2+}$  electrolyte and (b)  $\text{Mg}^{2+}/\text{Li}^+$  complex at different discharge/charge state after 5 cycles. (c) XPS spectra of S 2p for erythrocyte-like CuS cathode in  $\text{Mg}^{2+}/\text{Li}^+$  complex electrolyte.