Supporting Information

3-D Vertically Aligned Few Layer Graphene – Partially Reduced Graphene Oxide/Sulfur Electrodes for High Performance Li-S Batteries

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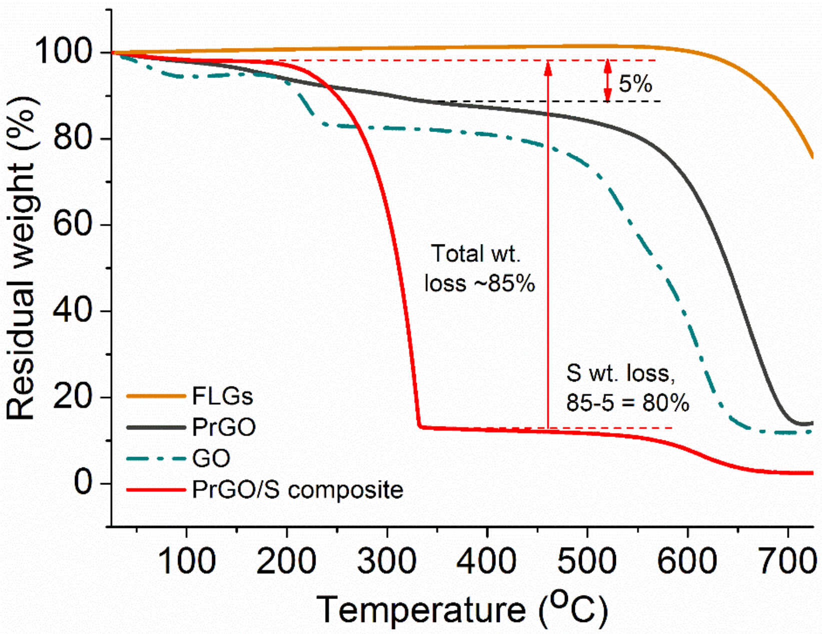

Figure S1: TGA analysis of the pristine FLGs, GO (graphene oxide), PrGO (partially reduced graphene oxide) and PrGO/S nanocomposites carried out at 5 °C/min ramp rate in air, showing a weight loss of ~80% corresponding to the loss of sulphur (~330 °C). The TG curves for pristine GO, partially reduced graphene oxide (PrGO) and FLGs are shown for comparison. The FLGs do not show any appreciable weight loss until ~600 °C owing to their highly crystalline structure.

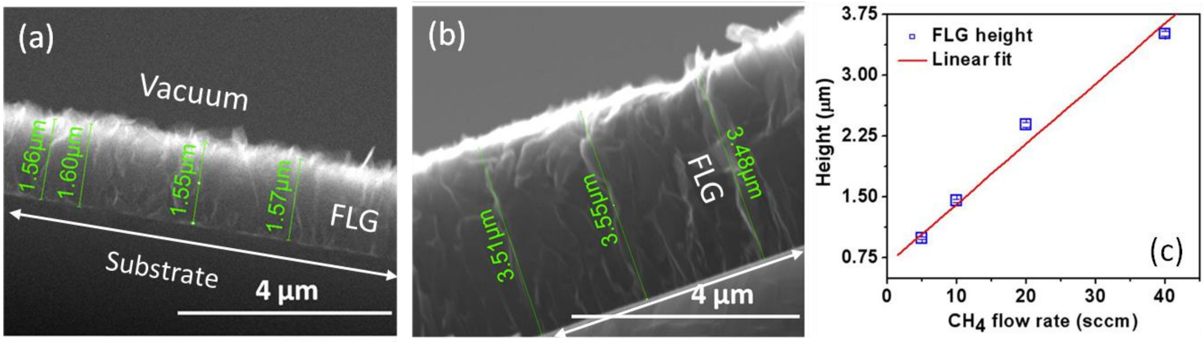

Figure S2: (a) Cross-sectional SEM image showing the vertical alignment of the FLGs with respect to the substrate. Variation of height (b, c) of the FLGs as a function of the CH_4 concentration.

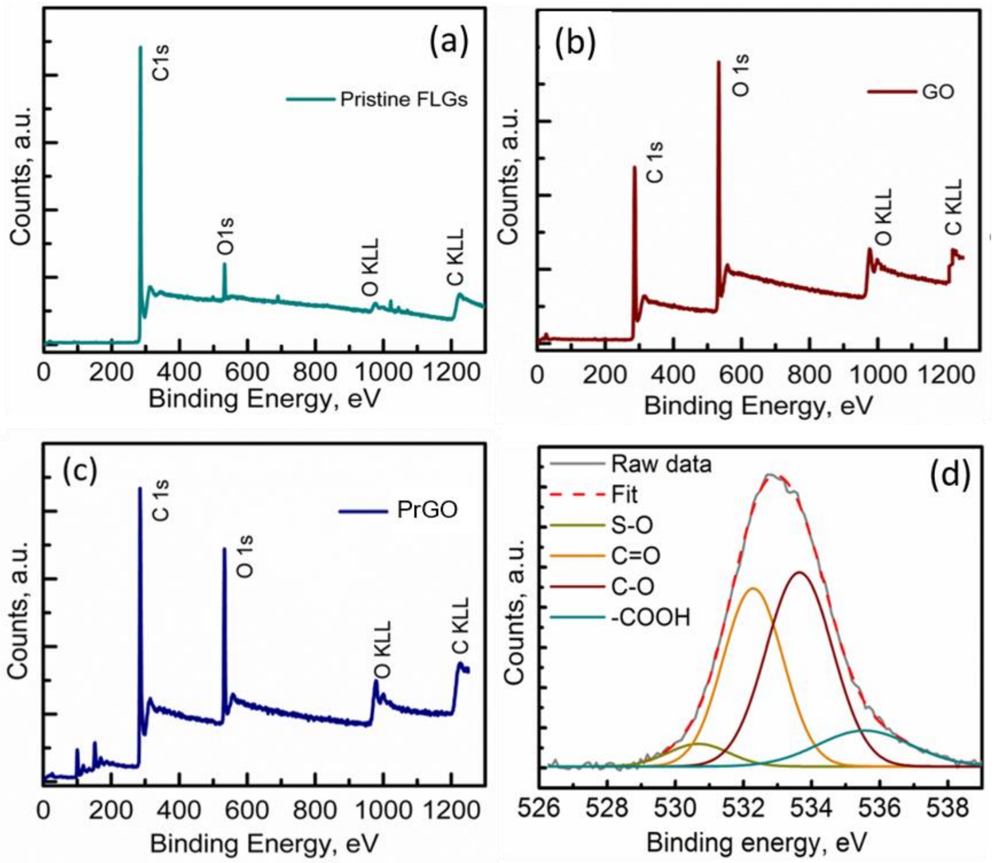

Figure S3: WESS XPS analysis of (a) pristine FLGs showing the chemical purity of the samples, (b) graphene oxide (GO) showing the enhancement in the oxygen content upon oxidation and (c) Partially reduced graphene oxide (PrGO) showing the reduction in the oxygen content upon L-Ascorbic Acid treatment.

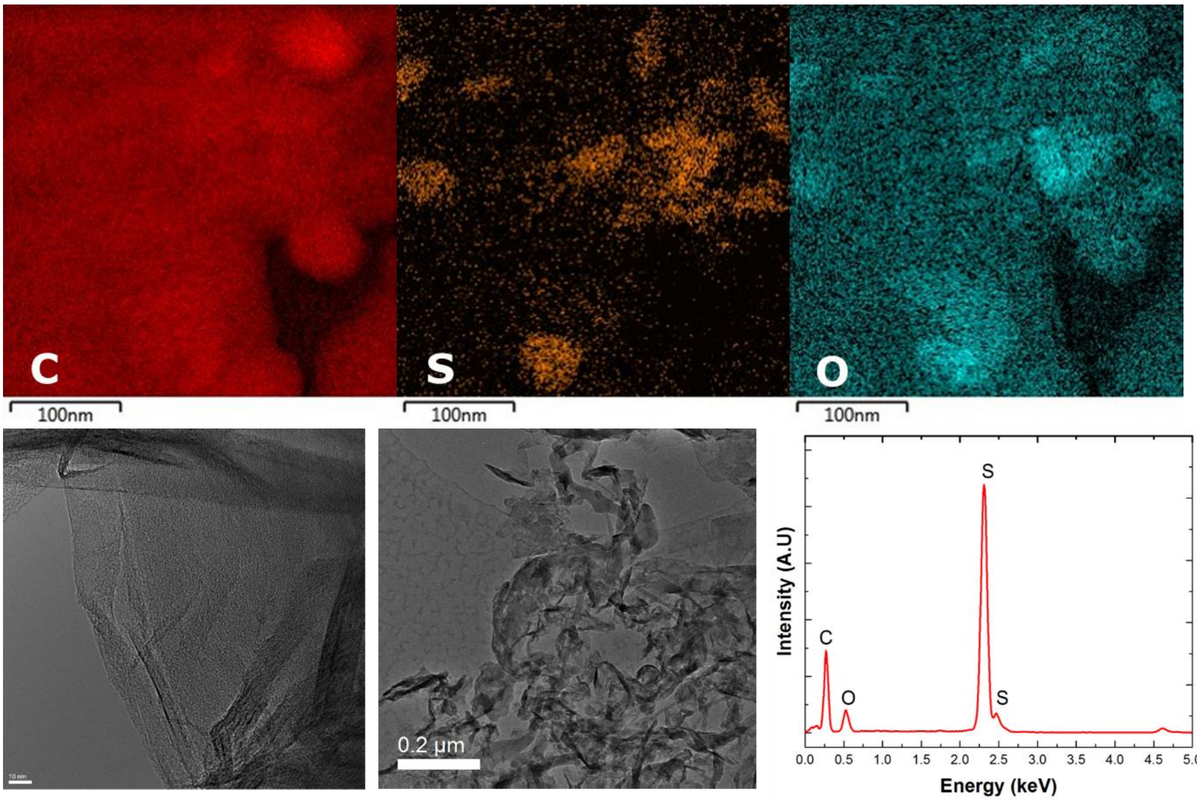

Figure S4: EDX analysis of the PrGO/S nanocomposites. (a) Elemental mapping of the standard planar PrGO/Sulphur composite electrode showing the uniform distribution of sulphur and oxygen species. (b) TEM image of pristine PrGO sheets, (c) TEM image of the FLG-PrGO/S nanocomposites showing the presence of nanocrystalline sulfur while the TEM-EDX confirms the chemical signature of PrGO and sulfur in FLG/PrGO-S electrode.

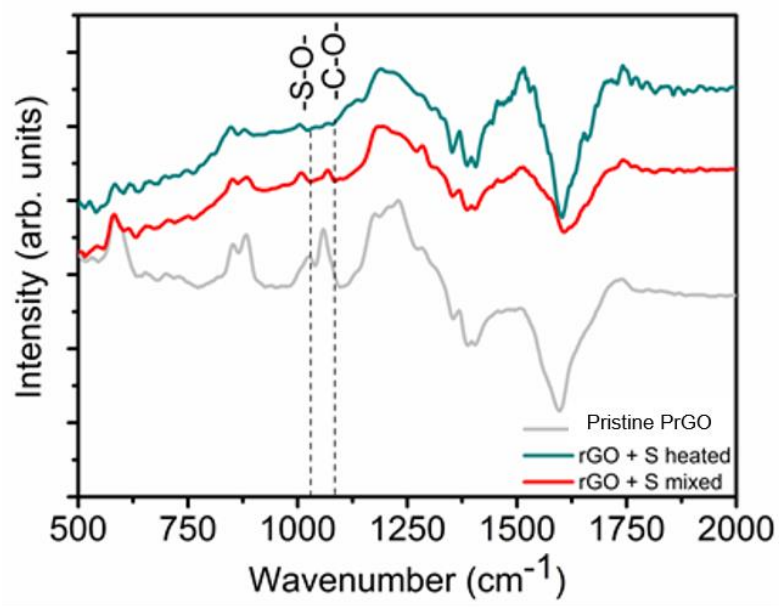

Figure S5: FTIR analysis of PrGO and PrGO/S samples subjected to mixing and further heating showing the formation of S-O bonds.

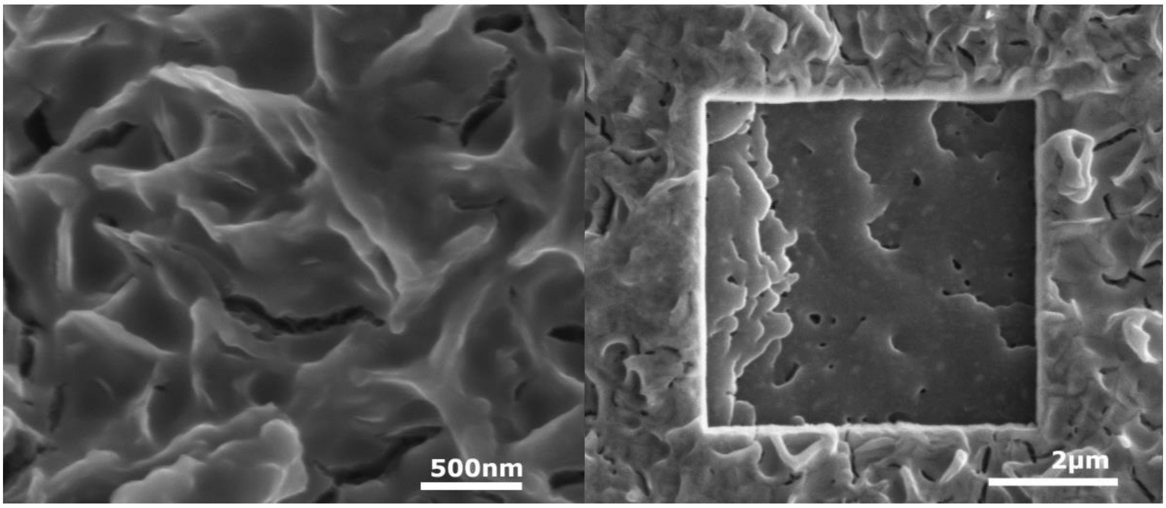

Figure S6: Post-mortem SEM analysis of 3D electrodes showing the intact structural integrity even after 350 cycles at 1C

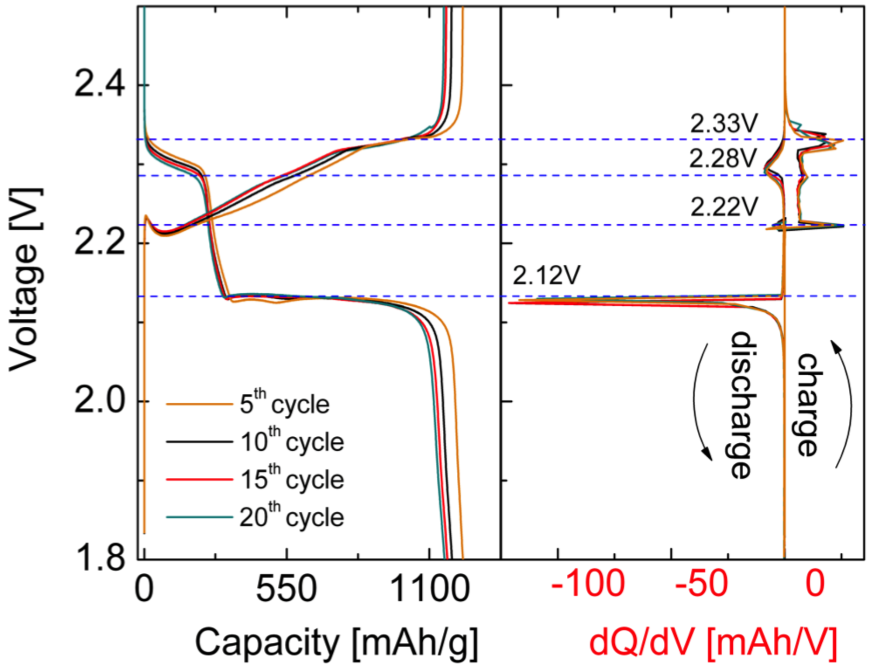

Figure S7. Galvanostatic charge discharge at C/20 and corresponding differential capacity curves.

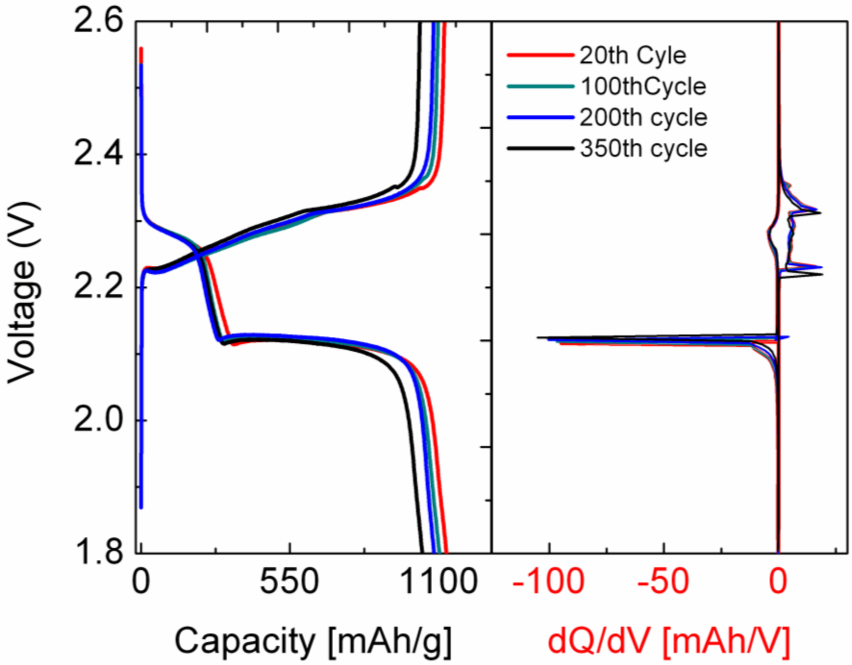

Figure S8. Galvanostatic charge discharge of the 3-D FLG/PrGO/S electrodes at various cycles during the 350 charge-discharge cycles at C/10 and their corresponding differential capacity curves.