

## Electronic Supplementary Information

# Multifunctional $\text{Co}_{0.85}\text{Se}$ /Graphene Hybrid Nanosheets: Controlled Synthesis and Enhanced Performances for Oxygen Reduction Reaction and Decomposition of Hydrazine Hydrate

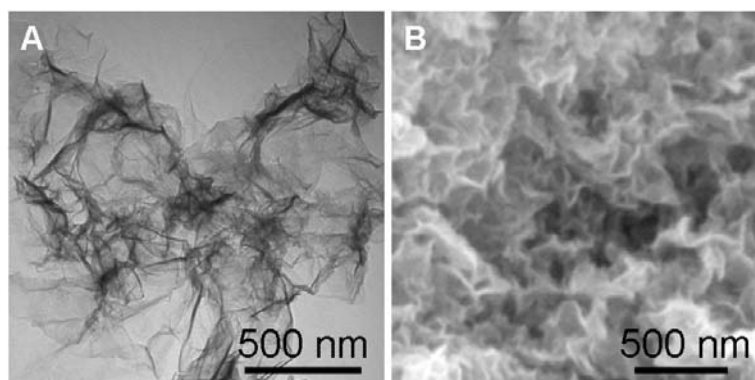
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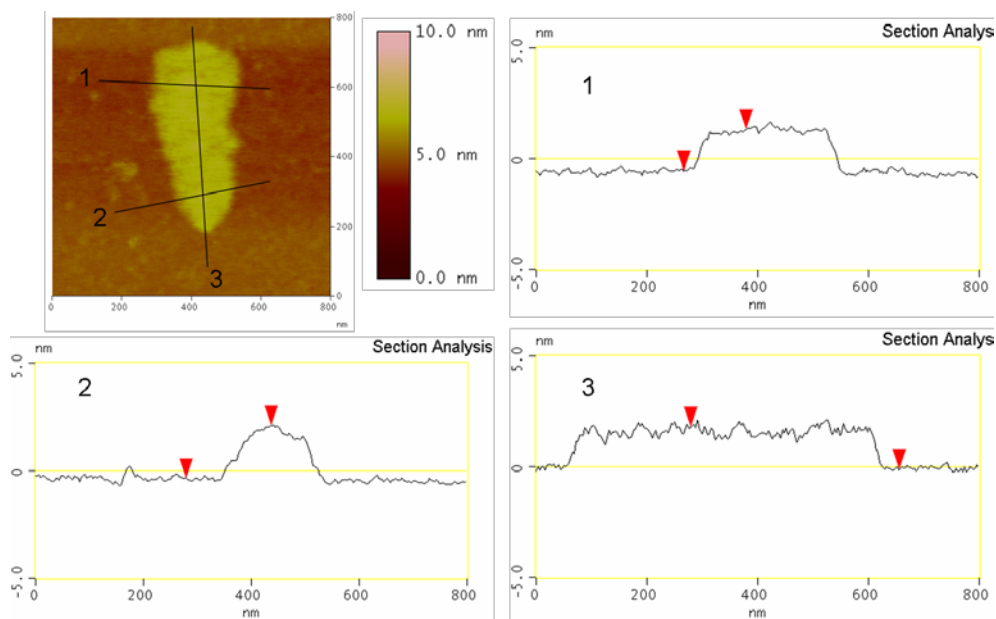
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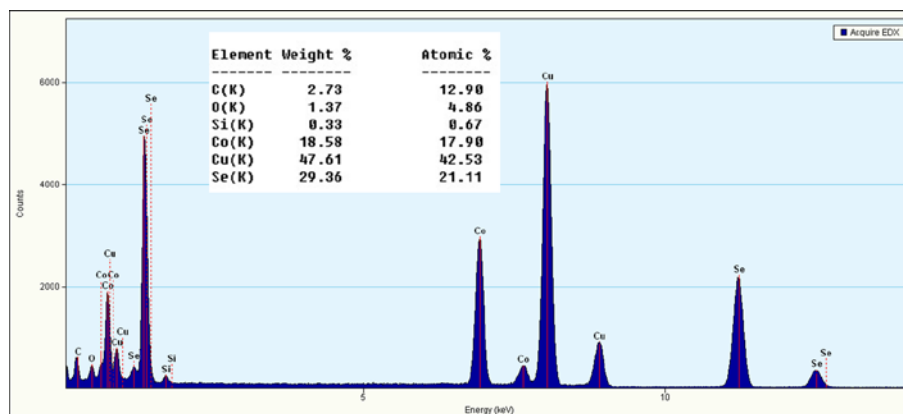


**Figure S1.** TEM image of GO sheets (A) and SEM image of  $\text{Co}_{0.85}\text{Se}$ /graphene nanocomposites

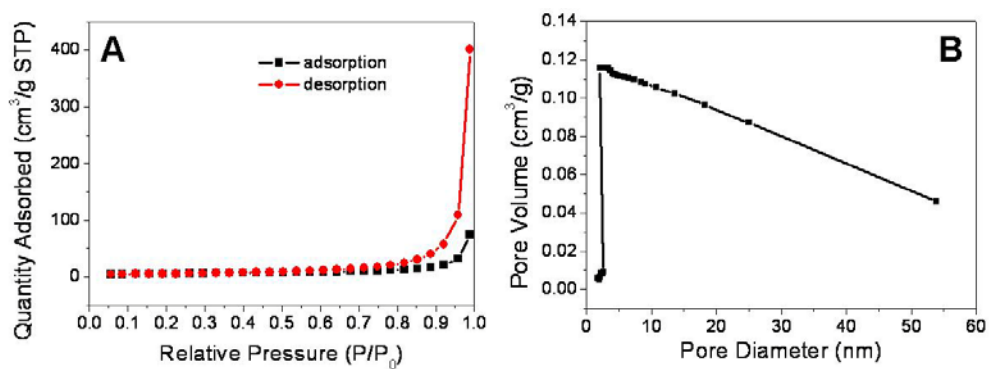
(B).



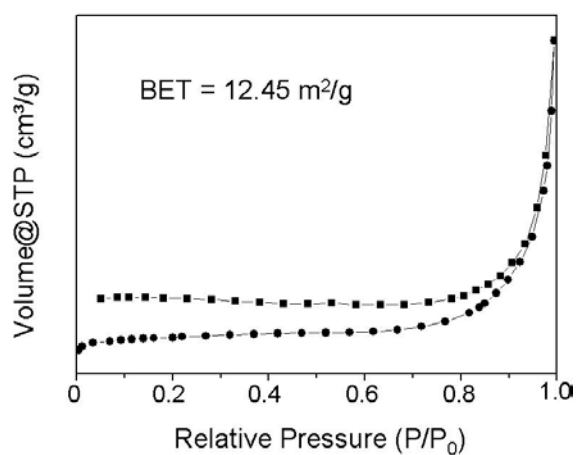
**Figure S2.** Tapping-mode AFM image of ultrathin  $\text{Co}_{0.85}\text{Se}$ /graphene nanosheets, and the height along the line (lines 1, 2 and 3) shown in the AFM image.



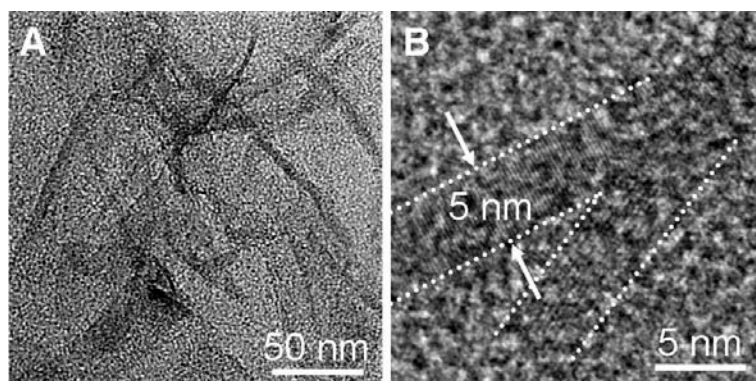
**Figure S3.** EDX analysis of  $\text{Co}_{0.85}\text{Se}$ /graphene hybrid nanosheets. The molar ratio of Co to Se atom is 0.83:1, close to the stoichiometric ratio of  $\text{Co}_{0.85}\text{Se}$ .



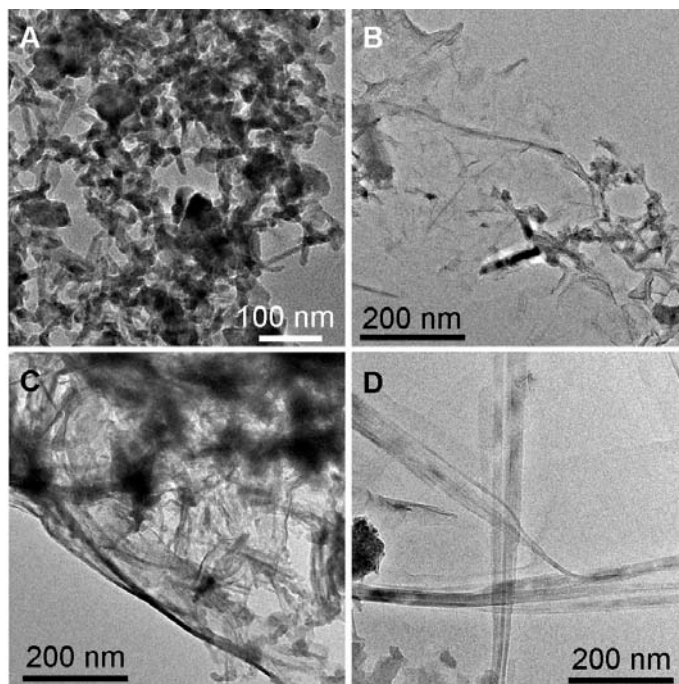
**Figure S4.** Nitrogen adsorption-desorption isotherms (A) and the pore size distribution (B) of Co<sub>0.85</sub>Se/graphene hybrids.



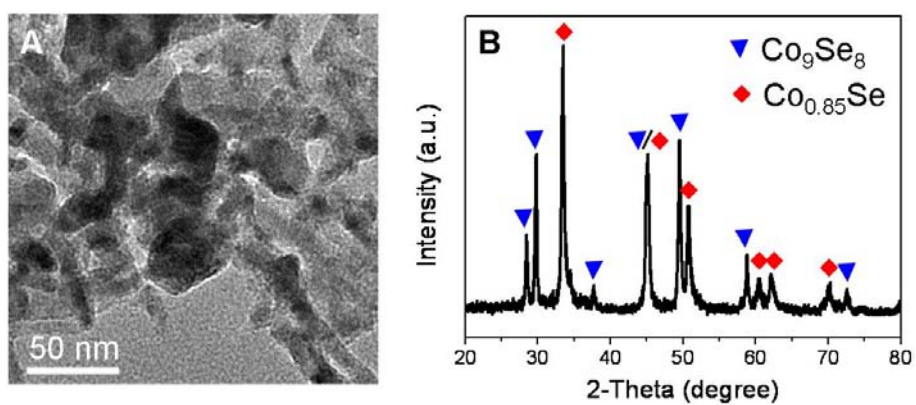
**Figure S5.** N<sub>2</sub> adsorption-desorption isotherm of the physical mixture of GO and Co<sub>0.85</sub>Se nanorod.



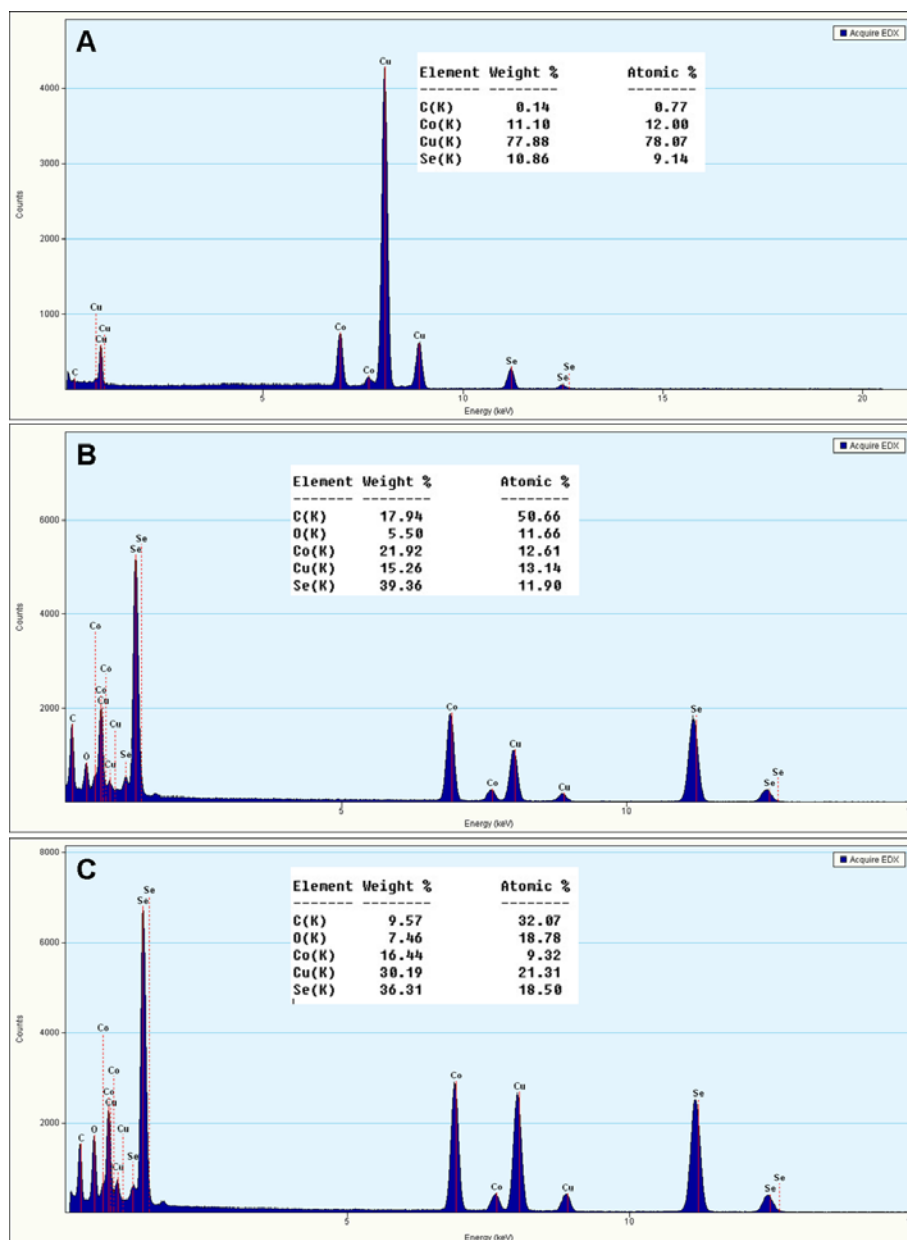
**Figure S6.** TEM and HRTEM images of the products obtained at 180 °C in ethylene glycol at reaction time of 3 h.



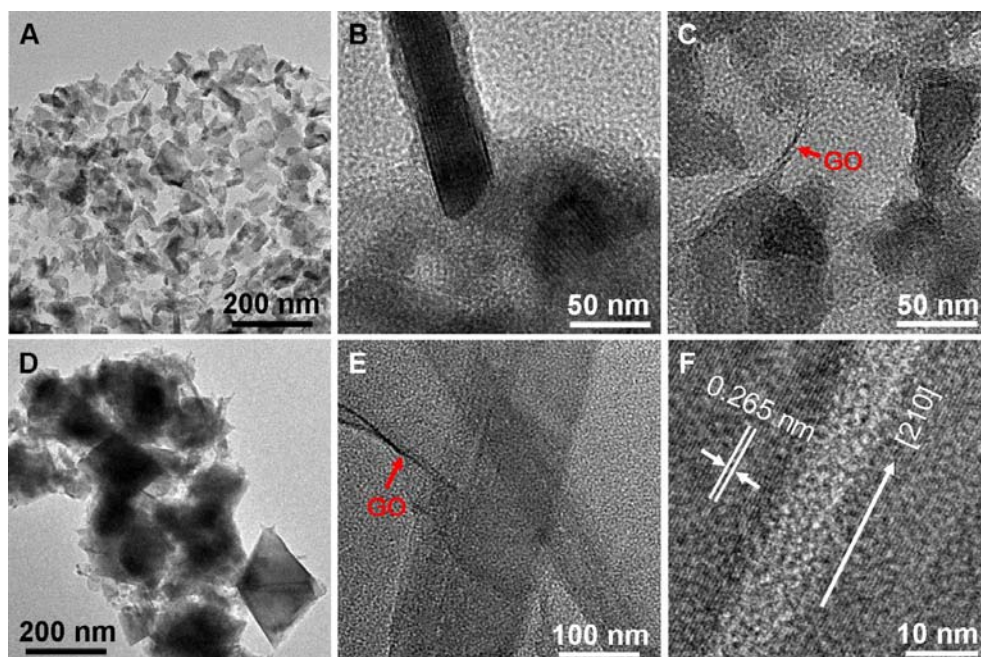
**Figure S7.** (A) TEM images of pure  $\text{Co}_{0.85}\text{Se}$  nanorods without the addition of GO. (B-D) TEM images of  $\text{Co}_x\text{Se}_y/\text{graphene}$  when the molar ratio of  $n(\text{Co atom}) : n(\text{Se atom})$  is 1.2 : 1 (B), 1 : 1 (C) and 1 : 2 (D).



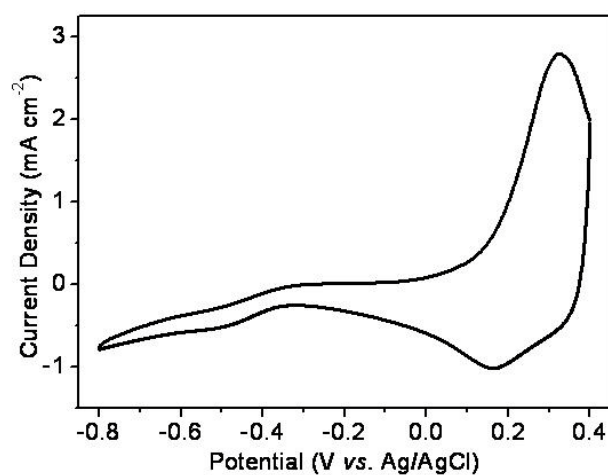
**Figure S8.** TEM image (A) and XRD pattern (B) of  $\text{Co}_x\text{Se}_y$  products obtained without the addition of GO.



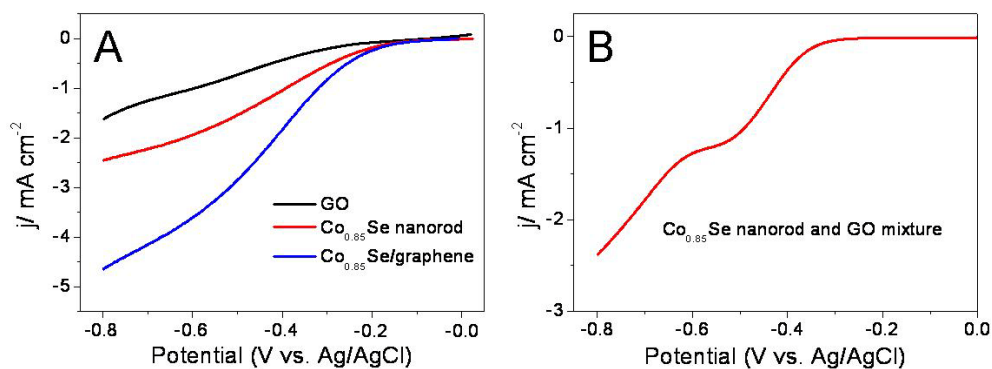
**Figure S9.** EDX analysis of  $\text{Co}_x\text{Se}_y/\text{graphene}$  when the molar ratio of  $n$  (Co atom):  $n$  (Se atom) is 1.2 : 1 (A), 1 : 1 (B) and 1 : 2 (C).



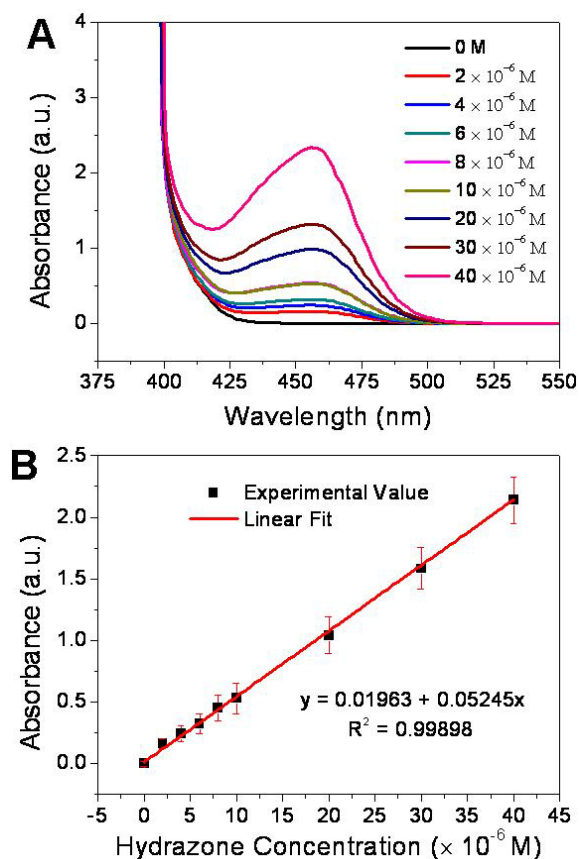
**Figure S10.** TEM images of the products obtained at 180 °C for 15 h in the presence of solvents of deionized water (A-C), ethanediamine (D), ethanol (E). (F) HRTEM image of the products obtained at 180 °C for 15 h with ethanol as the solvent.



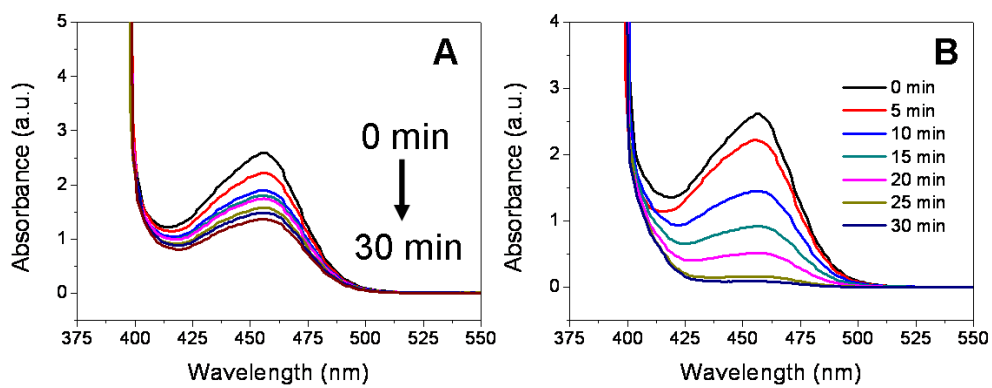
**Figure S11.** CV curves of Co<sub>0.85</sub>Se/graphene hybrids on a glass carbon electrode in O<sub>2</sub>-saturated 0.1 M KOH solution at a scanning rate of 50 mV·s<sup>-1</sup>.



**Figure S12.** (A) RDE curves for GO sheets, Co<sub>0.85</sub>Se nanorod, Co<sub>0.85</sub>Se/graphene, and (B) physical mixture of GO and Co<sub>0.85</sub>Se nanorod on glassy carbon electrodes in O<sub>2</sub>-saturated 0.1 M KOH solution at the potential ranging from -0.8 to 0 V with a scan rate of 10 mV·s<sup>-1</sup>. The electrode rotation rate is 1600 rpm.



**Figure S13.** (A) Variance of the absorption spectra with hydrazone concentration. (B) The linear relationship between absorbance value and hydrazone concentration.



**Figure S14.** UV-vis absorption spectra show the process of decomposition of hydrazine hydrate catalyzed by (A) 50 mg of GO sheets and (B) 50 mg of the mixture of  $\text{Co}_{0.85}\text{Se}$  nanorod (45 mg) and GO (5 mg) at room temperature.