Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Easy conversion of protein-rich enoki mushroom biomass to nitrogen-doped carbon nanomaterial as a promising metal-free catalyst for oxygen reduction reaction

Chaozhong Guo[a, b, *], Wenli Liao[c], Zhongbin Li[c], Lingtao Sun[a], Changguo Chen [b, *]

[a]Research Institute for New Materials Technology, Chongqing University of Arts and Sciences, Yongchuan, Chongqing 402160, China

[b]School of Chemistry and Chemical Engineering, Chongqing University, Chongqing 400044, China

[c]School of Materials and Chemical Engineering, Chongqing University of Arts and Sciences, Yongchuan, Chongqing 402160, China

Corresponding Author: E-mail: guochaozhong1987@163.com; cgchen@cqu.edu.cn

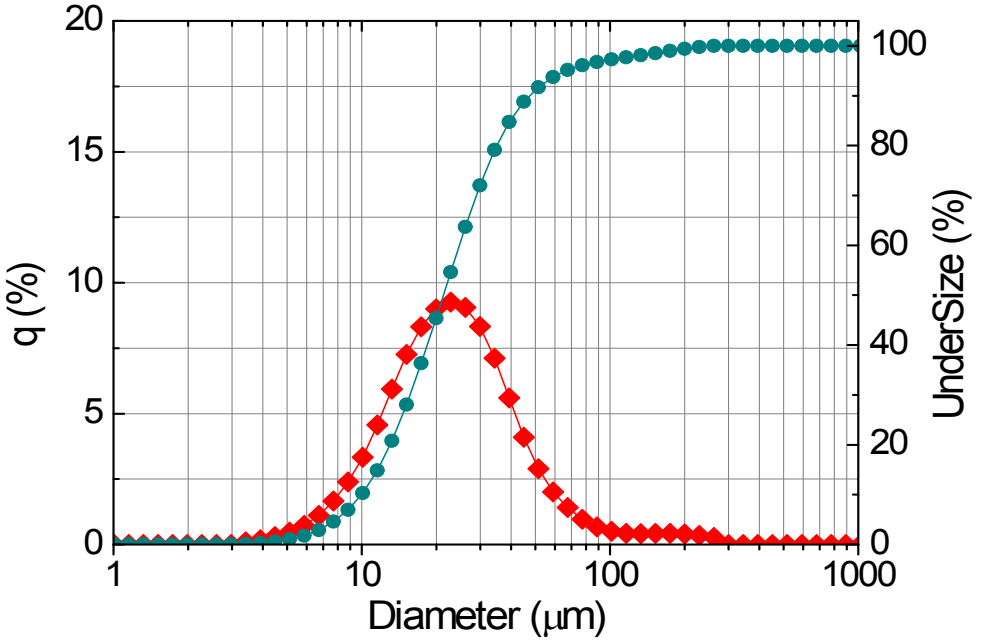

Figure 1S The particle-size distribution of the N-C-900 sample.

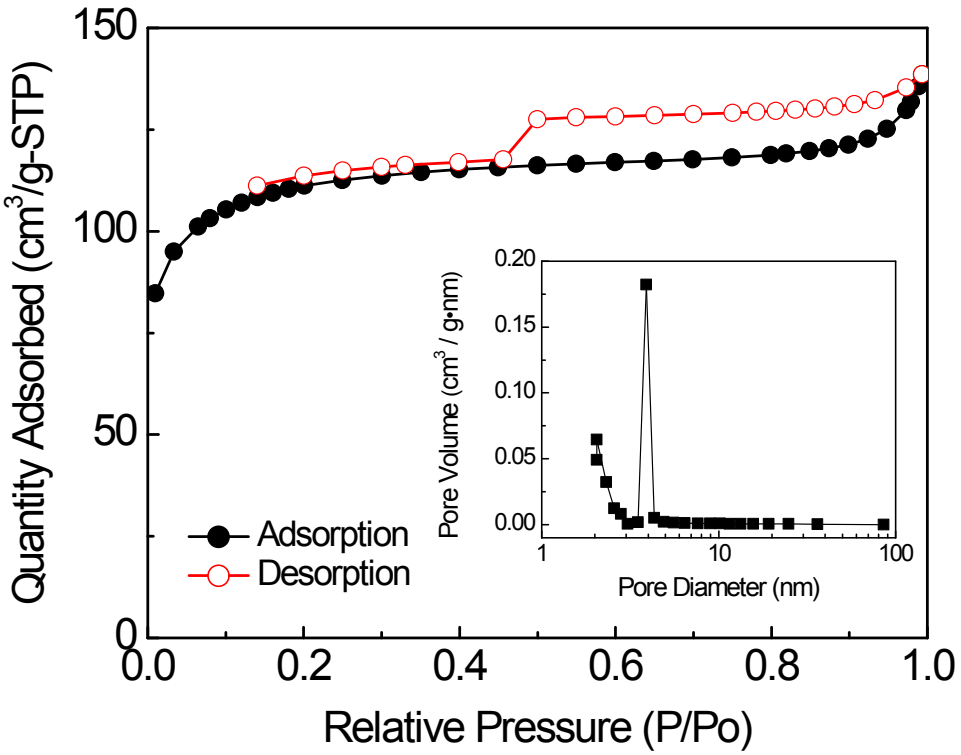

Figure 2S Nitrogen adsorption/desorption isotherms of N-C-900 and its corresponding pore size distribution (inset).

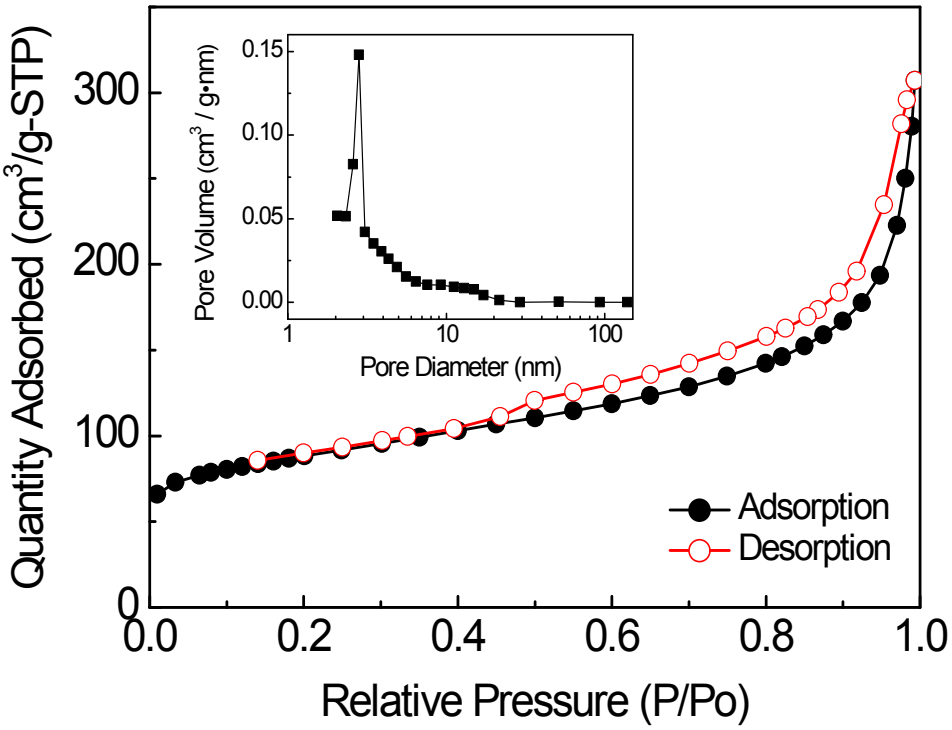

Figure 3S Nitrogen adsorption/desorption isotherms of N-C@CNT-900 and its corresponding pore size distribution (inset).

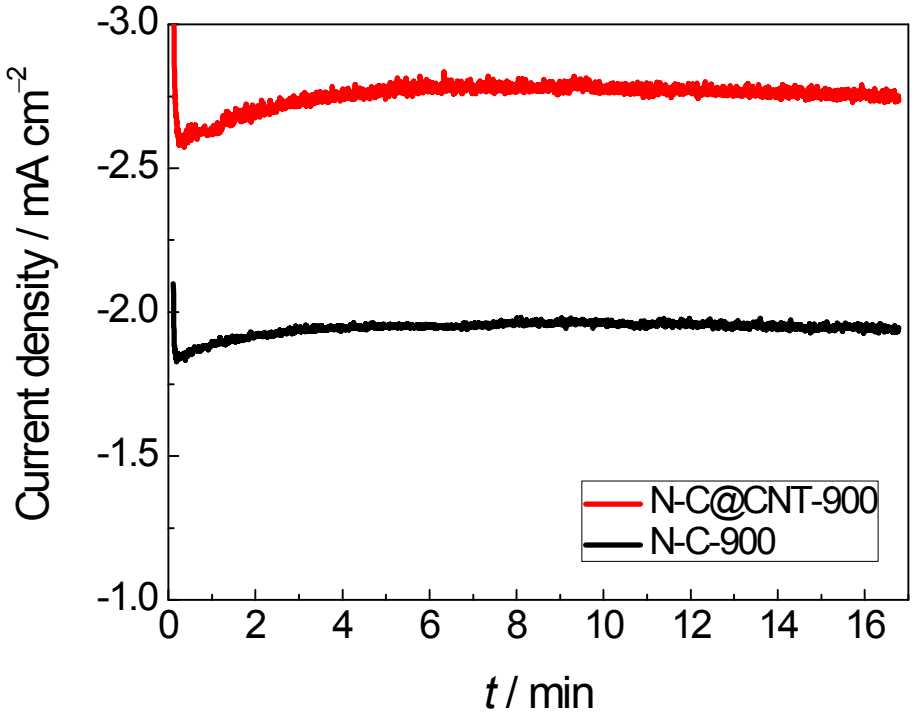

Figure 4S Amperometric current–time (i–t) responses for ORR at +0.7 V vs. RHE in an O_2-saturated 0.1 M KOH electrolyte at N-C-900 and N-C@CNT-900 modified electrodes with a rotation speed of 1600 rpm.

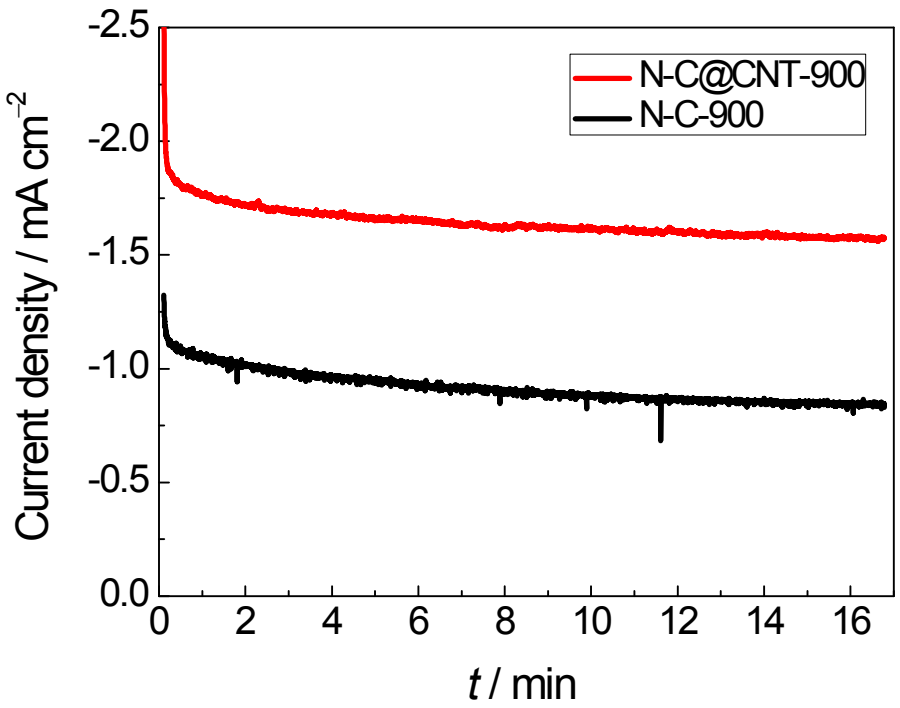

Figure 5S Amperometric current–time (i–t) responses for ORR at +0.5 V vs. RHE in an O_2-saturated 0.5 M H_2SO_4 electrolyte at N-C-900 and N-C@CNT-900 modified electrodes with a rotation speed of 1600 rpm.

Table 1S. N 1s XPS results from Fig. 4 and ORR activity data from Fig. 5 and 6 for EM, N-C-900, N-C@CNT-900, and 20 wt.% Pt/C catalyst.

Sample	Total N content [%][a]	Nitrile N [%]	Pyrrolic N [%]	Graphtic N [%]	Oxidized N [%]	E_{ORR} / V[b]	E_{ORR} / V[c]	$E_{1/2}$ / V[b]	$E_{1/2}$ / V[c]	j / mA cm^{-2} @ +0.5 V[b]	j / mA cm^{-2} @ +0.5 V[c]
EM material	5.27	100.0	---	---	---	---	---	---	---	---	---
N-C-900	3.43	26.6	---	43.3	30.1	0.87	0.77	0.73	0.46	3.62	1.56
N-C@CNT-900	3.20	25.5	33.3	41.2	---	0.94	0.81	0.81	0.60	3.98	2.85
20 wt.% Pt/C	---	---	---	---	---	0.98	0.93	0.86	0.82	5.02	3.74

[a]The total N content (at.%) was determined by XPS analysis in Figure 4a.

[b]The ORR activity data from Fig. 5 were obtained in O_2-saturated alkaline electrolyte.

[c]The ORR activity data from Fig. 6 were obtained in O_2-saturated acidic electrolyte.