Supporting Information

Solution-Processed PEDOT:PSS-Graphene Composites as Electrocatalyst for Oxygen Reduction Reaction

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Calculation of the Kinetic Parameters for ORR

The electron transfer numbers (*n*) for ORR based on the RDE measurements were estimated with the Koutecky-Levich equation as the follows:

$$\frac{1}{J} = \frac{1}{J_L} + \frac{1}{J_K} = \frac{1}{B\omega^{1/2}} + \frac{1}{J_K}$$

$$B = 0.2nFC_{\mathrm{O}}(D_{\mathrm{O}})^{2/3}\nu^{-1/6}$$

in which J, J_L, J_K are current density, the diffusion-limiting current density, and the kinetic current density, respectively; ω is the rotating rate in rpm, B can be determined by the slope of K-L plots based on Levich equation, n represents the transferred electron number per oxygen molecule, F is the Faraday constant (96 485 C mol^{-1}), C_{O} is the concentration of O_2, D_{O} is the diffusion coefficient of oxygen in 0.1 M KOH (1.9×10^{-5} cm^2 s^{-1}) and ν is the kinematic viscosity (0.01 cm^2 s^{-1}).

The electron transfer numbers (*n*) and HO_2^- yields based on the RRDE measurements at 1600 rpm were calculated by the following equations:[S1]

$$n = 4I_D/(I_D + I_R/\mathrm{N})$$

$$HO_2^-\% = 200 \times \frac{I_R/N}{I_D + I_R/N}$$

where I_D is the faradic disk current, I_R is the faradic ring current, and N = 0.37 is collection efficiency.

[S1] U. A. Paulus, T. J. Schmidt, H. A. Gasteiger, R. J. Behm, *J. Electroanal. Chem.* **2001**, *495*,134.

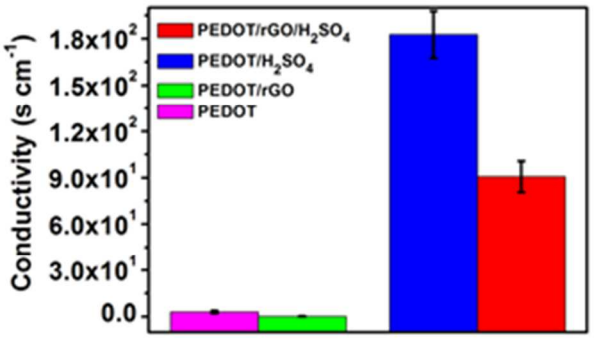

Figure S1. Conductivities of PEDOT:PSS and PEDOT:PSS/rGO composite before and after treatment with concentrated H_2SO_4.

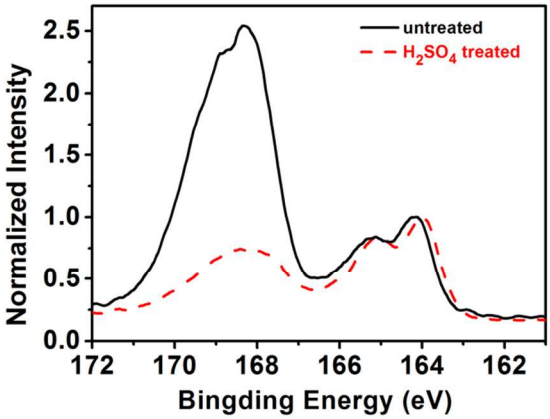

Figure S2. S 2p XPS spectra of PEDOT:PSS films before and after the treatment with concentrated H_2SO_4.

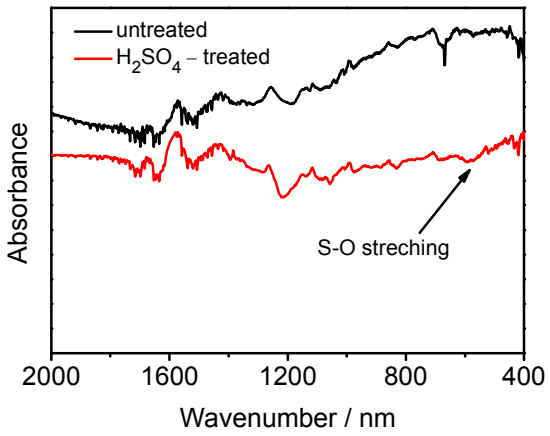

Figure S3. FTIR spectra of PEDOT:PSS films before and after the H_2SO_4 treatment.

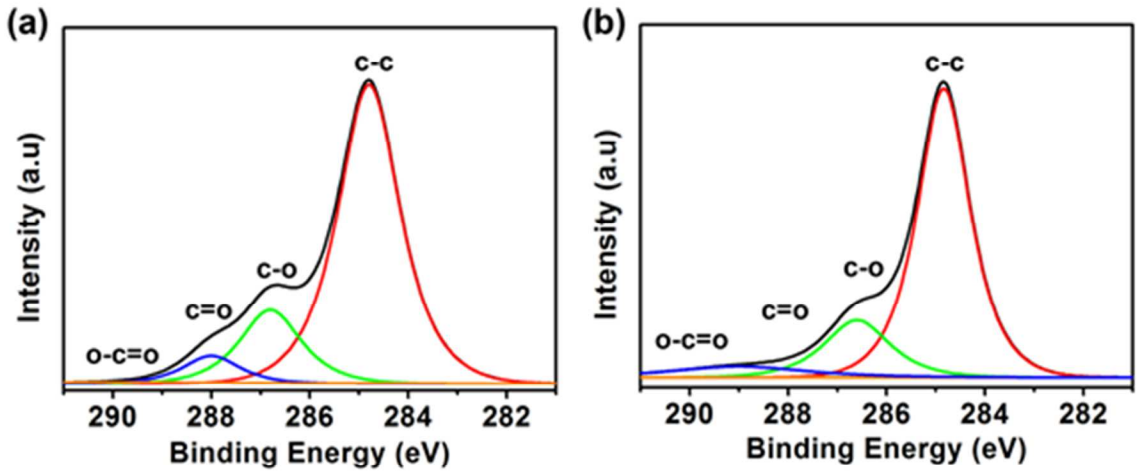

Figure S4. C 1s XPS spectra of rGO films before (a) and after (b) the H_2SO_4 treatment.

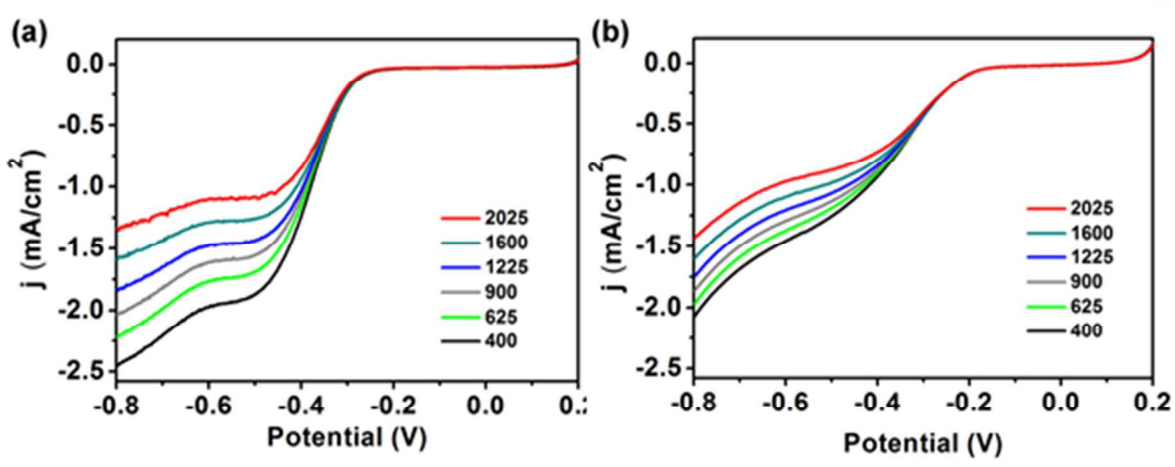

Figure S5. (a) RDE voltammograms for the ORR of the H_2SO_4-treated PEDOT:PSS (a) and rGO (b) on GC electrode in O_2-saturated 0.1M KOH solutions at a scan rate 10 mV/s with different rotation speeds.

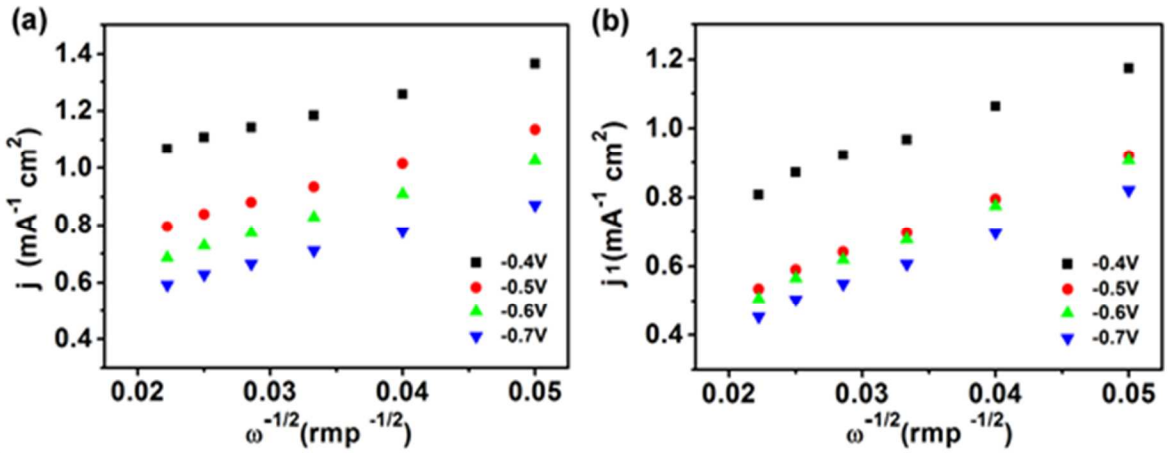

Figure S6. Koutecky–Levich plots of ORR on the H_2SO_4-treated PEDOT:PSS (a) and rGO (b) electrodes.

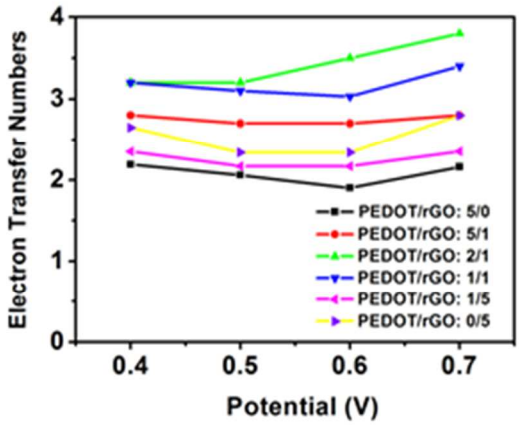

Figure S7. Electron transfer numbers as a function of the overpotential of the composites with different mass ratios of PEDOT:PSS to rGO (w/w).

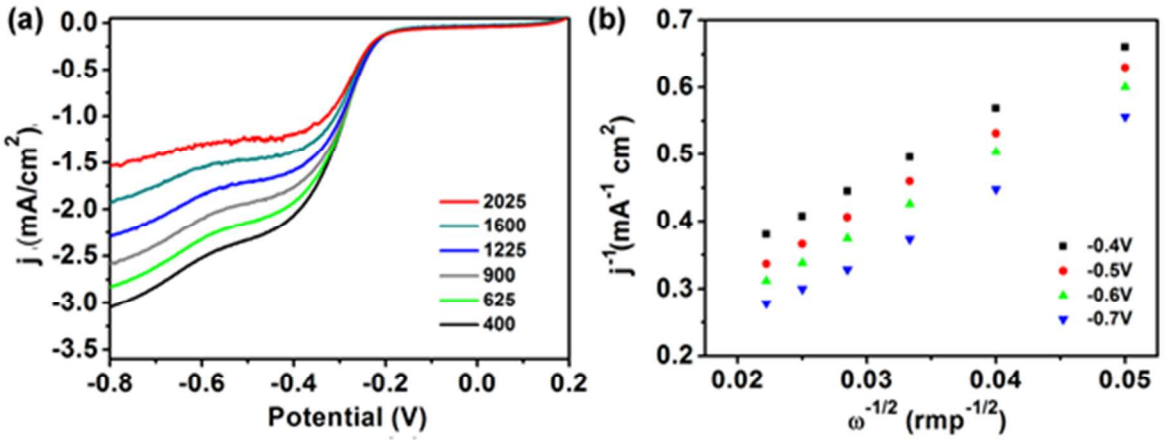

Figure S8. (a) RDE voltammograms for the ORR of H_2SO_4-treated PEDOT:PSS/rGO (5:1, w/w) on GC electrode in O_2-saturated 0.1M KOH solutions at a scan rate 10 mV/s with different rotation speeds. (b) Koutecky–Levich plots at different electrode potentials.

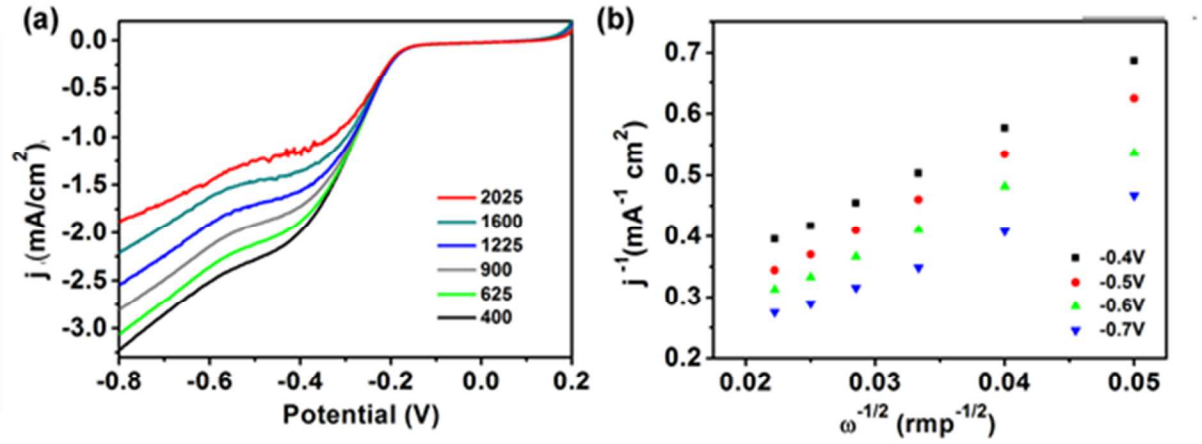

Figure S9. (a) RDE voltammograms for the ORR of H_2SO_4-treated PEDOT:PSS/rGO (1:1, w/w) on GC electrode in O_2-saturated 0.1M KOH solutions at a scan rate 10 mV/s with different rotation speeds. (b) Koutecky–Levich plots at different electrode potentials.

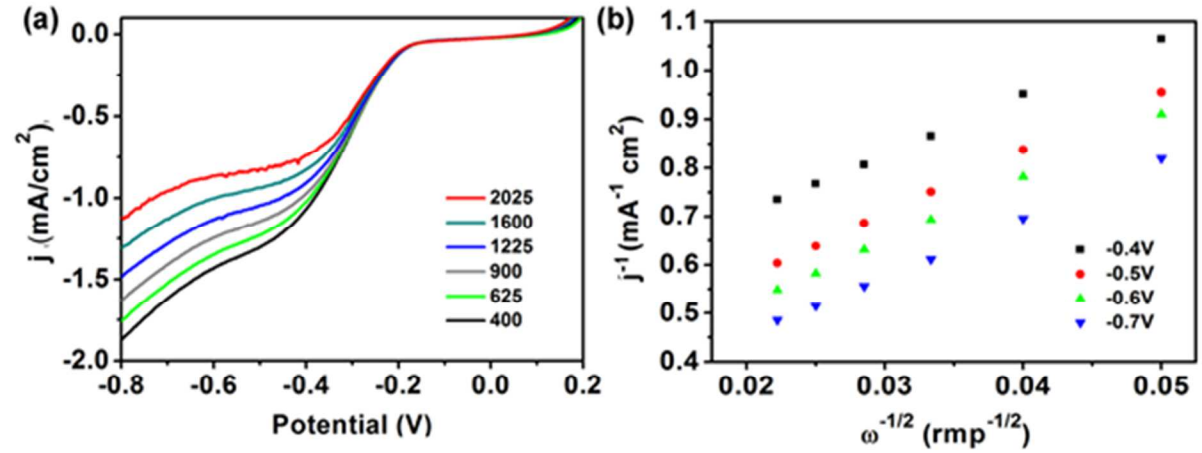

Figure S10. (a) RDE voltammograms for the ORR of H_2SO_4-treated PEDOT:PSS/rGO (1:2, w/w) on GC electrode in O_2-saturated 0.1M KOH solutions at a scan rate 10 mV/s with different rotation speeds. (b) Koutecky–Levich plots at different electrode potentials.