BATTERIES & SUPERCAPS

Supporting Information

Facile, Solvent-Free Preparation of High Density, High Mass Loading Sulfur Cathodes Enabled by Dry-Pressable Holey Graphene Scaffolds

Yi Lin,* Kobi J. Jones, Louisa C. Greenburg, Jae-Woo Kim, Liangbing Hu, and John W. Connell*

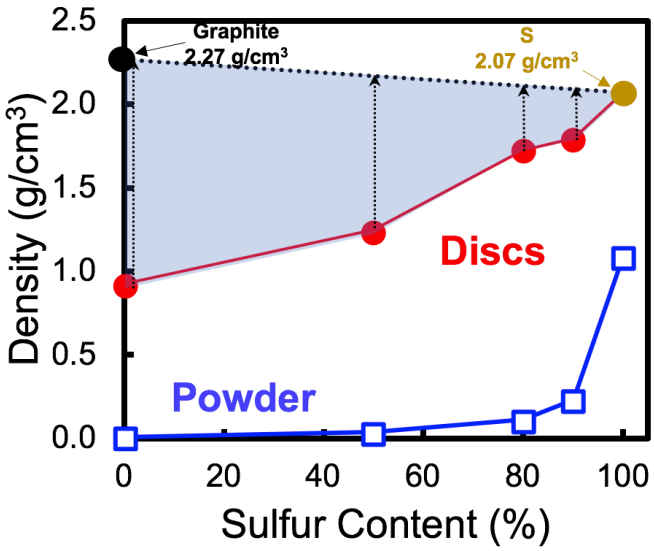

Figure S1. Dependence of various hG/S powder tap densities and the final composite disc density on the sulfur content. The intrinsic densities of S (2.07 g/cm^3) and graphite (2.27 g/cm^3) are shown for comparison. Each dashed arrow in the shaded area represents the density difference between the hG/S composite disc and an ideal graphite/S mixture of the same respective composition and should thus correlate with the available porosity.

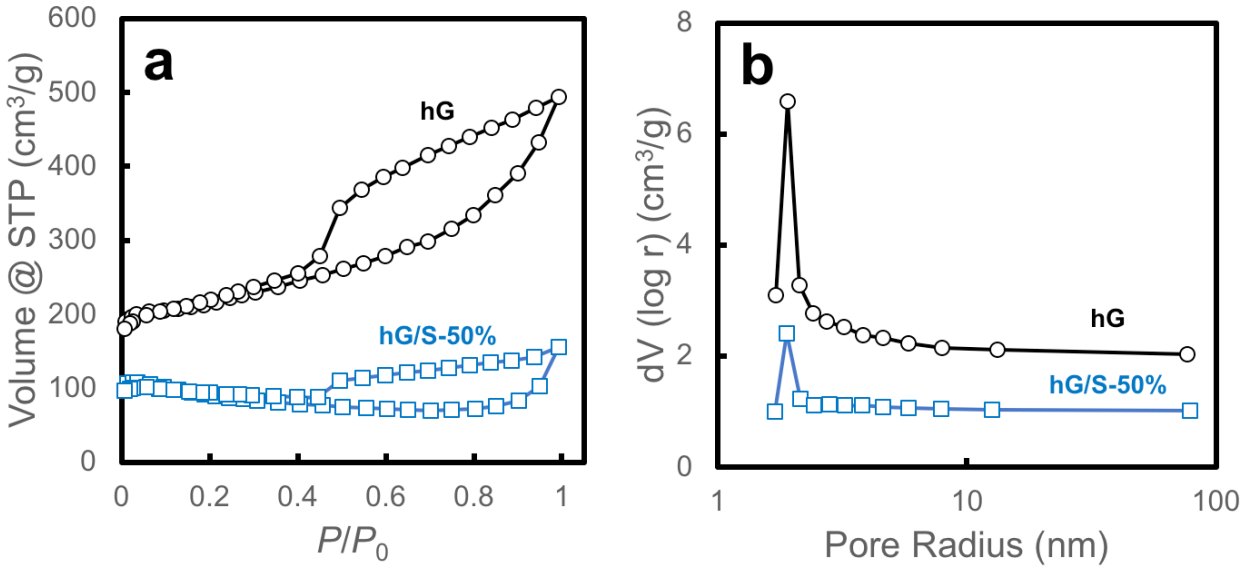

Figure S2. Pore analysis data from N_2 adsorption/desorption measurements of a neat hG disc and a hG/S-50% composite disc: (a) isotherms and (b) BJH pore size distribution plots. The y-axis values in both (a) and (b) are relative with traces vertically shifted for clarity.

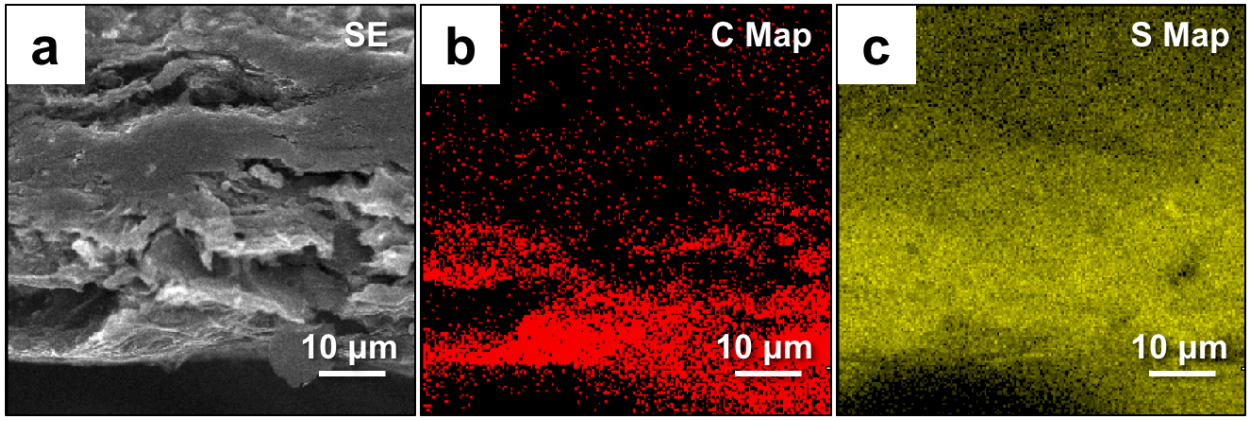

Figure S3. (a) A typical SEM image and the corresponding (b) C map and (c) S map from EDS of a hG/S-50% composite disc.

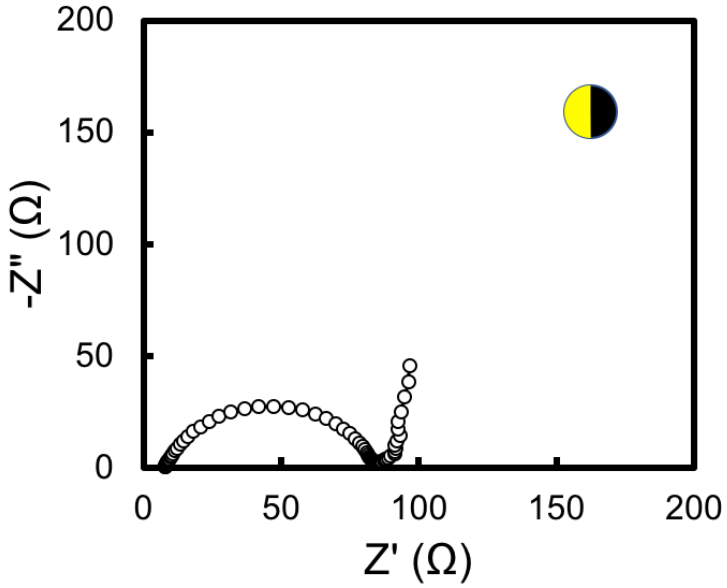

Figure S4. EIS of a typical Li-S cell with a hG/S-50% cathode ($m_{A\text{-}S}$ ~ 6 mg/cm^2). The inset symbol indicates 50% S (yellow: S; black: hG).

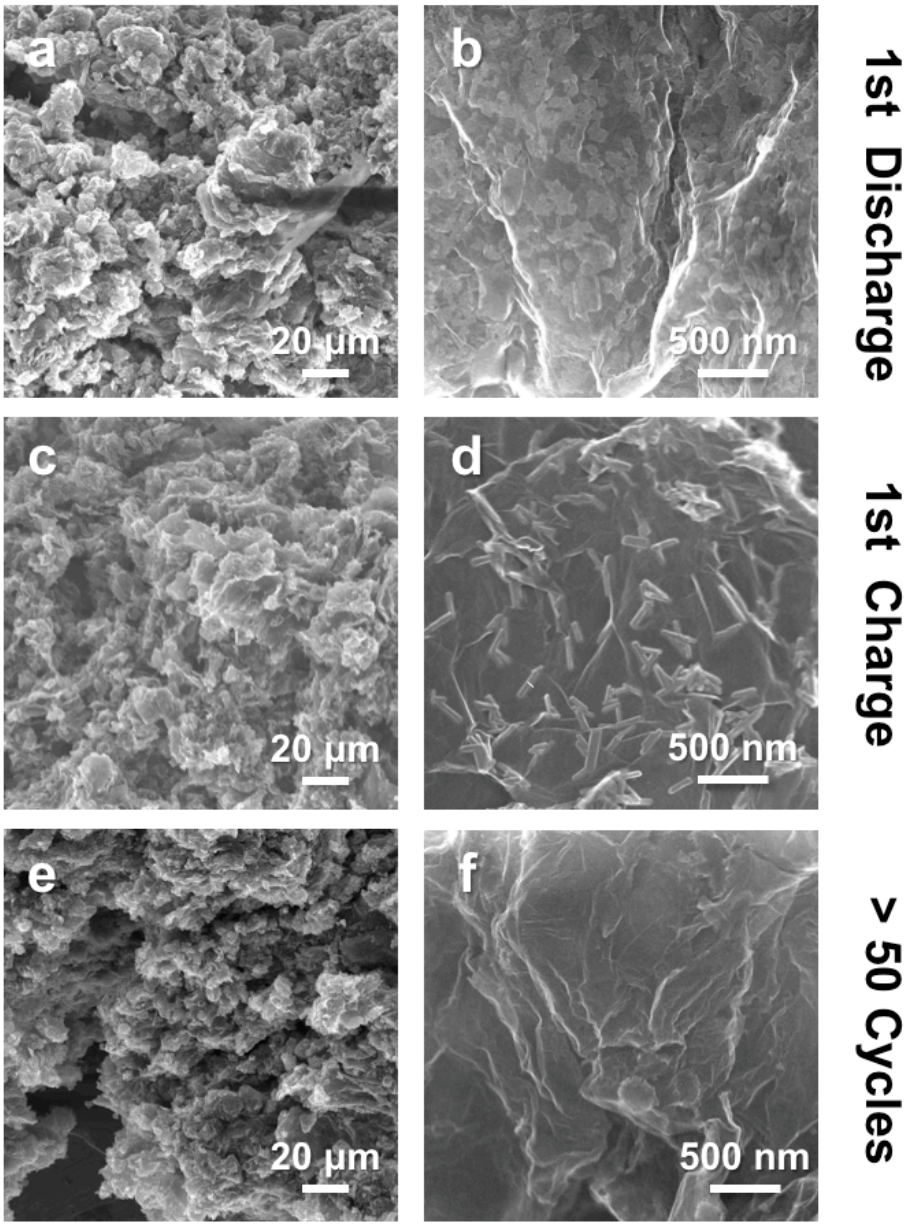

Figure S5. SEM images at low (left) and high (right) magnifications of the hG/S-50% cathodes after (a,b) first discharge, (c,d) first charge, and (e,f) prolonged cycling (> 50 cycles).

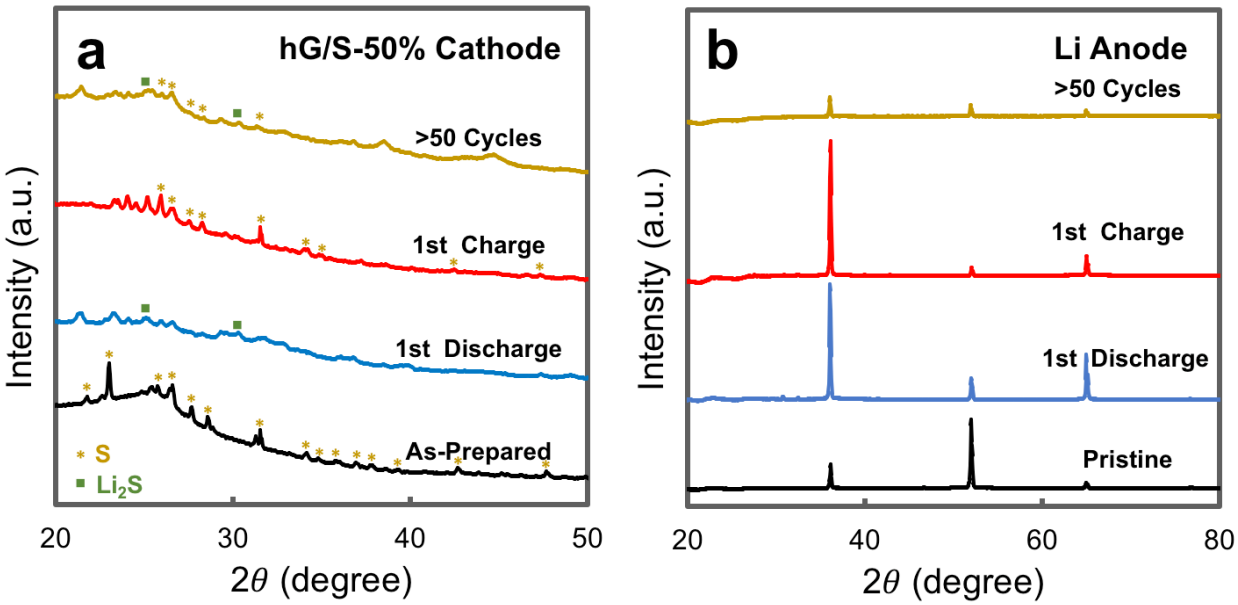

Figure S6. XRD patterns of (a) hG/S-50% composite cathodes and (b) Li anodes after first discharge, first charge, and prolonged cycling (> 50 cycles). Data from the pristine/as-prepared samples are also shown for comparison.

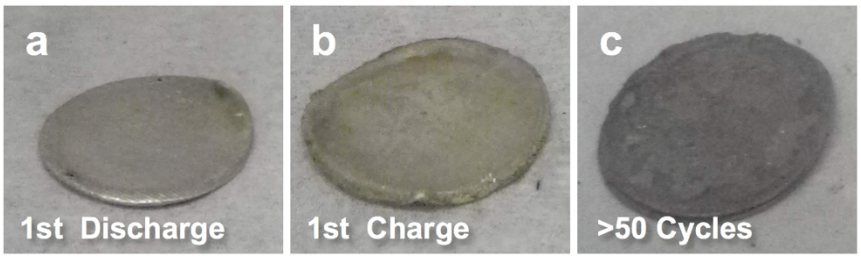

Figure S7. Photographs of Li anodes after (a) first discharge, (b) first charge, and (c) prolonged cycling (> 50 cycles).

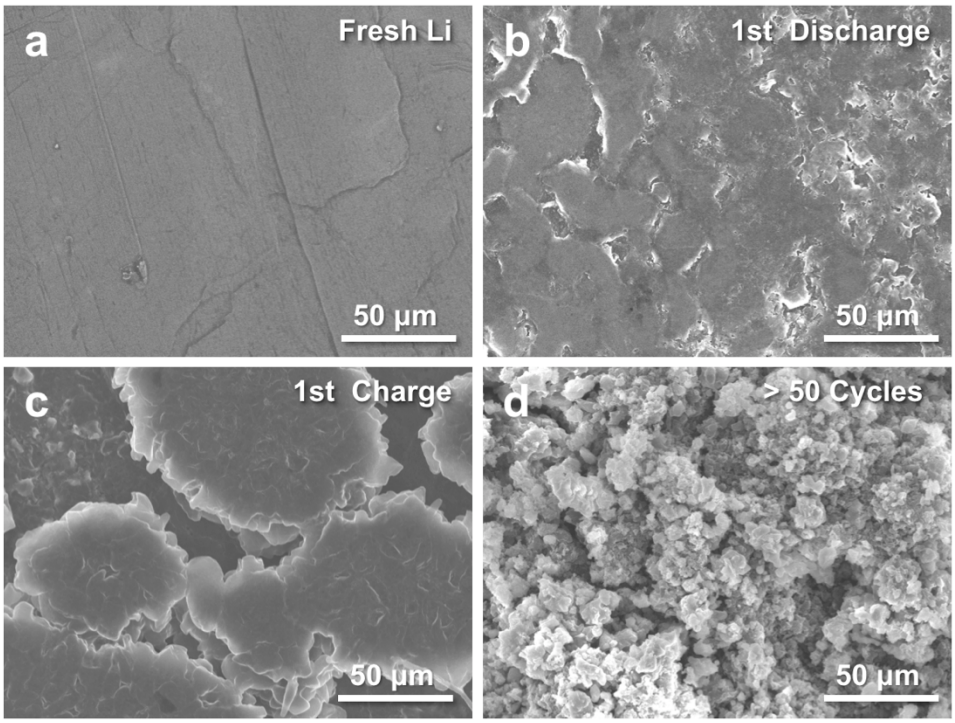

Figure S8. SEM images of (a) a fresh Li chip and those after (a) first discharge, (b) first charge, and (c) prolonged cycling (> 50 cycles).

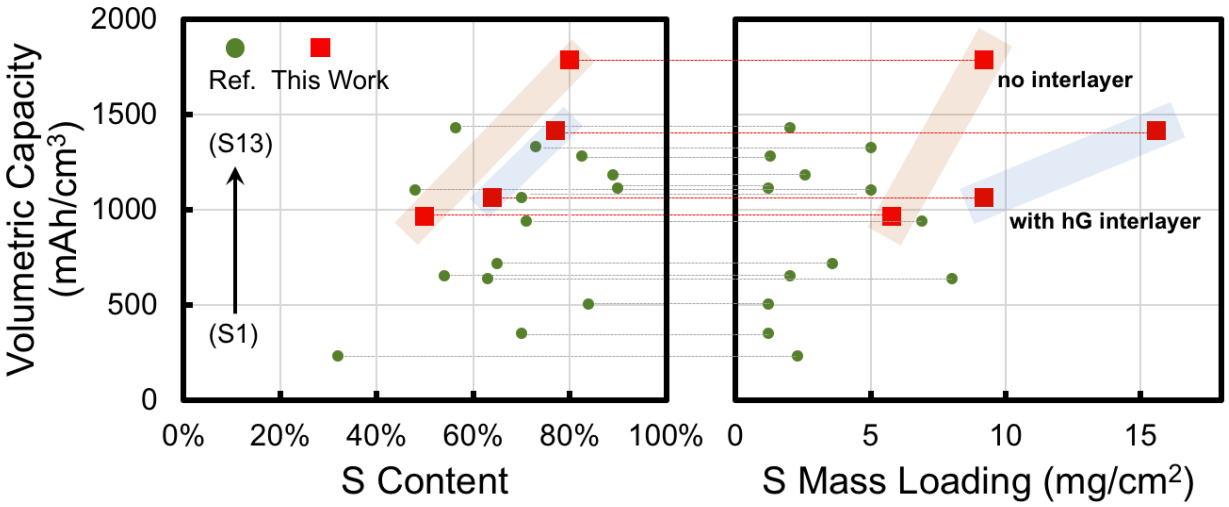

Figure S9. Volumetric capacity values of hG/S composite cathodes reported in this work in comparison to those in the literature. More details are provided in **Table S1**.

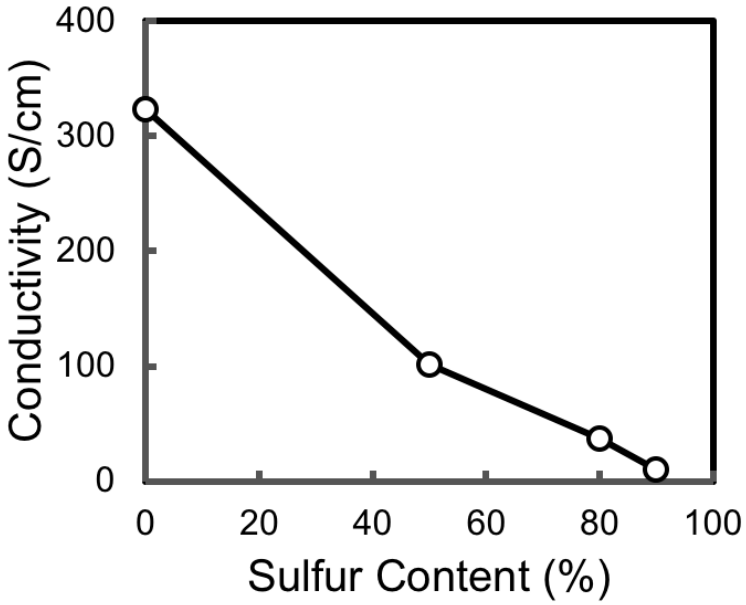

Figure S10. Dependence of surface conductivity of hG/S composite discs on the S content.

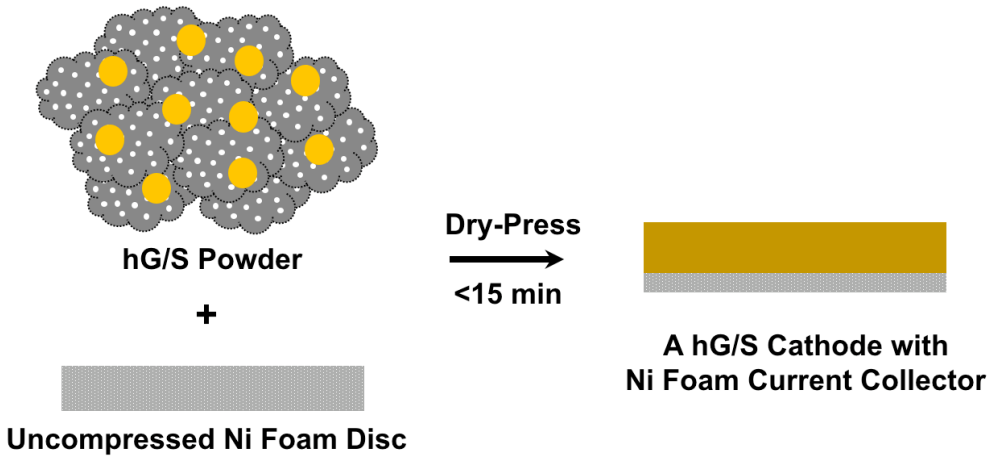

Figure S11. A schematics showing the preparation of a hG/S composite cathode disc with Ni foam current collector via dry compression.