Electronic Supplementary Information

Cylindrical nanostructured MoS_2 directly grown on CNT composites for lithium ion batteries

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In this Supplement, we present six figures that support results in the main text. The list is

Figure S1: X-ray photospectroscopy patterns of (a) MDGC-E and (b) MDGC-D.

Figure S2: Raman Spectra of (a) CNT (b) Sulfur coated CNT (C) MDGC-E and (d) MDGC- D samples.

Figure S3: TGA analysis of MDGC-E sample.

Figure S4: HRTEM of (a) MDGC-E and (b) MDGC-D samples.

Figure S5: Galvanostatic charge-discharge profile of MDGC-D.

Figure S6: Cycling performance of MDGC-D and corresponding charge discharge curve with different rate condition.

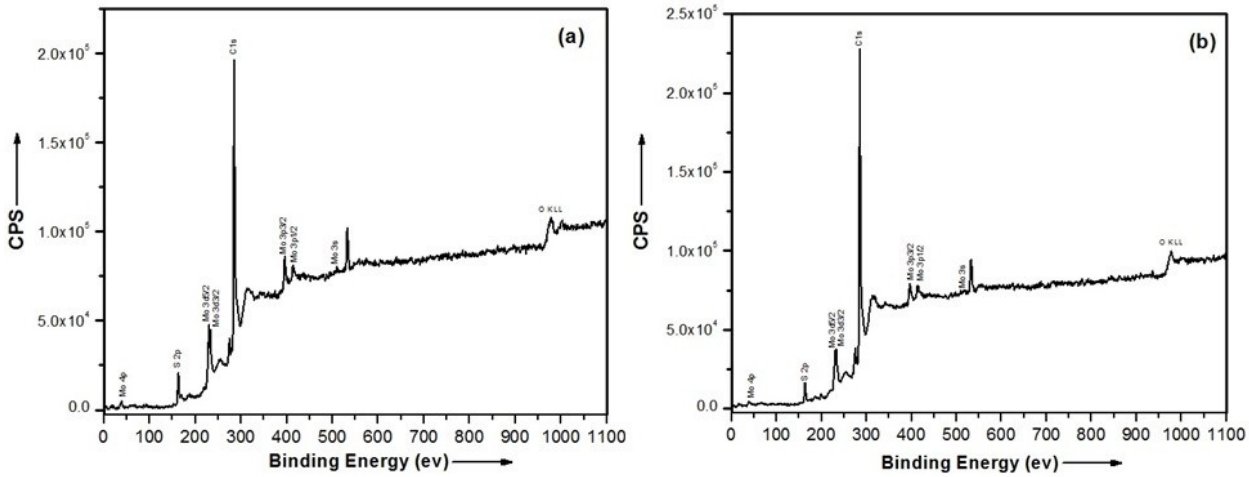

Figure S1: XPS patterns of (a) MDGC-E and (b) MDGC-D: It can be seen from Figures S1(a) and (b) that the sample contains the C, Mo and S elements. The calculated atomic ratio of Mo to S element is 1 to 2.14 and 1 to 2.20 for MDGC-E and MDGC-D samples, respectively, approaching the theoretical value of MoS_2. The high-resolution of C1s can be seen apart from the "C = C" bond.

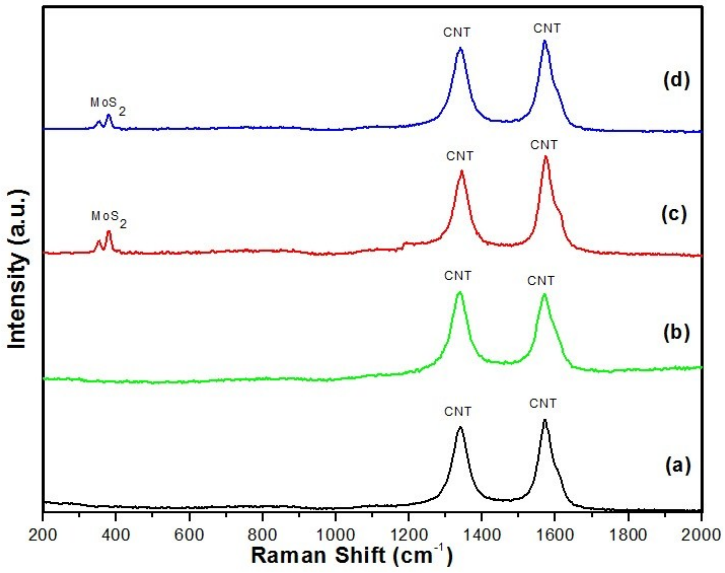

***Figure S2: Raman Spectra of (a) CNT (b) Sulfur coated CNT (C) MDGC-E and (d) MDGC-D samples*:** It is evident from the Raman spectra S2(C) and S2 (d) that MoS_2 sheets have well

layered structure on the CNT surfaces. It is also illustrated that the D to G peak ratio of sulfur coated CNT increases with respect to bare CNT due to sulfur created some defects on the CNT surfaces.

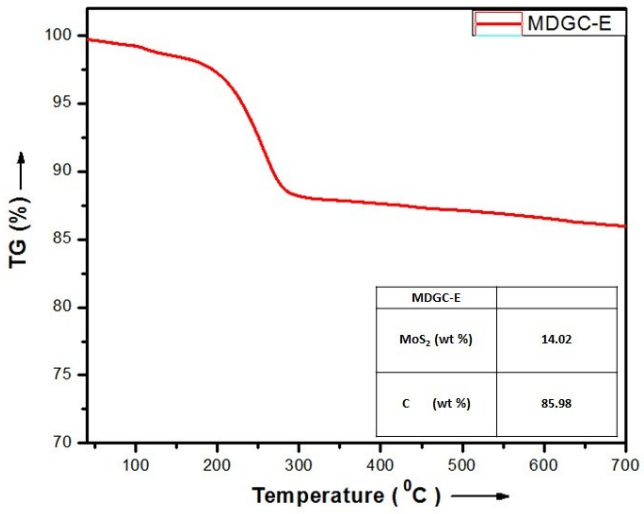

Figure S3: TGA curve of MDGC-E: The MDGC-E composite exhibits two weight losses. The first one appears at approximately between 230-250 ^{0}C, which can probably be attributed to the removal of oxygen-containing groups. The second is only one large continuous weight loss in the range of approximately 300-450 ^{0}C. This thermal behavior might be caused by the decomposition of the amorphous carbon and CNT, and oxidation of MoS_2 in the composites. The mass fraction of carbon and MoS_2 in the MDGC-E can be determined to be around 85.98 wt% and 14.02 wt%, respectively, assuming the complete conversion from MoS_2 to MoO_3.

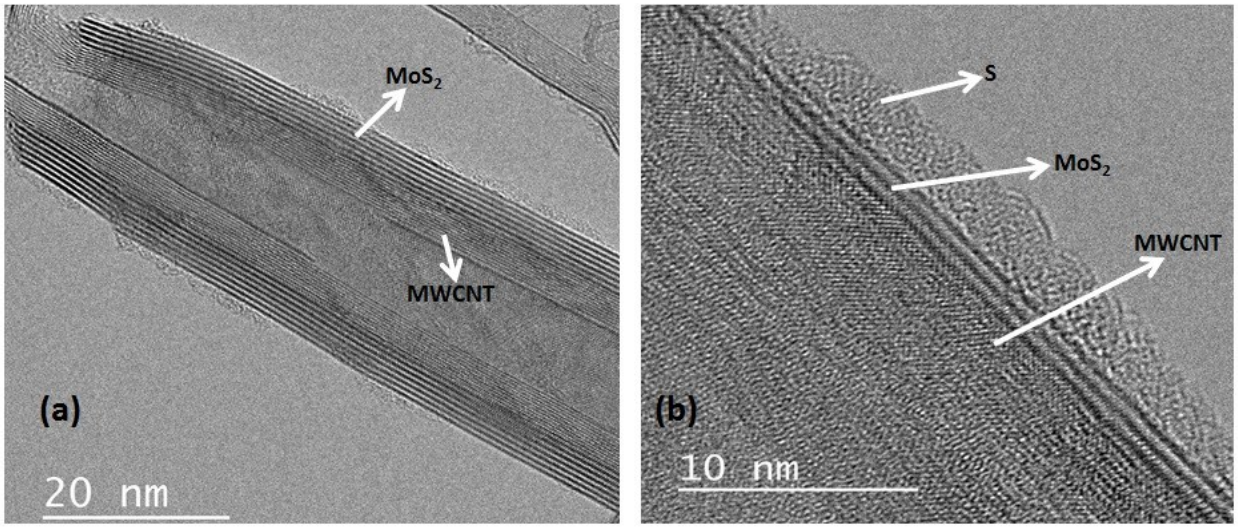

Figure S4: HRTEM of (a) MDGC-E and (b) MDGC-D samples. It can be clearly seen from Figures S4 (a) that MoS2 sheets are well coated on the CNT surface. The d-values between the sheets are 0.62 nm which agrees with XRD analysis. It is illustrated from the Figures S4 (a) that the MDGC-E sample contains the 4-8 layers of MoS_2. The amorphous phase of residual S can be seen in the MDGC-D sample (Figure S4 (b)).

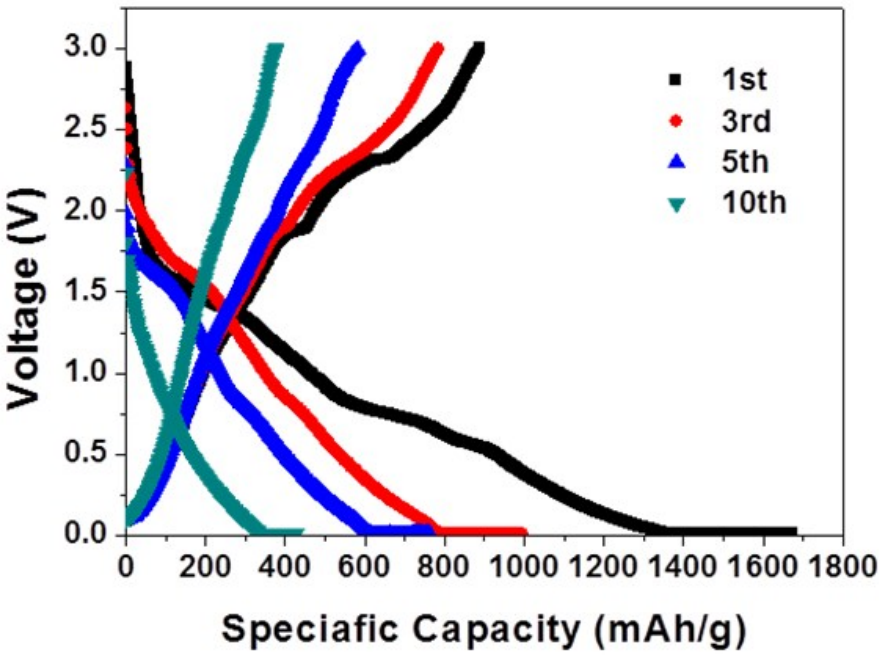

Figure S5 Galvanostatic charge-discharge profile of MDGC-D

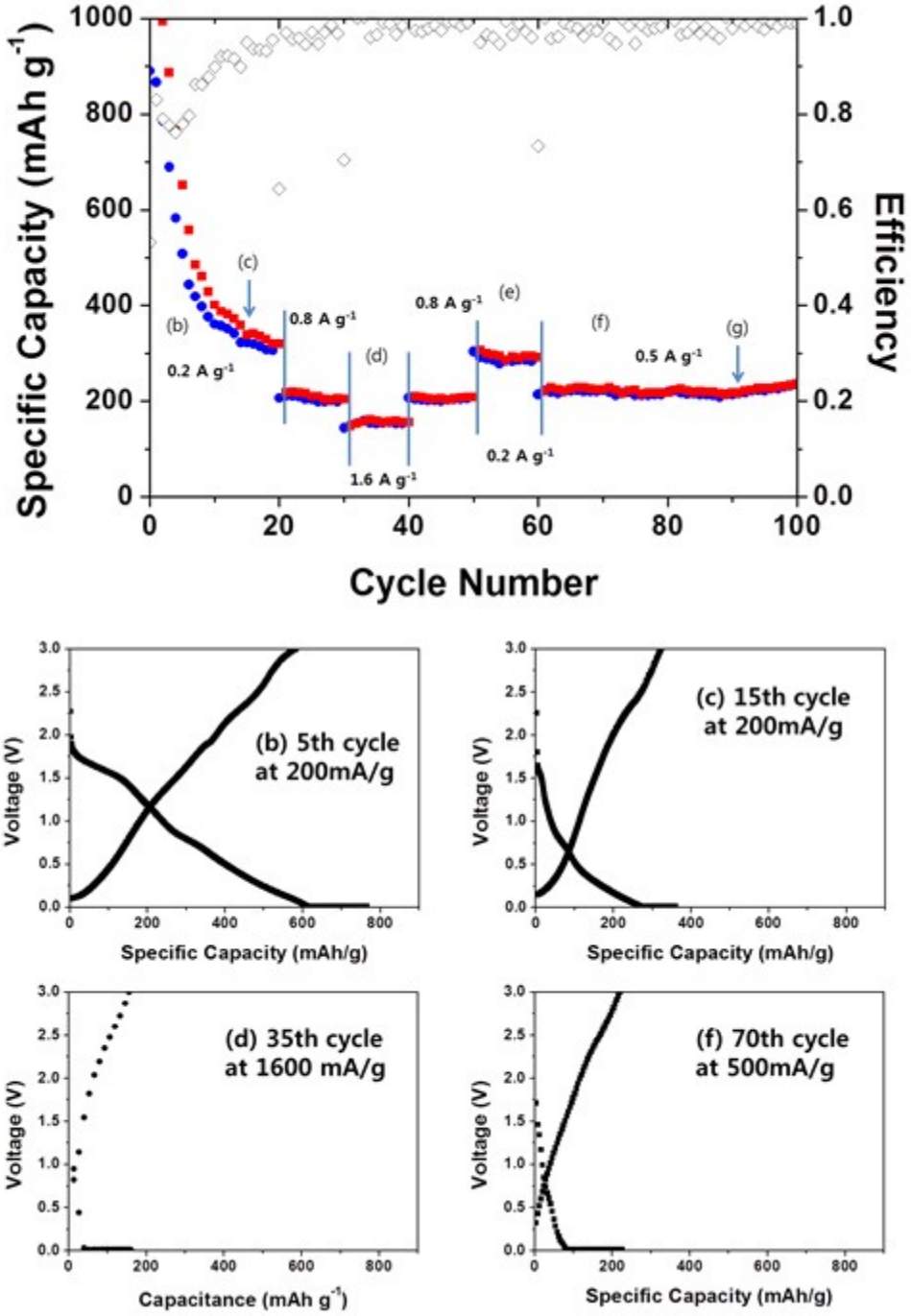

Figure S6 Cycling performance of MDGC-D and corresponding charge discharge curve with different rate condition.