Supporting Materials for

Power-output Reduction of Graphene Oxide and MnO_2-free Zn/GO Primary Cell

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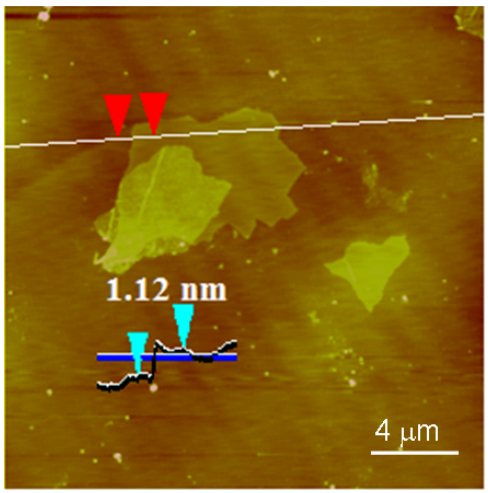

Figure S1. Typical AFM image of GO used in this study.

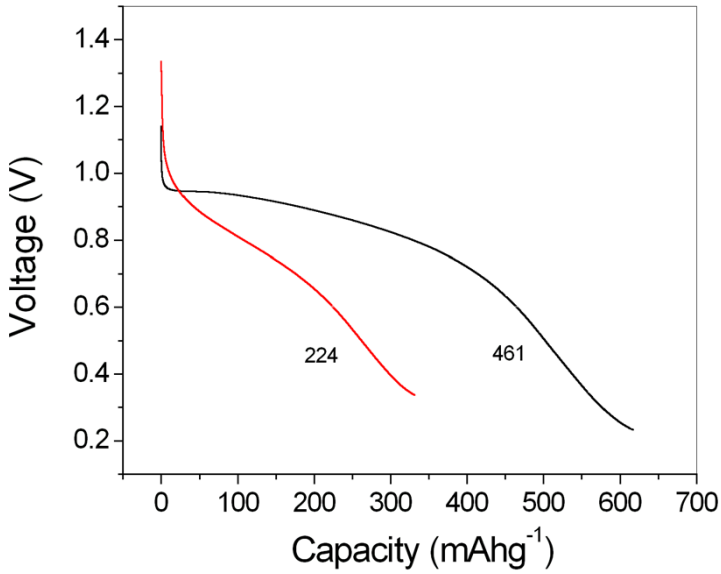

Figure S2. Capacity of GO decayed 51% in 5MKOH electrolyte after one month from 461mAhg^{-1} to 224mAhg^{-1}.

GO is unstable in KOH aqueous, Fan ea al. has reported the deoxygenation of GO in alkali aqueous. In our work, we found the capacity of GO decayed 51% after soaked in 5M KOH electrolyte for one month (see in Fig.S2). However no obvious capacity decay was observed when GO was soaked in NH_4Cl electrolyte for one month.

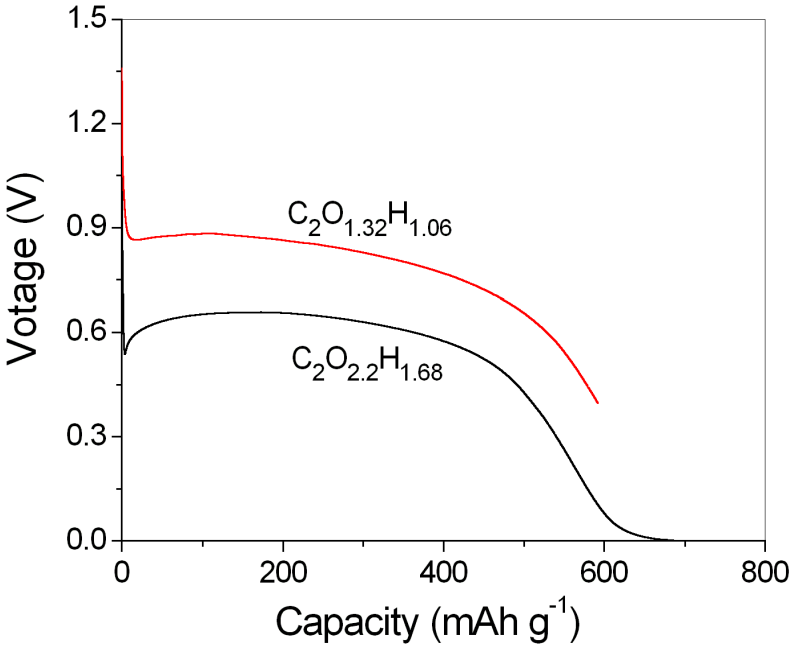

Figure S3.Galvanostatic discharge curves of Hummers method moderately oxidized GO (h1-GO) in NH_4Cl electrolyte at 1.5mAcm^{-2}, strongly oxidized GO (h2-GO) resulted in lower capacity than moderately oxidized GO (h1-GO).

When GO was strongly oxidized by Hummers method, lower capacity was obtained comparing with the moderately oxidized GO, we ascribed this to the destruction of graphene basal plane which is irreversible to restore.

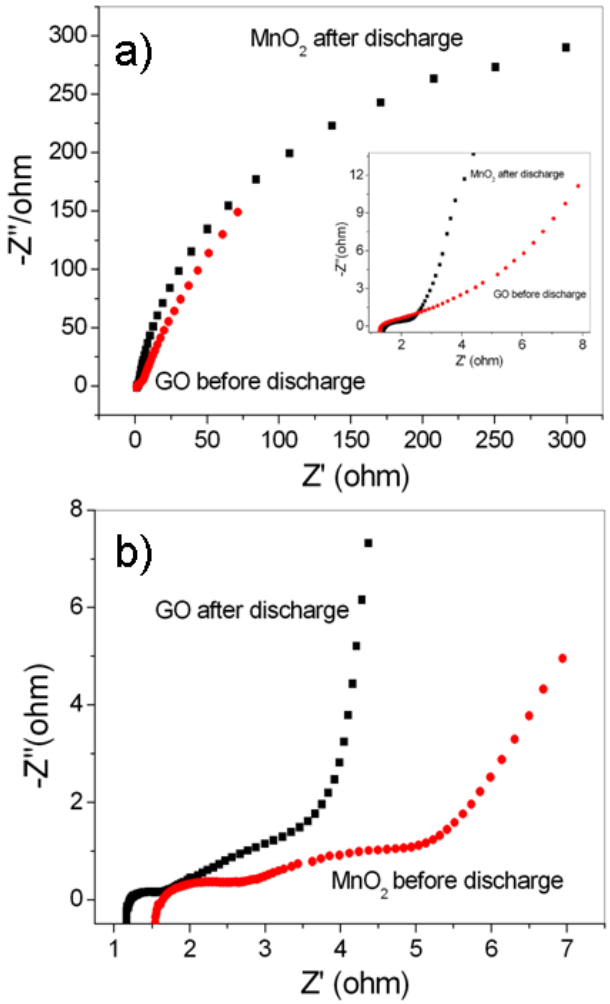

Figure S4. Nyquist curves of the electrochemical impedance spectroscopy (EIS) tests for cells at 10% and 90% depth of discharge for p-GO (a) and MnO_2 (b), respectively.

Figure S4 shows the Nyquist impedance plots for the Zn/GO primary cells discharge at 10% and 90% degrees (the discharging capacity of end voltage at 0.6V was normalized as 100%). High-frequency data was not given, which shows non-conductive behavior due to the porous nature of the electrodes.[1] The high-frequency circular arc intercept on the real axis was ohmic resistance R_s, including the resistance of the electrolyte and collector. For MnO_2 cathode, resistance increased from 1.20 Ω to 1.26 Ω, and for GO cathode the resistance maintained at 1.13Ω. Circular arc rather

than semicircle appeared at mid-frequency region because of the porous structure of the electrode, especially for GO electrode. The arrows show the point that the system is diffusion control changed from a kinetic control at low-frequency. And from the circular arc at mid-frequency, the charge transfer resistance decreased for Zn-GO cell while increased significantly for Zn-MnO_2 cell from 10% discharge depth to 90% discharge depth. These results agreed well with that reported by Cheng et al.[2]. The total resistance of Zn-MnO_2 increased during the discharge, as MnO_2 was reduced into insulated MnOOH. However, for the GO electrode with original poor conductivity, the as-formed rGO became highly conductive, resulting in a better conductive electrode.

References

1. S. S. Zhang, K. Xu and T. R. Jow, *J. Electrochem. Soc.*, 2002, **149**, A1521-A1526.
2. F. Y. Cheng, J. Chen, X. L. Gou and P. W. Shen, *Adv. Mater.*, 2005, **17**, 2753-+.