small methods

Supporting Information

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A Multiscale X-Ray Tomography Study of the Cycled-Induced Degradation in Magnesium–Sulfur Batteries

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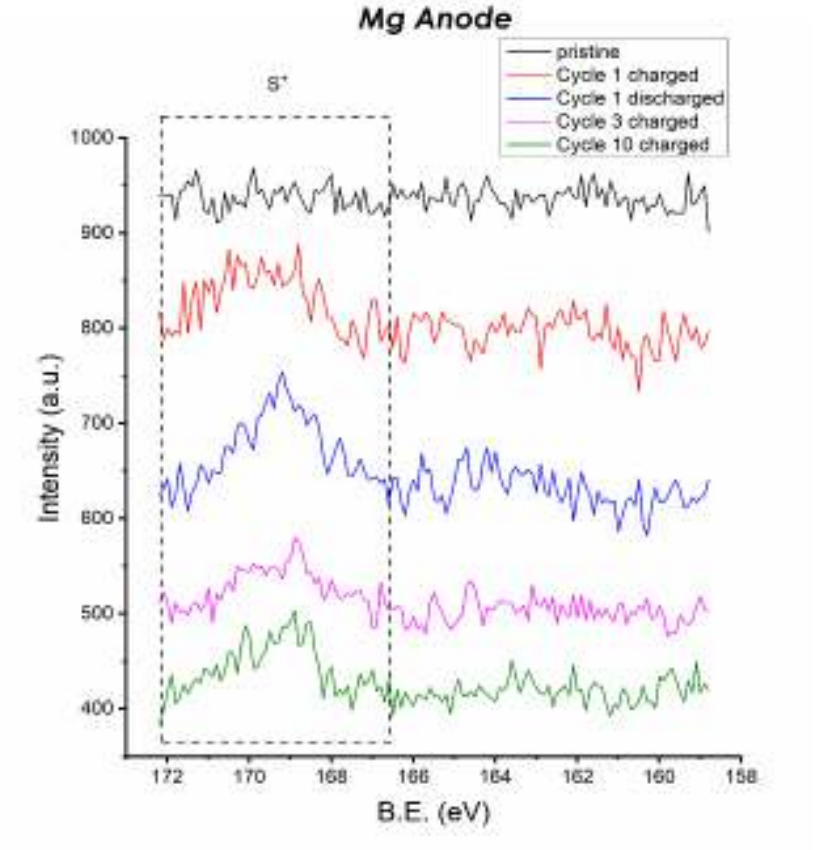

Figure S1. The high-resolution XPS shows S 2p spectra of the Mg anodes at pristine and after 1st (in both charge and discharge state), 3rd and 10th cycle.

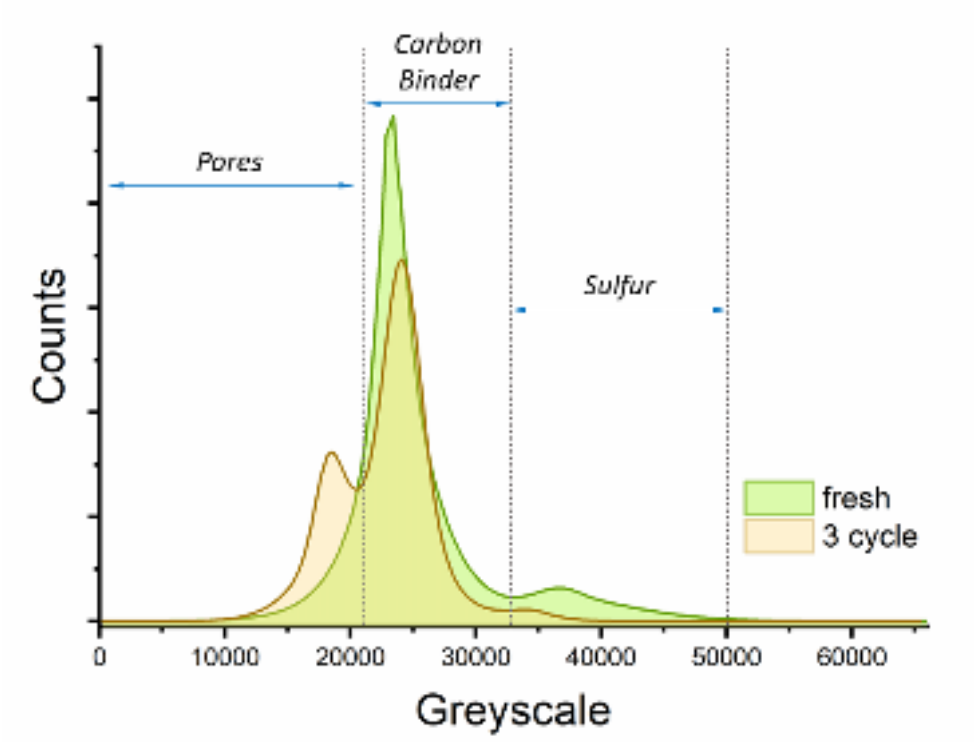

Figure. S2. The grayscale histogram of the S/C electrode at pristine and after 3 cycles (charge-state) *via ex-situ* X-ray nano-CT. Three-phases segmentation (pores, carbon binder, and sulfur materials) was implemented for this study.

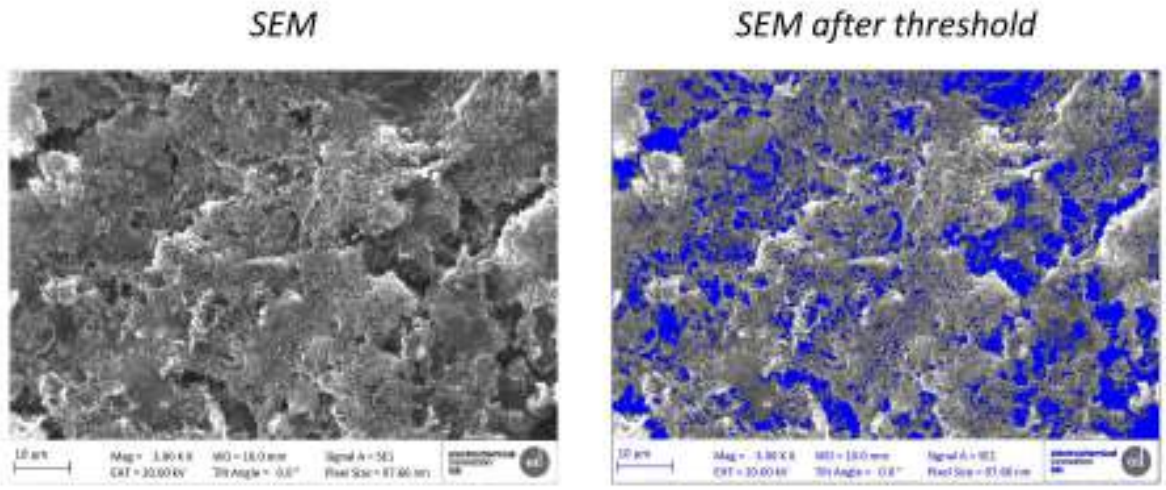

Figure. S3. The SEM of S/C cathode and the associated porosity segmentation (blue), showing porosity fraction measured by SEM (25.98 %) is comparable to that by nano-CT (30 %).

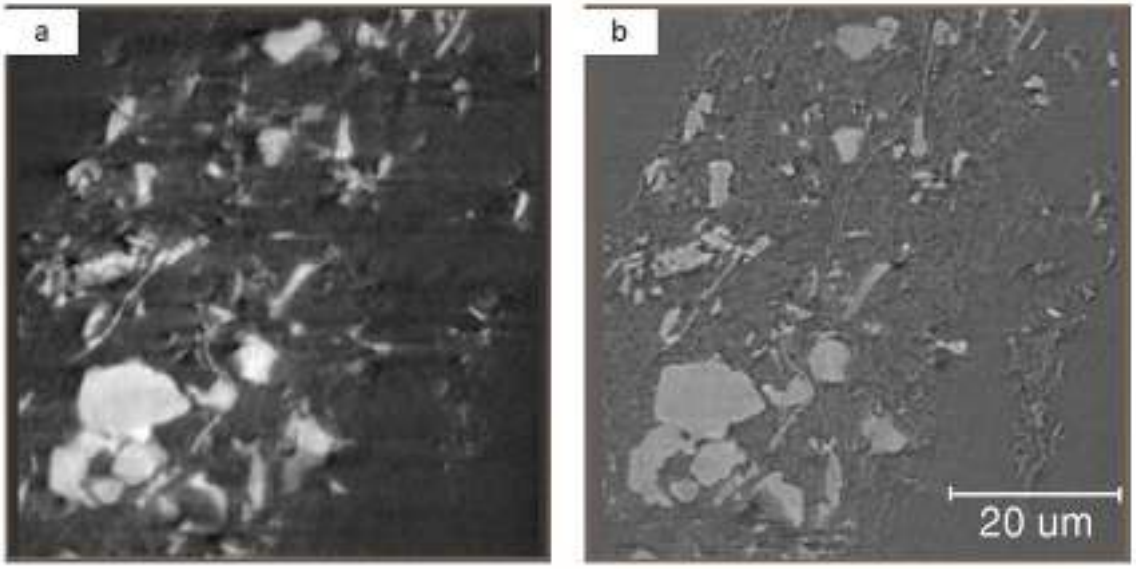

Figure. S4 The nano-CT images of S/C cathode at pristine state by using (a) the absorption mode and (b) the Zernike phase-contrast mode, showing that importance of phase-contrast imaging in resolving the CBD and porosity morphology.

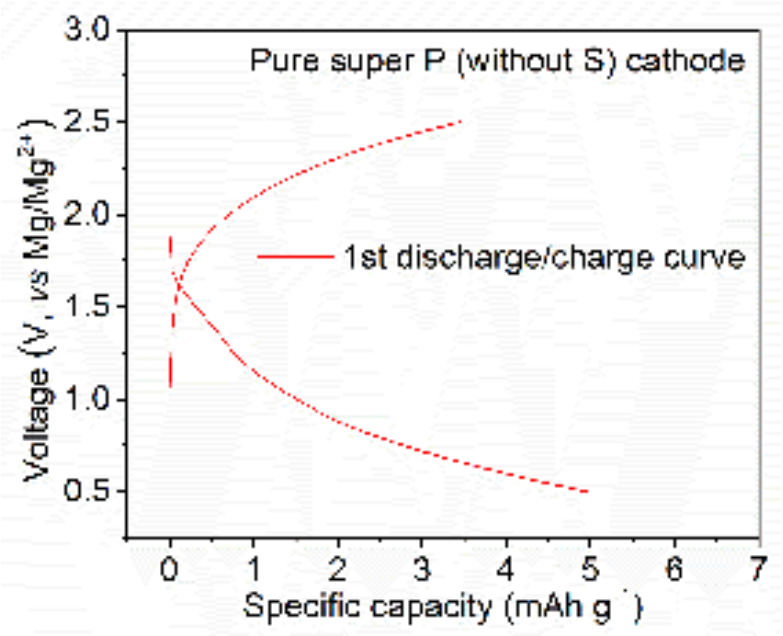

Figure. S5 Discharge/charge profile of pure super P (without S) cathode in the first cycle. The pure super P (no sulfur) based cathode was prepared coupling with the super P functionalized separator as a Mg-S cell. The super P was used to replace the sulfur in the cathode, and the other materials are identical. Furthermore, the super P functionalized separator, Mg anode, electrolyte, Swagelok cells and testing conditions are the same.