Electronic Supplementary Material (ESI) for Energy & Environmental Science

Supporting infromation for

A General Strategy toward Graphene@Metal Oxide Core-Shell Nanostructures for High-performance Lithium Storage

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Supplementary Figures

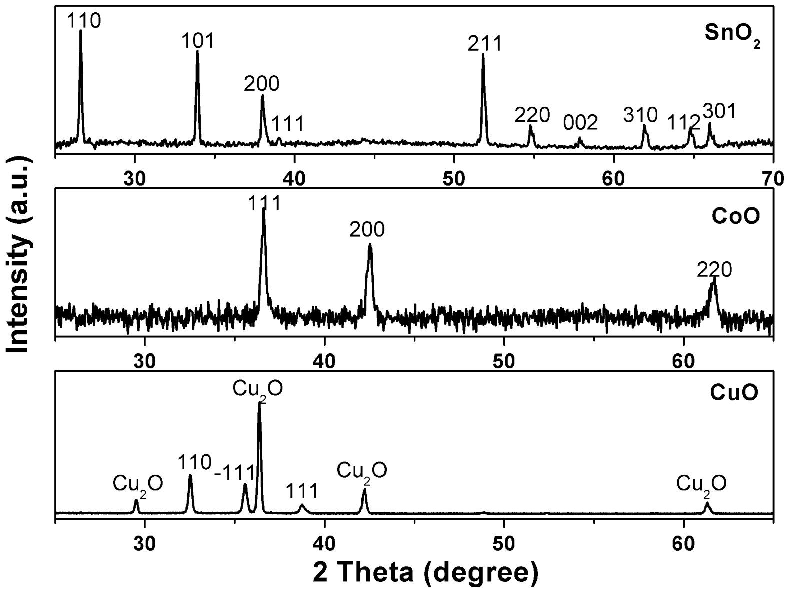

Fig. S1. XRD patterns of the as-obtained oxide NWs. The Cu_2O phase appearing in the XRD pattern of CuO is believed to exist as a thin film precursor for growing CuO NWs during the oxidation of Cu plate.[1,2]

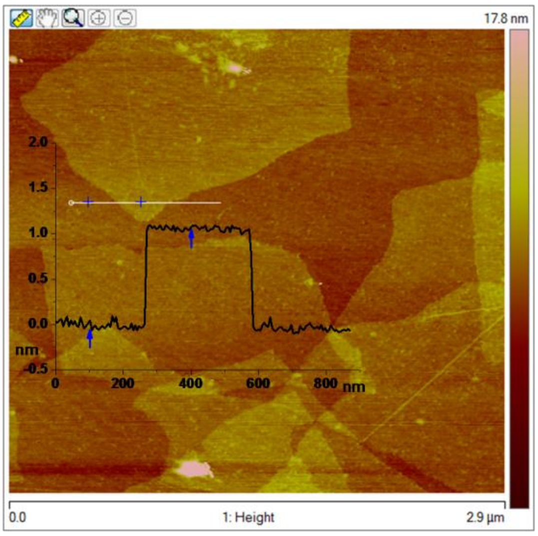

Fig. S2. AFM image of the as-obtained GO platelets. Inset is depth profile of the line of interest on the GO platelets, the height difference between two arrows is about 1nm, indicating a single layer GO sheet.

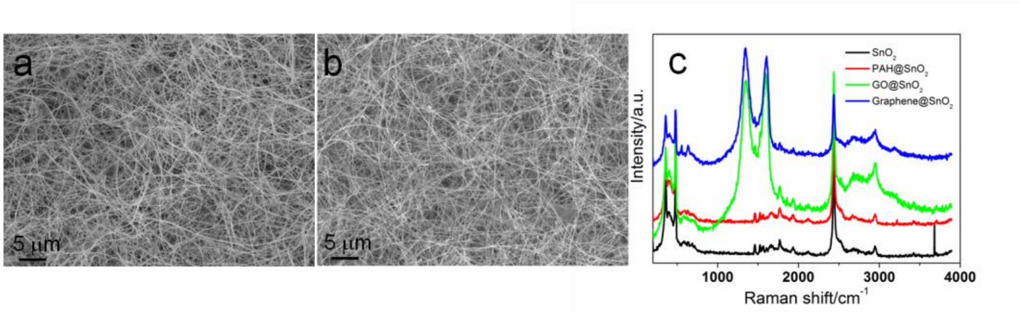

Fig. S3. Low-magnification SEM images of the SnO_2 NWs: (a) before, and (b) after graphene coating. (c) Raman spectra of the products at different steps, corresponding to the scheme illustrated in Fig.1c.

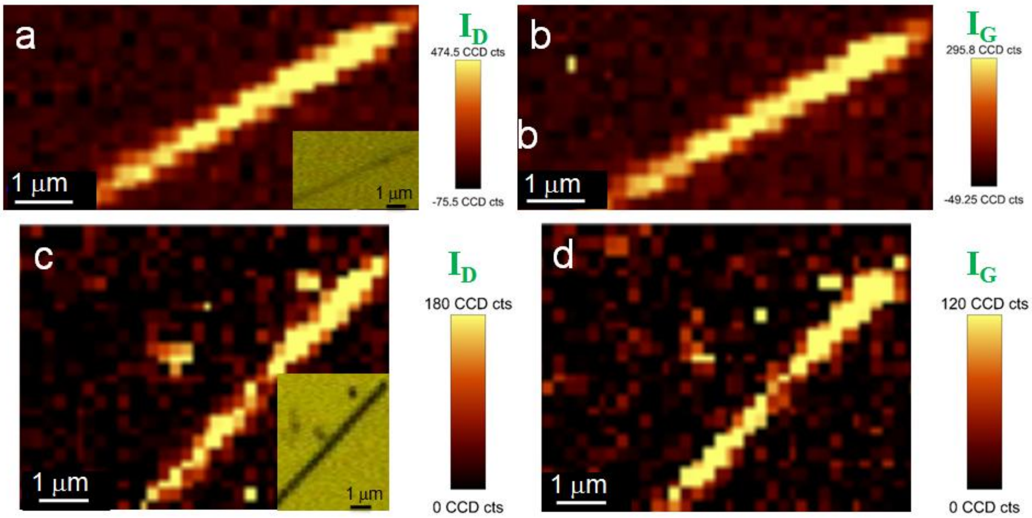

Fig. S4. Raman mapping images of the D and G bands of graphene for different individual graphene@SnO_2 NWs, revealing the full coverage along the SnO_2 NW. Insets in Fig. S4a and S4c show the optical images of the selected graphene@SnO_2 NWs.

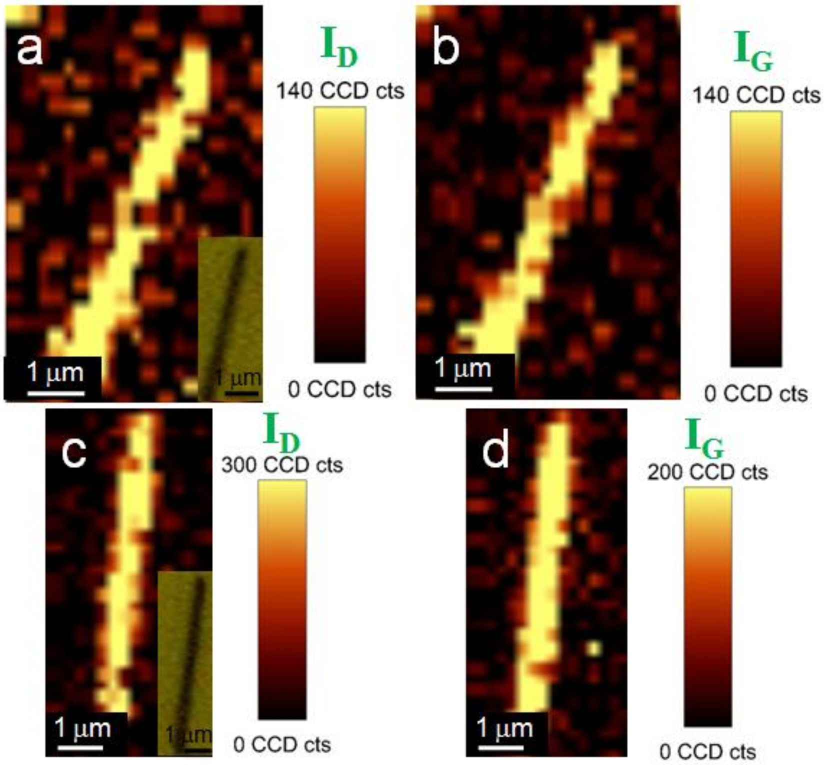

Fig. S5. Raman mapping images of the D and G bands of graphene for different single graphene@CuO NWs. Insets in Fig. S5a and S5c show the optical images of the selected graphene@CuO NWs.

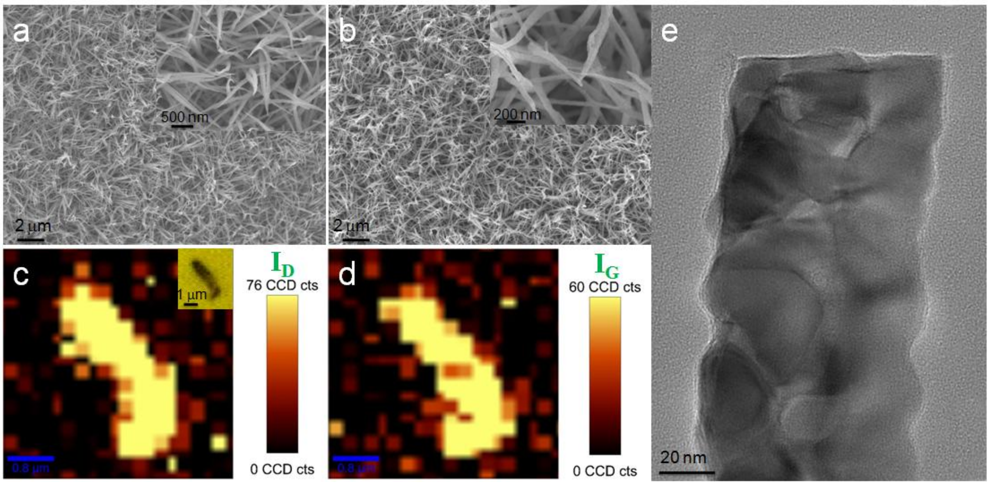

Fig. S6. Low-magnification SEM images of porous CoO NWs: (a) before and (b) after graphene coating. Insets in Fig. S6a and S6b are corresponding high-magnification SEM images. All the low- and high-magnification SEM images don't show noticable changes after graphene coating. (c - d) Raman mapping images of the D and G bands of graphene for a single graphene@CoO NW, affirming the existence of graphene shell. Inset in Fig. S6c shows the optical image of the selected graphene@CoO NW. (e) TEM image of a single graphene@CoO NW, displaying a thin graphene layer.

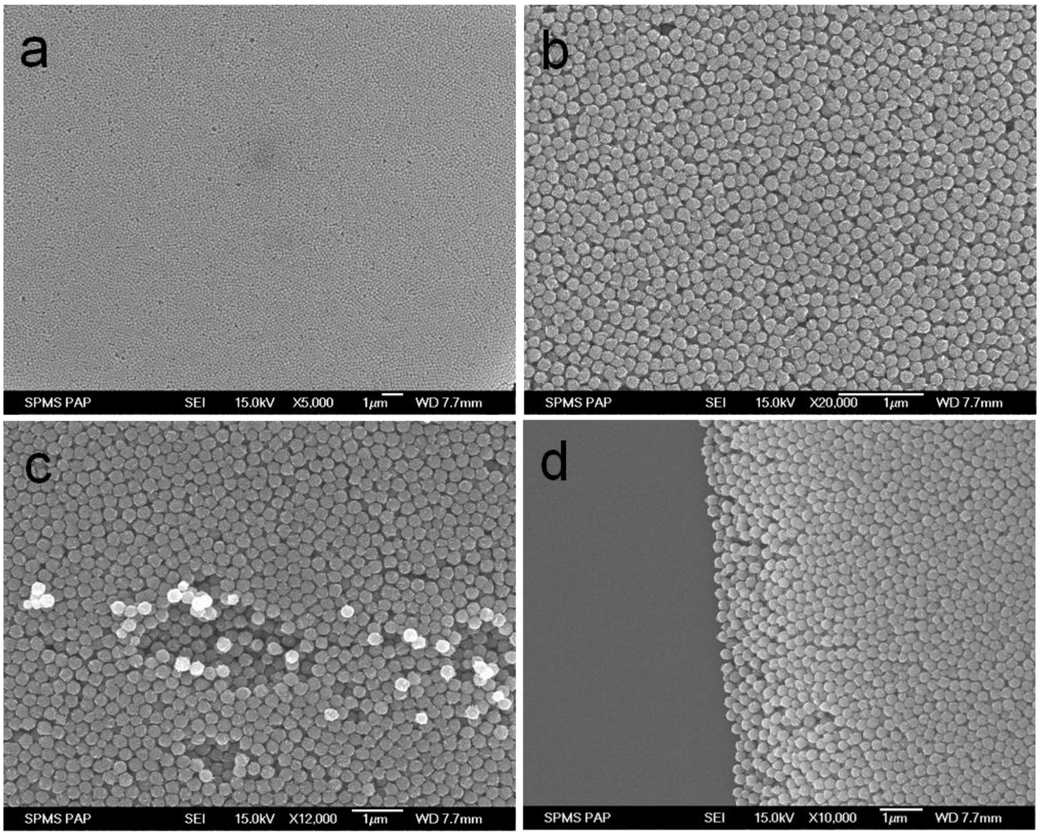

Fig. S7. SEM images of the as-obtained α-Fe_2O_3 precursor, revealing a highly ordered stacking fashion.

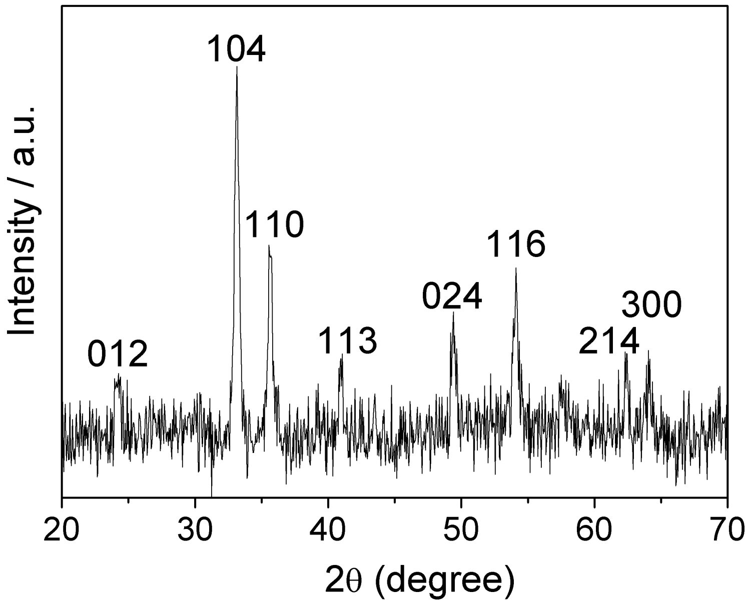

Fig. S8. XRD pattern of the as-prepared α-Fe_2O_3 NPs (JCPDS 33-0664).

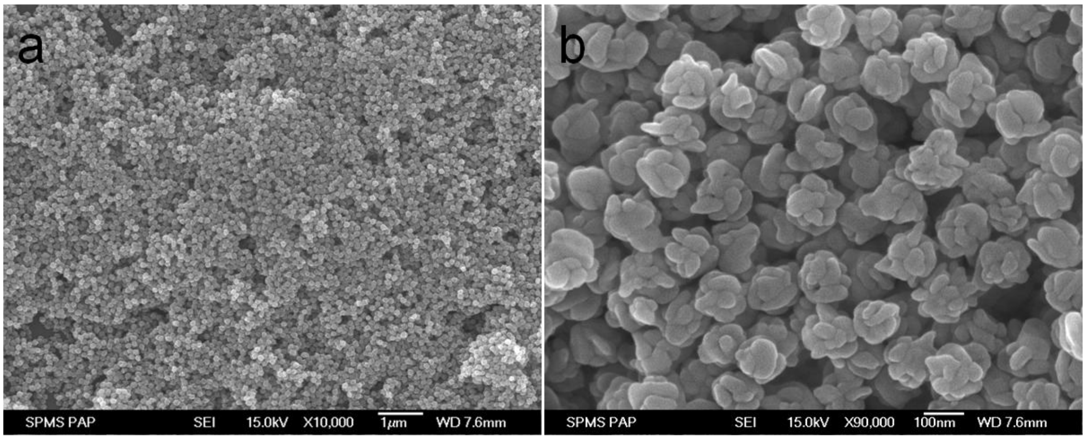

Fig. S9. SEM images of the as-obtained α-Fe_2O_3 NPs, showing high uniformity.

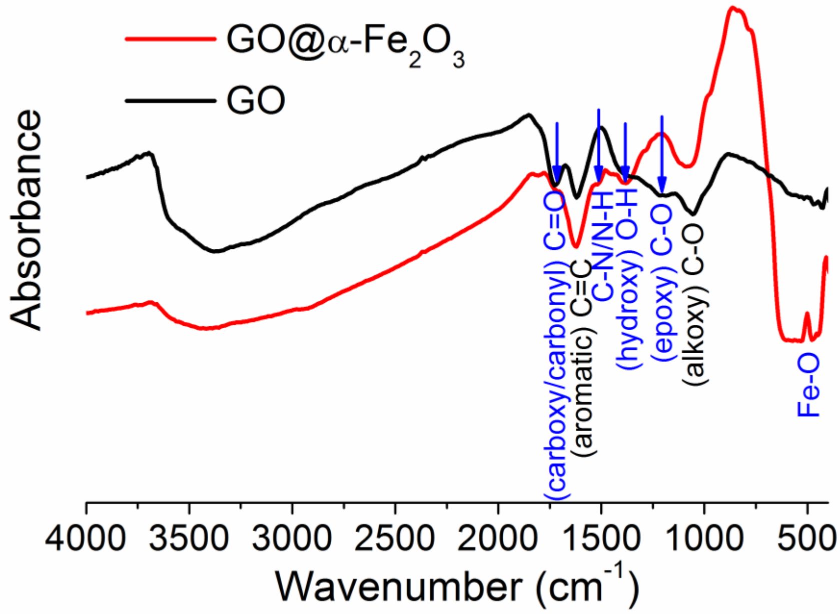

Fig. S10. FT-IR spectra of GO and GO@α-Fe_2O_3. Compared with pure GO, the epoxy C-O stretch at 1220 cm^{-1} disappears in the FT-IR spectrum of GO@α-Fe_2O_3. As GO contains reactive epoxy groups, its exposure to amine groups could lead to a ring-opening reaction, creating new C-N and O-H bonds.[3] An appearance of a new peak at 1510 cm^{-1}, which corresponds to a stretching of the new C-N bonds and possibly remaining PAH, is observed in the FT-IR spectrum of GO@α-Fe_2O_3. Meanwhile, the intensity of the vibrations at 1385 cm^{-1} corresponded to O-H bending from hydroxyl groups is increased for GO@α-Fe_2O_3. All these observations are quite supportive of the ring-opening reaction between the epoxy and amine groups. In addition, the intensity of C=O stretches significantly decrease for GO@α-Fe_2O_3. This could be interpreted as evidence that carboxylic acid groups interact with amine groups.[4]

Reference:

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2. T. Yu, X. Zhao, Z. X. Shen, Y. H. Wu, W. H. Su, *J. Cryst. Growth,* 2004, **268**, 590.
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