Electronic supplementary material

Cobalt and Nitrogen codoped carbon nanotubes derived from graphitic C_3N_4 template as electrocatalyst for the oxygen reduction reaction

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Electrochemical Measurement

Electrochemical analysis was fulfilled by the DyneChem electrochemical workstation, and Ag/AgCl and platinum are used as reference electrode and counter electrode, respectively. The cyclic voltampis was tested in 0.1M potassium hydroxide solution. The glass carbon electrode (GCE) was polished and washed before using. To prepare the working electrodes, aliquots of 5 μL and 2.5 mg/mL NC-120, NC-140, NC-160, Pt/C solutions were dipped on to GCE for further test.

Characterization

The structure and chemical composition of the NC-T was analyzed by X-ray diffraction (XRD) (D-MAX II A X-ray diffractometer), transmission electron microscopy (TEM) (Tecnai F20), scanning electron microscope (SEM) (JEOL7610), fourier transform infrared (FT-IR) (Nicolet iS50) spectra, X-ray photoelectron spectroscopy (XPS) (Kratos Axis UltraDLD), and Raman (Horiba, Japan); N2 adsorption-desorption (77K) isotherms were carried out on a Micromeritics ASAP 2020 instrument (MICROSENSOR, USA).

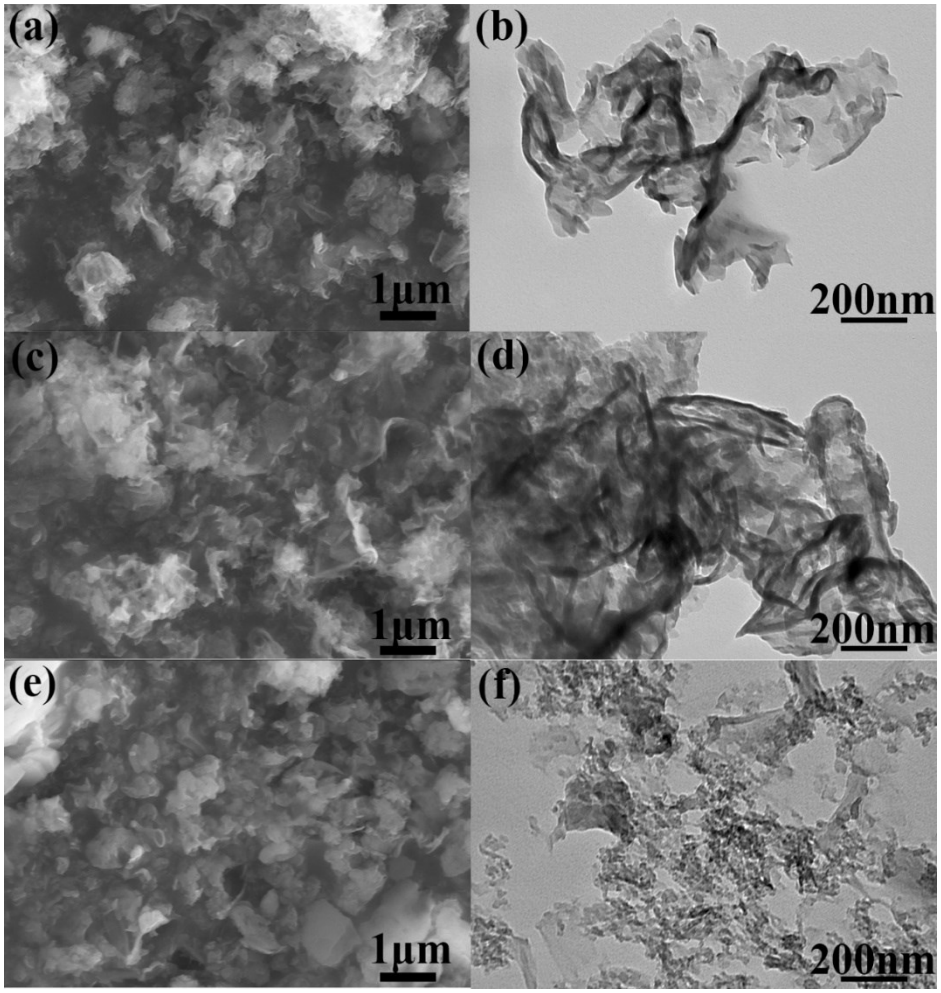

Figure S1 (a)SEM and (b)TEM images of g-C_3N_4/PCA-120; (c)SEM and (d)TEM images of g-C_3N_4/PCA-160; (e)SEM and (f)TEM images of g-C_3N_4/PCA-180;

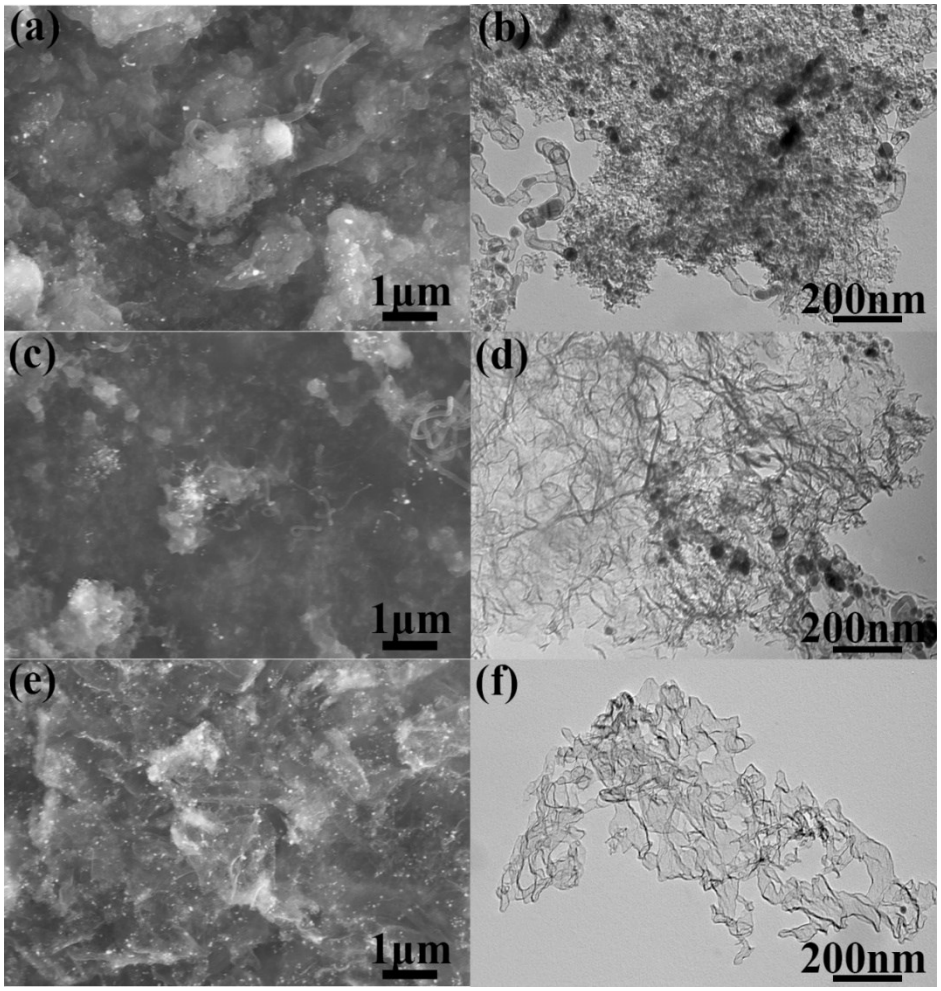

Figure S2 (a)SEM and (b) TEM images of Co, N-CNT-120; (c)SEM and (d) TEM images of Co, N-CNT-160; (e)SEM and (f) TEM images of Co, N-CNT-180.

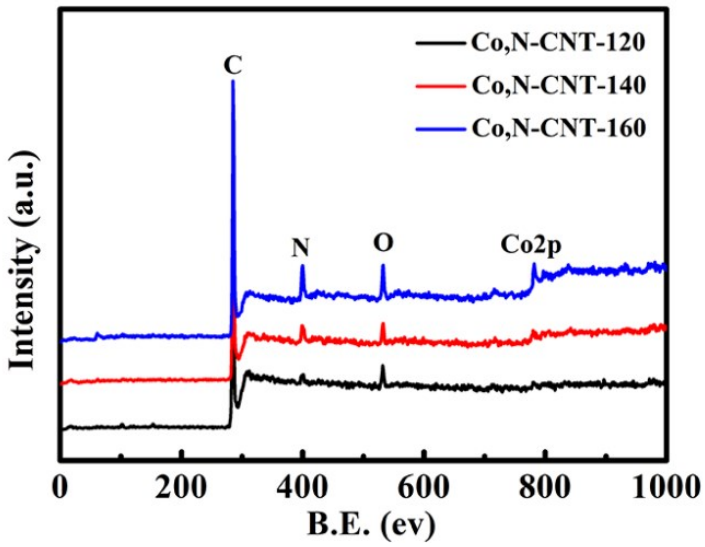

Figure S3 XPS survey a of g-C3N4@PCA-T (120℃, 140℃, 160℃)

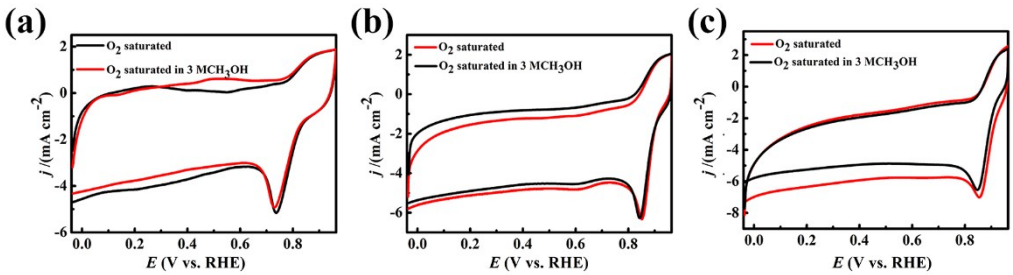

Figure S4 (a) CV of Co, N-CNT-120 in O_2-saturated 0.1 M KOH solution with 3M CH_3OH; (b) CV of Co, N-CNT-140 in O_2-saturated 0.1 M KOH solution with 3M CH_3OH; (c) CV of Co, N-CNT-160 in O_2-saturated 0.1 M KOH solution with 3M CH_3OH.

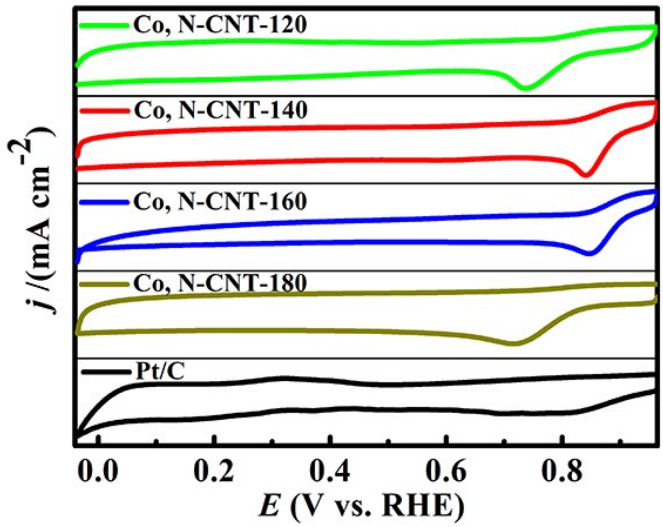

Figure S5 CV curves of Co, N-CNT-T (120 ℃, 140 ℃, 160 ℃ 180℃) and Pt/C in O_2 saturated 0.1 M KOH aqueous solution with a scan rate of 100 mV s^{-1}.

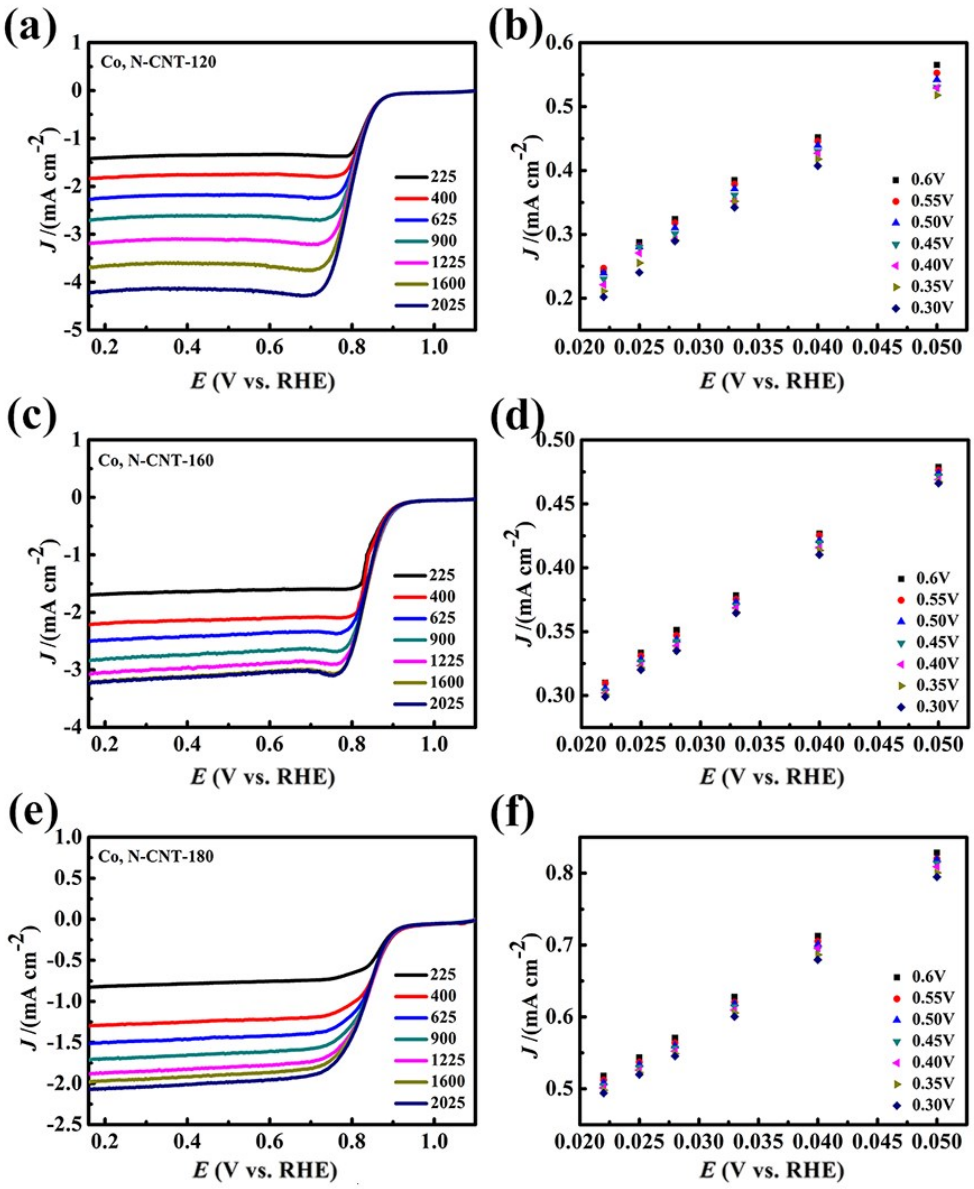

Figure S6 (a) LSV curves using a rotating-disk electrode; (b) number of electrons transferred of Co, N-CNT-120 at different potentials; (c) LSV curves using a rotating-disk electrode; (d) number of electrons transferred of Co, N-CNT-140 at different potentials; (e) LSV curves using a rotating-disk electrode; (f) number of electrons transferred of Co, N-CNT-160 at different potentials.

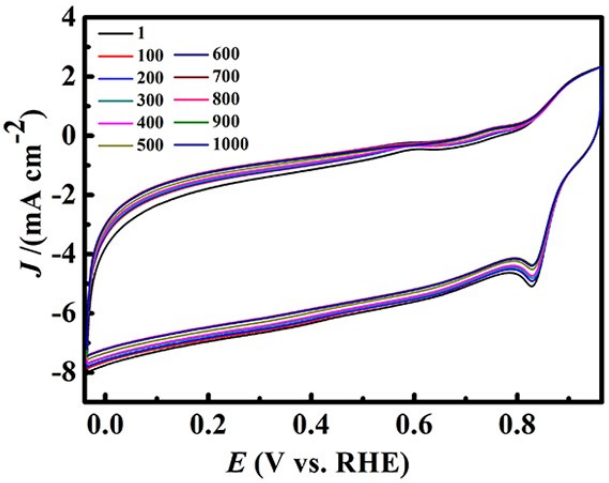

Figure S7 CV curves of Co, N-140 before and after cycling 1000 cycles in O_2 saturated 0.1 M KOH aqueous solution with a scan rate of 100 mV s^{-1}.

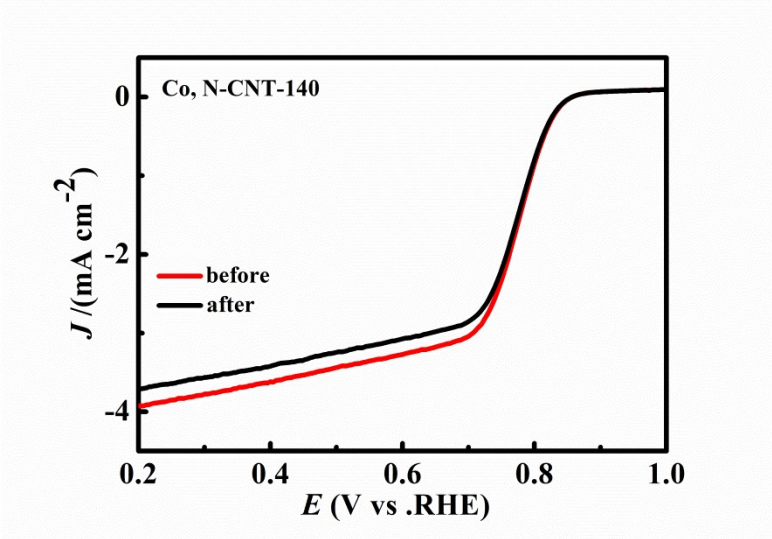

Figure S8 LSV curves of Co, N-CNT- 140 before and after 5000 cycles.

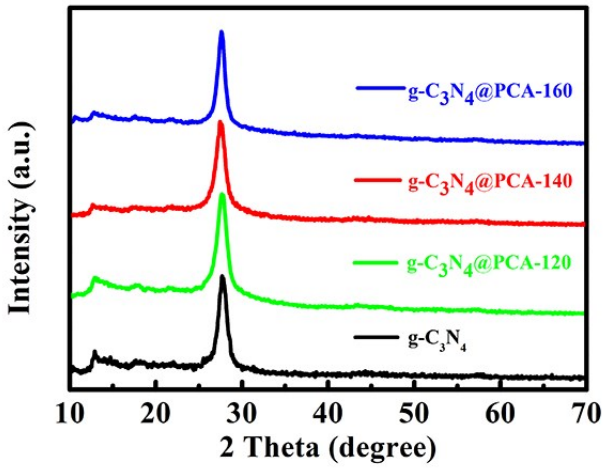

Figure S9 XRD patterns of g-C_3N_4@PCA-T (120 ℃, 140 ℃, 160 ℃, 180 ℃).

The hydrothermal temperature significantly changes the XRD peak of the sample. As shown in Figure S8, the samples with different hydrothermal temperatures have two diffraction peaks at 13.1° and 27.3°, which correspond to the (100) and (002) crystal planes of the g-C_3N_4 template, respectively.