Electronic Supporting Information

Sulfur doped reduced graphene oxides with enhanced catalytic activity for oxygen reduction *via* molten salt redox-sulfidication

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Specific area and pore structure characterization

The specific surface area and the pore size distribution of rGO, S-rGO-6h and S-Co-rGO-6h samples were determined by N_2 adsorption and desorption isotherms (Fig. S1). The determined BET specific area, total pore volume and average pore size of these samples are summarized in Table S1.

Table S1. The BET specific area and pore structure parameters of the rGO, S-rGO-6h and S-Co-rGO-6h samples

Sample	S_{BET} (m^2/g)	V_{Tot} (m^3/g)	D_{Ave} (nm)
rGO	232	0.10	7.3
S-rGO-6h	312	0.13	6.0
S-Co-rGO-6h	214	0.09	4.9

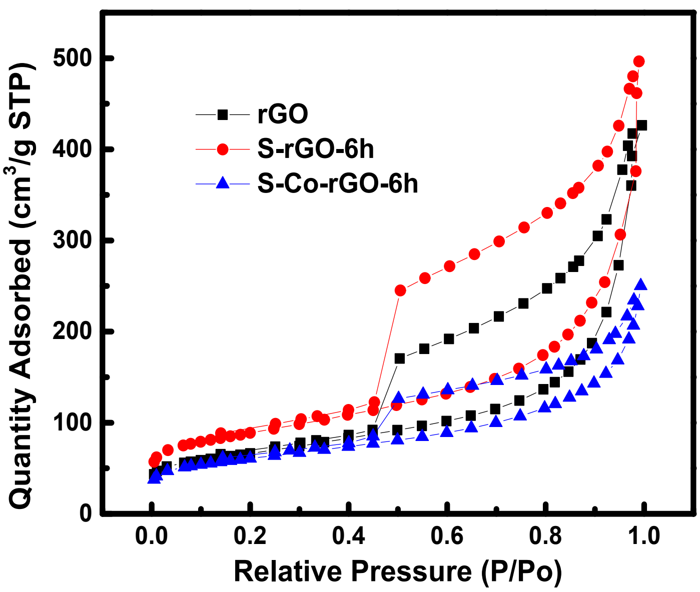

Fig. S1 Nitrogen adsorption/desorption isotherms for the rGO, S-rGO-6h and S-Co-rGO-6h samples

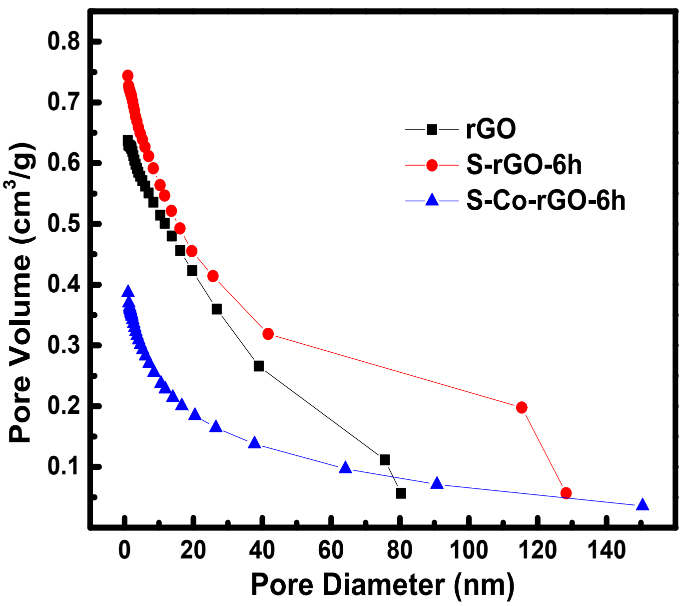

Fig. S2 Pore distribution of rGO, S-rGO-6h and S-Co-rGO-6h

EIS measurement

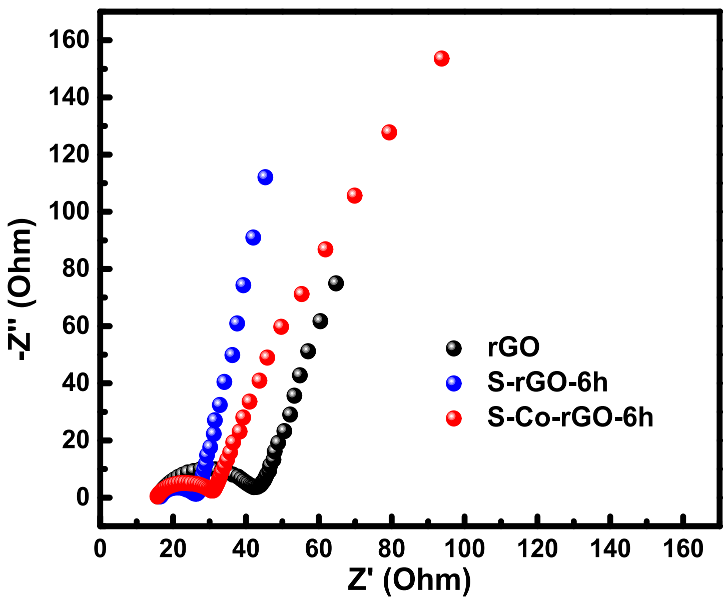

Fig. S3 Nyquist plots of rGO, S-rGO-6h and S-Co-rGO-6h performed in 0.1 M KOH.

Durability test

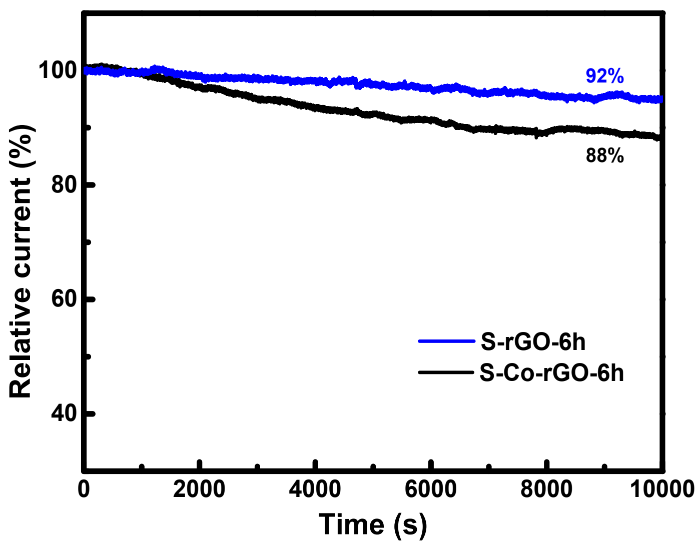

Fig. S4 Durability tests of S-rGO-6h and S-Co-rGO-6h, at -0.4V in O_2-saturated 0.1 M KOH solution with a rotation rate of 1,600 rpm

The calculation of electron transfer number

The Koutecky–Levich equations shown below were employed to analyze the transferred electron number (n):

$$\frac{1}{J}=\frac{1}{J_L}+\frac{1}{J_K}=\frac{1}{B\omega^{1/2}}+\frac{1}{J_K} \quad \text{(S1)}$$

$$B=0.2nFC_0(D_0)^{2/3}\nu^{-1/6} \quad \text{(S2)}$$

$$J_K=nFkC_0 \quad \text{(S3)}$$

where J is the measured current density, J_K and J_L are the kinetic and diffusion limiting current densities, respectively, ω is the angular velocity of the disk, and *n* is the overall number of electrons transferred in oxygen reduction. According to eqn (S1) and (S2), *n* and J_K can be obtained from the slope and intercept of the Koutecky–Levich plots, respectively. F is the Faraday constant (F=96485 C mol^{-1}), C_0 is the bulk concentration of oxygen ($C_0=1.2\times10^{-3}$ mol L^{-1}), ν is the kinetic viscosity of the electrolyte (ν=0.1 m^2 s^{-1} in 0.1 M KOH) and *k* is the electron transfer rate constant. D_0 is the diffusion coefficient of O_2 in 0.1 M KOH ($D_0=1.9\times10^{-5}$ cm s^{-1} at 25 °C). The constant of 0.2 is adopted when the rotating speed is expressed in rpm, and it changes to 0.62 when the rotating speed is expressed in rps.