

## Supporting Information

### **Cobalt/nitrogen Codoped Carbon Nanosheets Derived from Catkin as a High Performance Non-Noble Metal Electrocatalyst for Oxygen Reduction Reaction and Hydrogen Evolution Reaction\*\***

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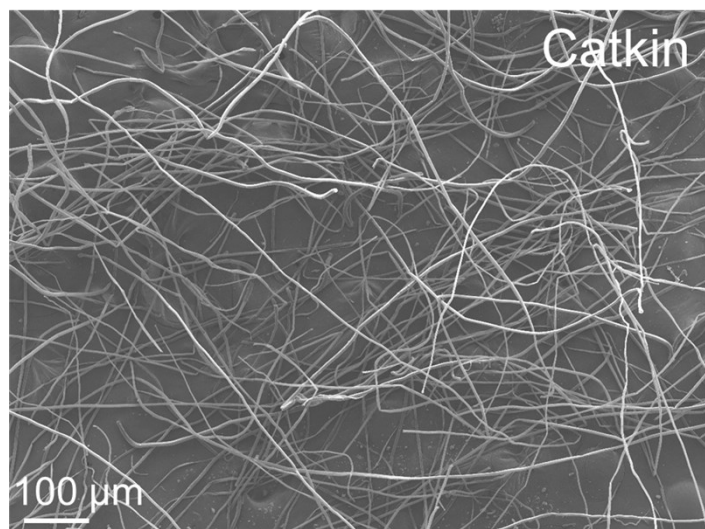


Figure S1. SEM image of pristine catkins.

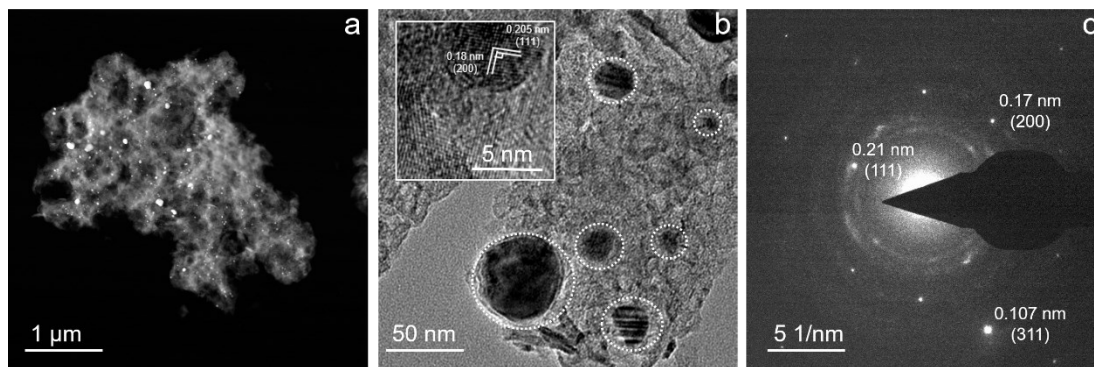


Figure S2. (a) HAADF-STEM and (b) HRTEM images (the inset: the enlarged HRTEM image of the Co nanoparticles), and (c) SAED pattern of CoNPs-Co/N-CNSs-800.

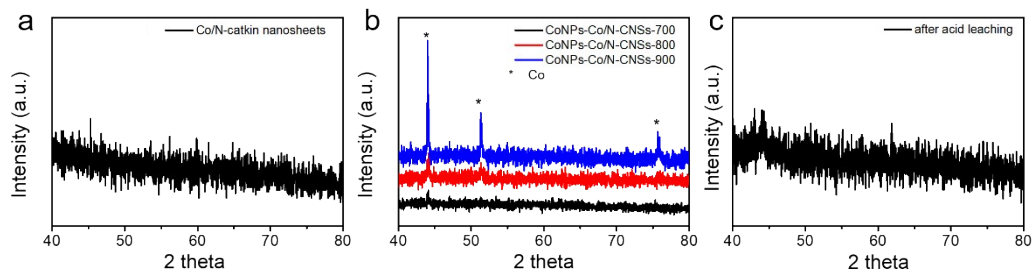


Figure S3. XRD patterns of (a) Co/N-catkin nanosheets, (b) CoNPs-Co/N-CNSs-700, CoNPs-Co/N-CNSs-800 and CoNPs-Co/N-CNSs-900, and (c) CoNPs-Co/N-CNSs-800 subject to acid leaching.

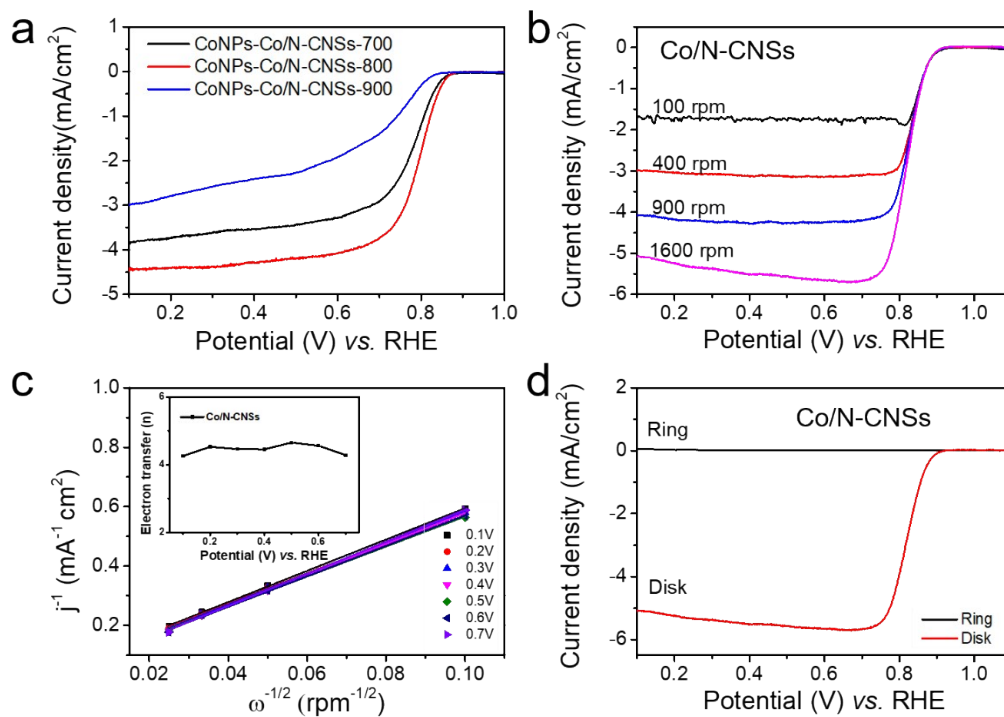


Figure S4. ORR polarization plots of CoNPs-Co/N-CNSs-700, CoNPs-Co/N-CNSs-800, and CoNPs-Co/N-CNSs-900. (b) LSV curves of Co/N-CNSs-800 at different rotating speeds from 100 to 1600 rpm. (c) The corresponding Koutecky-Levich plots of Co/N-CNSs-800 from 0.1 to 0.7 V (vs. RHE). The inset of S4c shows the electron-transfer number as a function of potential. (d)  $\text{H}_2\text{O}_2$  yield of Co/N-CNSs.

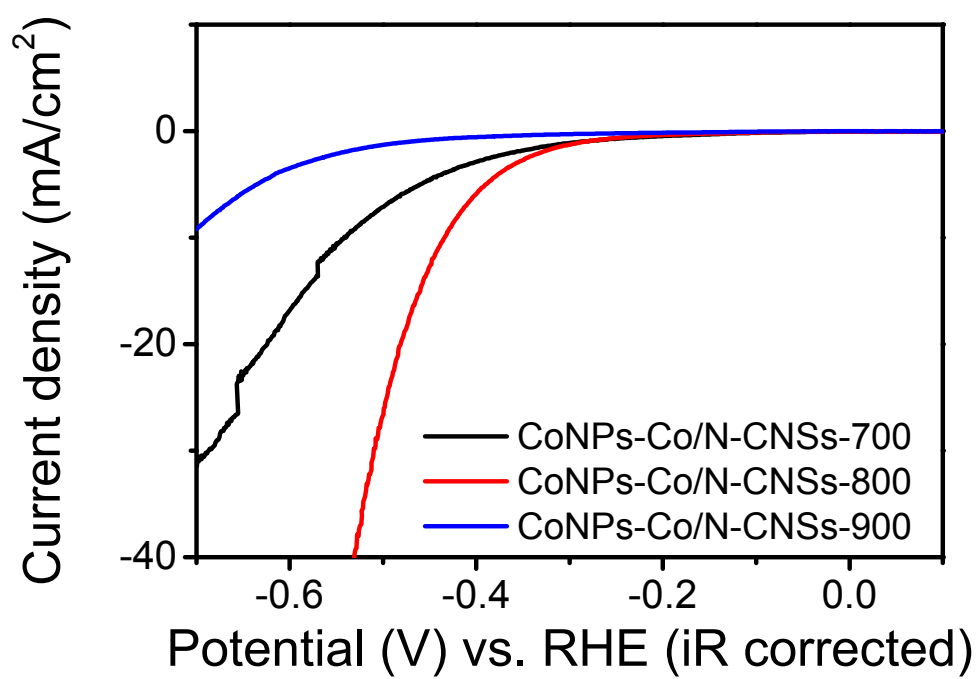


Figure S5. HER LSV curves of CoNPs-Co/N-CNSs-700, CoNPs-Co/N-CNSs-800 and CoNPs-Co/N-CNSs-900.

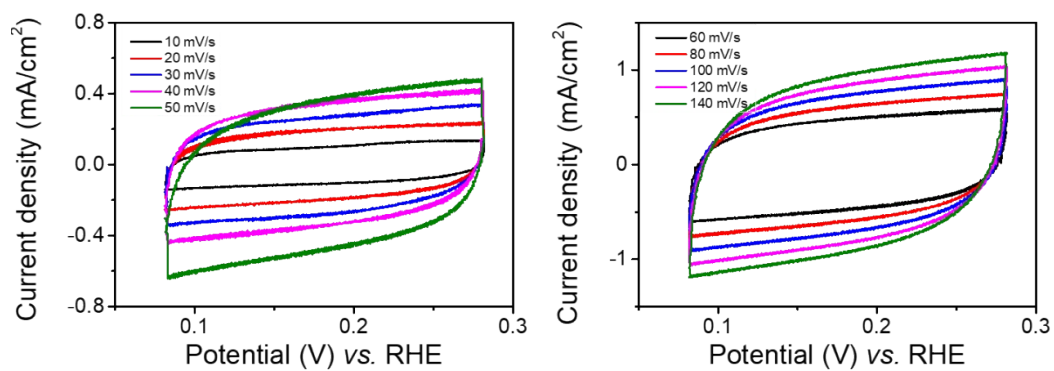


Figure S6. The corresponding CV curves for  $C_{dl}$  in the range of 10 - 140 mV/s where no faradaic reactions occurred.

Table S1. Percentages of elements involved in CoNPs-Co/N-CNSs-800 and Co/N-CNSs.

	<b>C (%)</b>	<b>N (%)</b>	<b>O (%)</b>	<b>Co (%)</b>
CoNPs-Co/N-CNSs-800	92.59	1.023	4.607	1.785
Co/N-CNSs	94.076	2.144	3.573	0.208

Table S2. ORR and HER performance comparison of biomass-derived electrocatalysts in this work and those reported in the literature.

	<b>ORR half-wave potential</b>	<b>HER overpotential at 10 mA/cm<sup>2</sup></b>	<b>Ref.</b>
Co/N-CNSs	0.83 V vs. RHE	-0.278 V vs. RHE	This work
Co/CNFs	0.896 V vs. RHE	0.19 V vs. RHE	<i>Adv. Mater.</i> <b>2019</b> , 31, 1808043
Co@NG-800	-	-0.286 V vs. RHE	<i>Electrochim. Acta</i> <b>2018</b> , 26, 48
Co-N-PCM	0.82 V vs. RHE	-	<i>Carbon</i> <b>2019</b> , 141, 704
CoFe/N-GCT	0.91 V for Pt/C	-	<i>Angew. Chem. Int. Ed.</i> <b>2018</b> , 57,16166
MoO <sub>2</sub> -FeP@C	-	0.103 V vs. RHE	<i>Adv. Mater.</i> <b>2020</b> , DOI:10.1002
Co-N <sub>x</sub> @CNF-700	0.814 V vs. RHE	-	<i>J. Power Sources</i> <b>2018</b> , 380, 174
Co-Co <sub>2</sub> P@NPC/rGO	-	-0.136 V vs. RHE	<i>Adv. Funct. Mater.</i> <b>2018</b> , 28, 1801332