Electronic Supplementary Material (ESI) for Nanoscale.

Nitrogen and Sulfur Co-doping of 3D Hollow-Structured Carbon Spheres as an Efficient and Stable Metal Free Catalyst for the Oxygen Reduction Reaction

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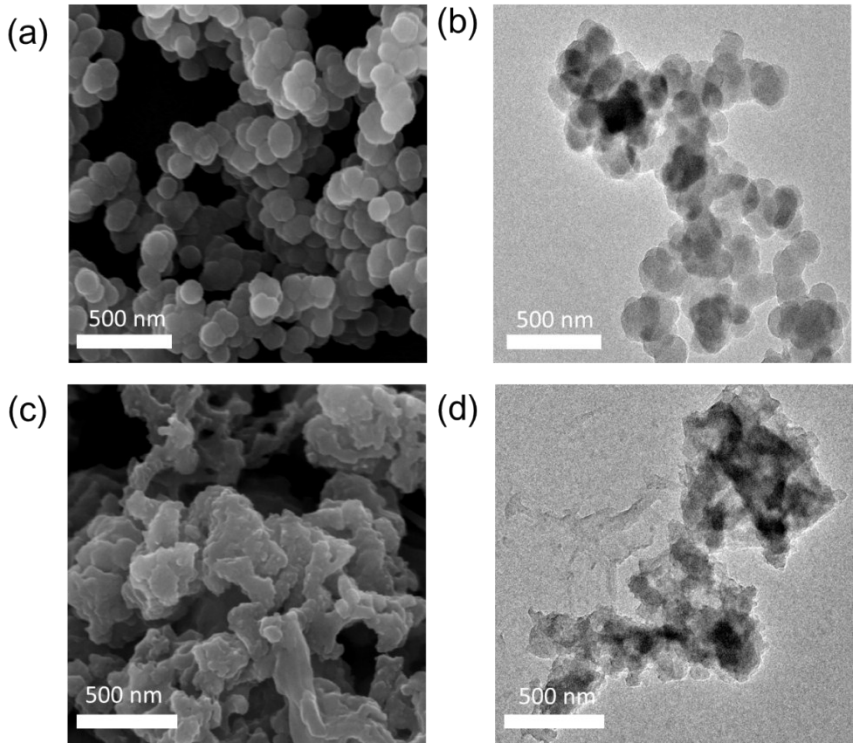

Fig. S1 SEM and TEM images of PPY (a), (b) and PAN (c), (d).

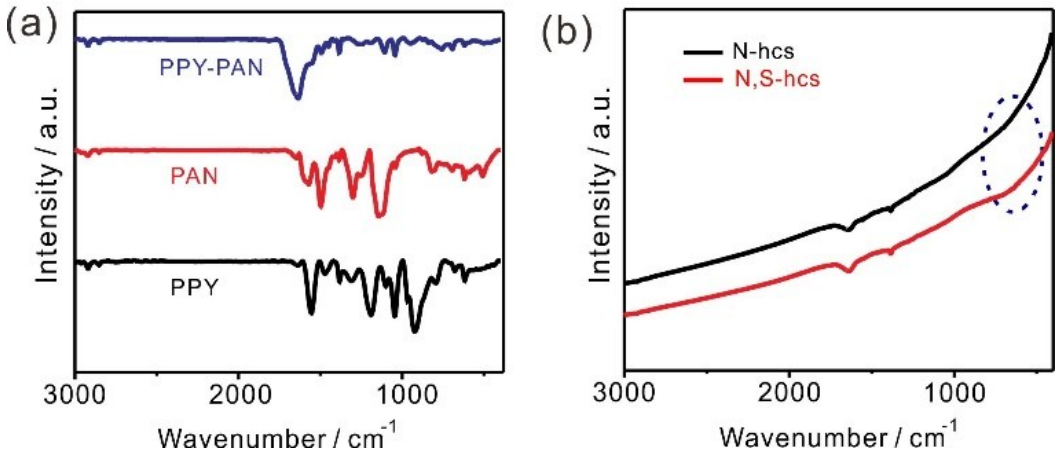

Fig. S2 FT-IR spectra of PPY-PAN, PPY, PAN (a) N-hcs and N,S-hcs-900 ºC (b).

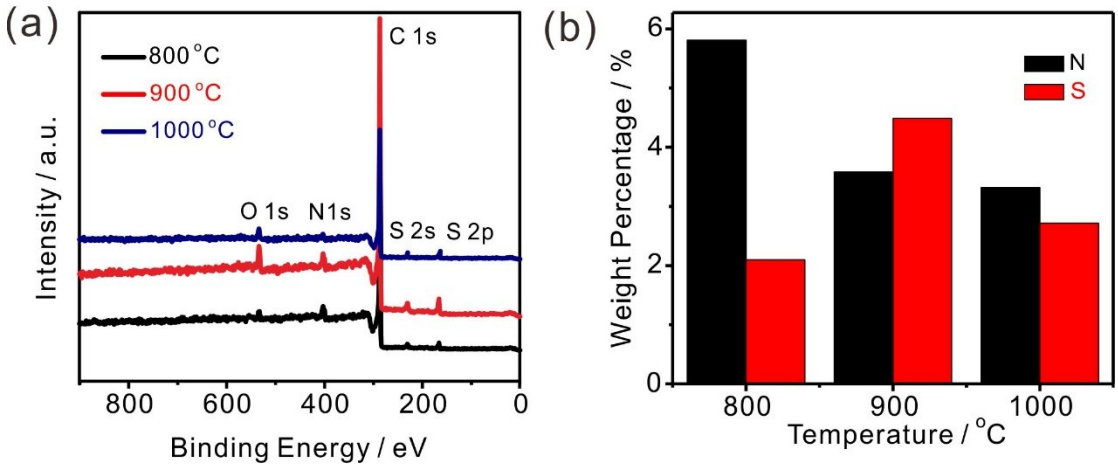

Fig. S3 (a) XPS spectra and EDS results of N,S-hcs treated at different temperatures.

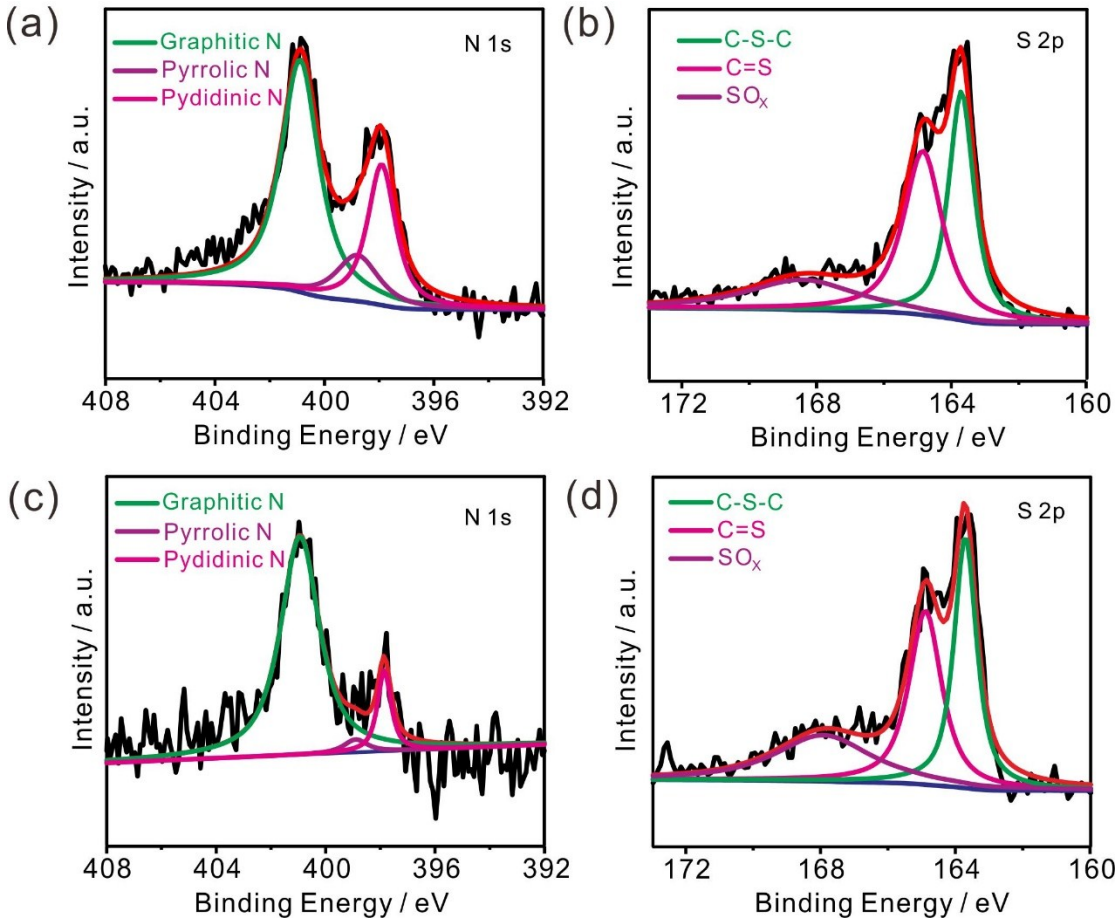

Fig. S4 The corresponding high resolution spectra of N 1s and S 2p of N,S-hcs-800 °C (a), (b) and N,S-hcs-1000 °C (c), (d).

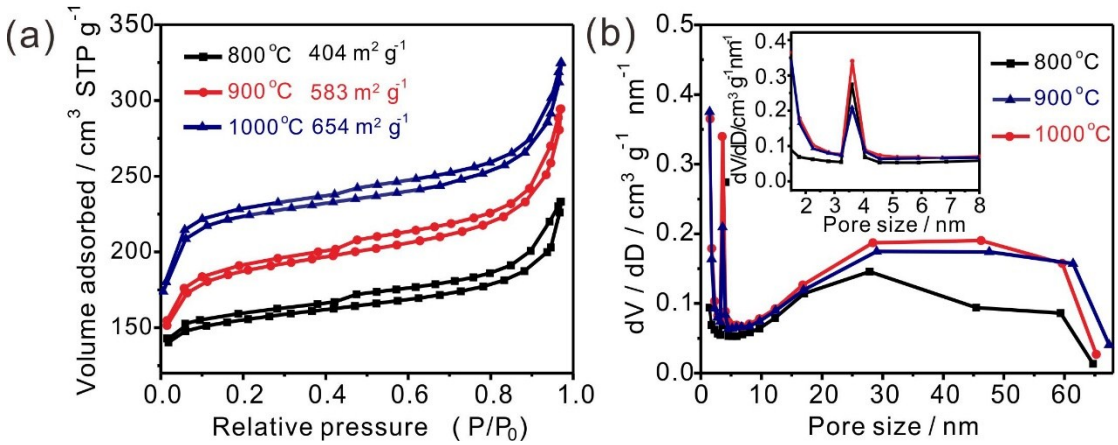

Fig. S5 Nitrogen adsorption/desorption isotherms (a) and pore distribution (b) of N,S-hcs treated at different temperatures.

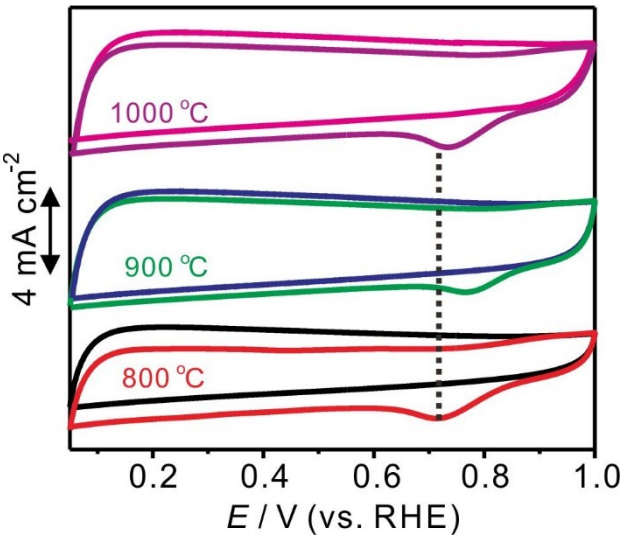

Fig. S6 CV curves of N,S-hcs treated at different temperatures in the O_2- and N_2-saturated 0.1 M KOH electrolyte at a scan rate of 50 mV s^{-1}.

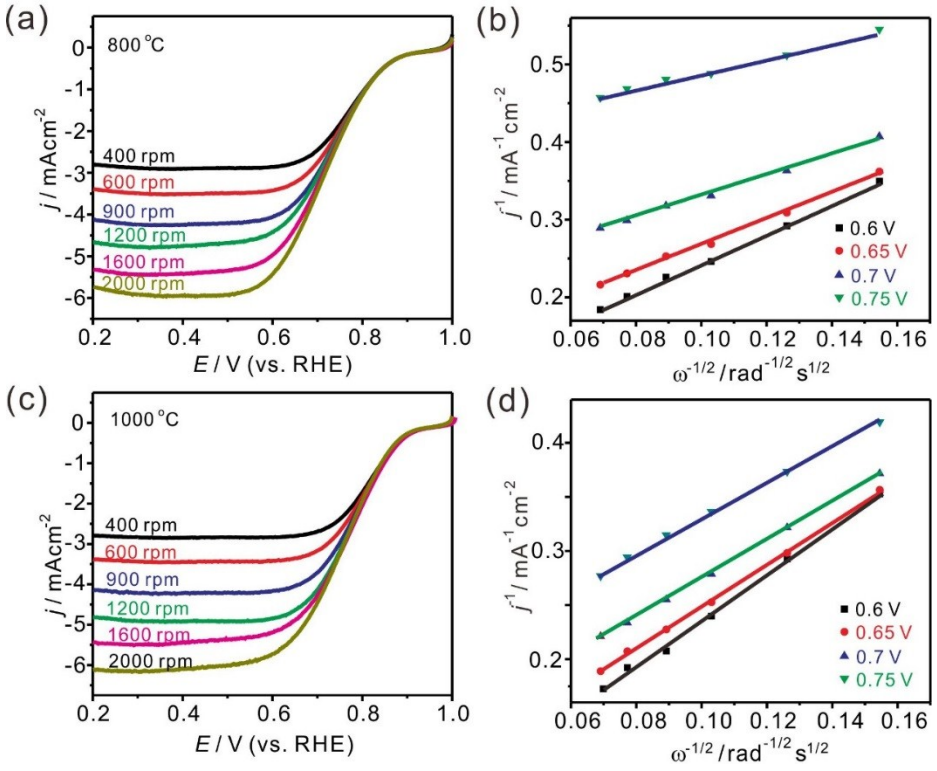

Fig. S7 LSVs of N,S-hcs-800 °C (a), (b) and N,S-hcs-1000 °C (c), (d) at different rotating speeds and the Koutecky–Levich plots at different potentials.

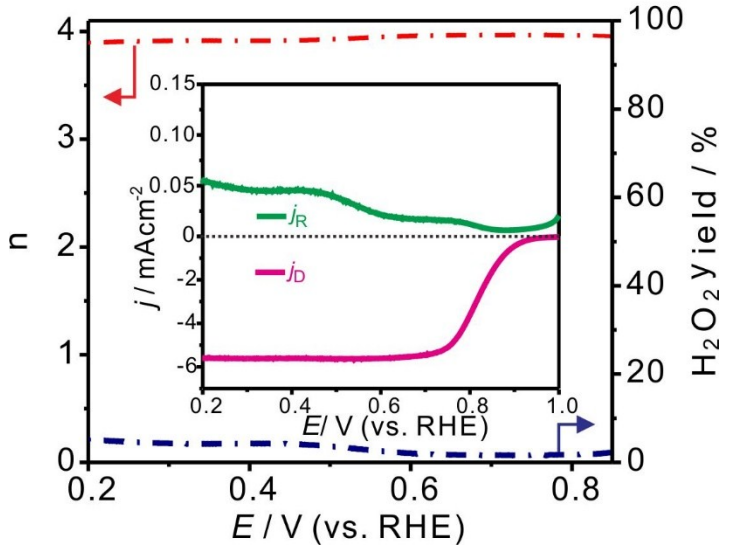

Fig. S8 The electron transfer number n, H_2O_2 yield and RRDE voltammograms (inset) of Pt/C.