Electronic Supplementary Material (ESI) for RSC Advances

Sponge-like N-doped Carbon Materials with Co-based Nanoparticles Derived from Biomass as High Efficient Electrocatalysts for Oxygen Reduction Reaction in Alkaline Media

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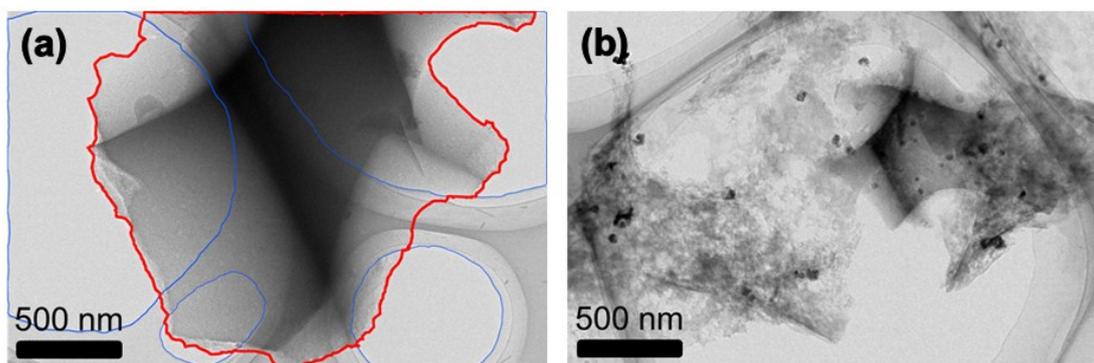
Tables and Figures

Figure S1. TEM images of ASS and CoASS (a-b), respectively. The sample is in the red circle and the substrate is in the position enclosed by the blue line.
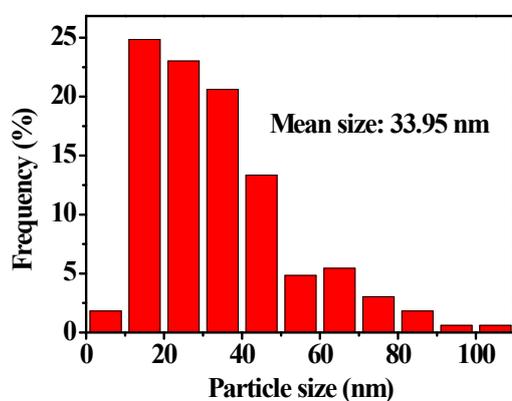

Figure S2. The average size and size distribution of CoO nanoparticles.
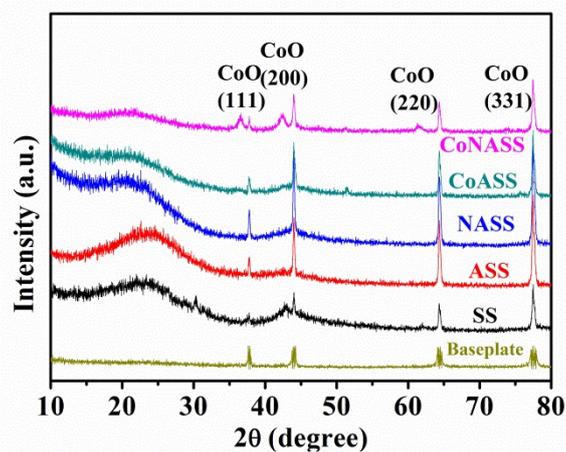

Figure S3. XRD curves of SS, ASS, NASS, CoASS and CoNASS (a-b), respectively
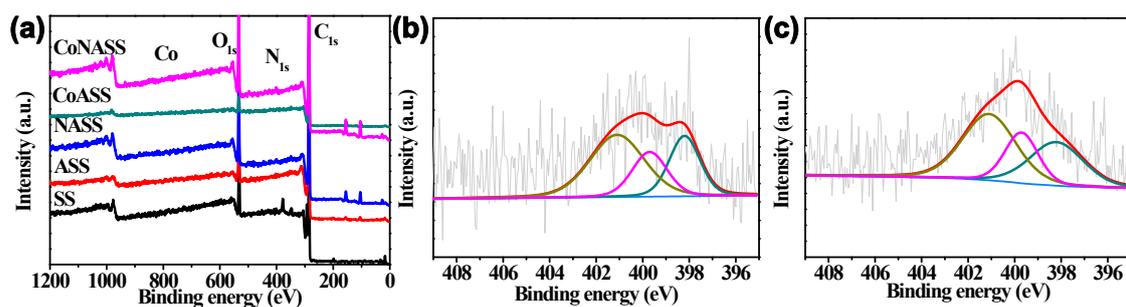
Figure S4. Full-survey XPS spectra (a), the high-resolution N1s spectra of NASS and CoNASS (b-c), respectively
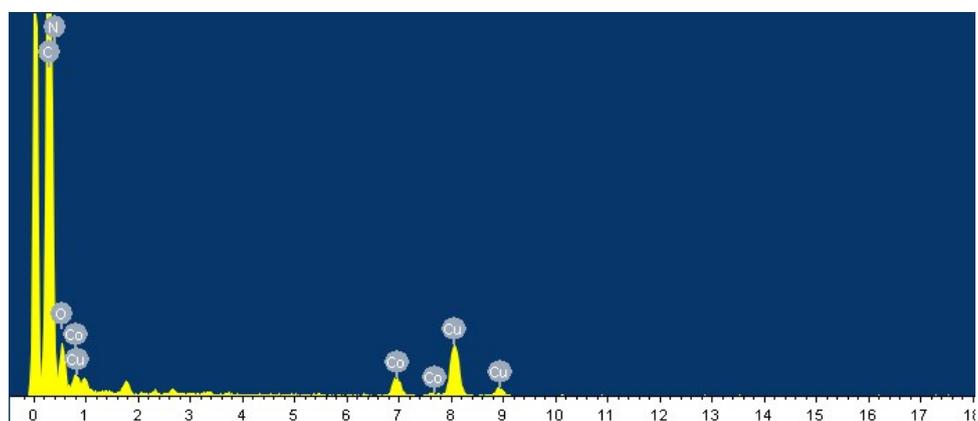

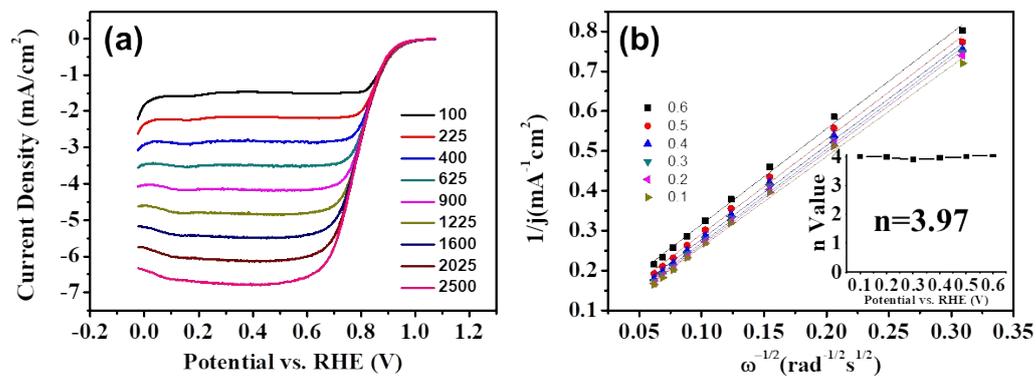**Figure S5.** The EDS of CoNASS catalyst.

Figure S6. The LSV curves of Pt/C at the rotating speeds of 100, 225, 400, 625, 900, 1225, 1600, 2025 and 2500 rpm (a). The corresponding K-L plots (b) and *n* (inset).

Table S1 I_D/I_G ratio, element content, and nitrogen species analysis of the catalysts.

Catalysts	I_D/I_G	at.%				Pyridinic-N	Pyrrolic-N	Graphitic-N
		C (at%)	O (at%)	N (at%)	Co (at%)			
SS	1.00	72.12%	27.88%	0	0			
ASS	1.03	77.58%	21.10%	0	0			
NASS	1.06	61.58%	36.29%	2.13%	0	27.34%	22.96%	49.70%
CoASS	1.05	86.17%	11.53%	0	2.30%			
CoNASS	1.18	58.59%	36.78%	1.92%	2.71%	30.81%	22.31%	46.88%