Supporting Information

An advanced oxygen reduction electrocatalyst based on nitrogen-doped graphene derived from edible sugar and urea

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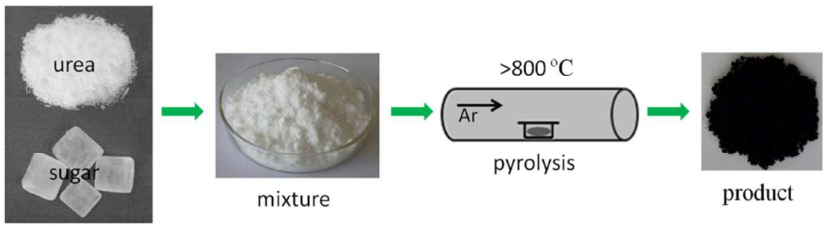

Figure S1. Schematic illustration of fabrication process for NG; The digital photographs of crystal sugar, urea, and as-prepared NG are presented.

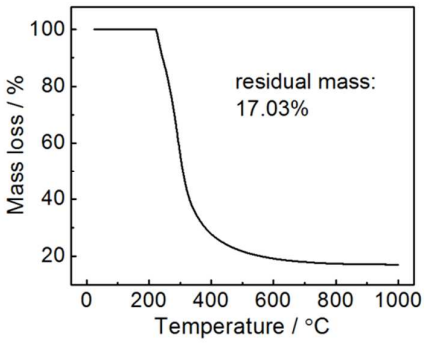

Figure S2. TGA characterization of crystal sugar used as carbon precursors.

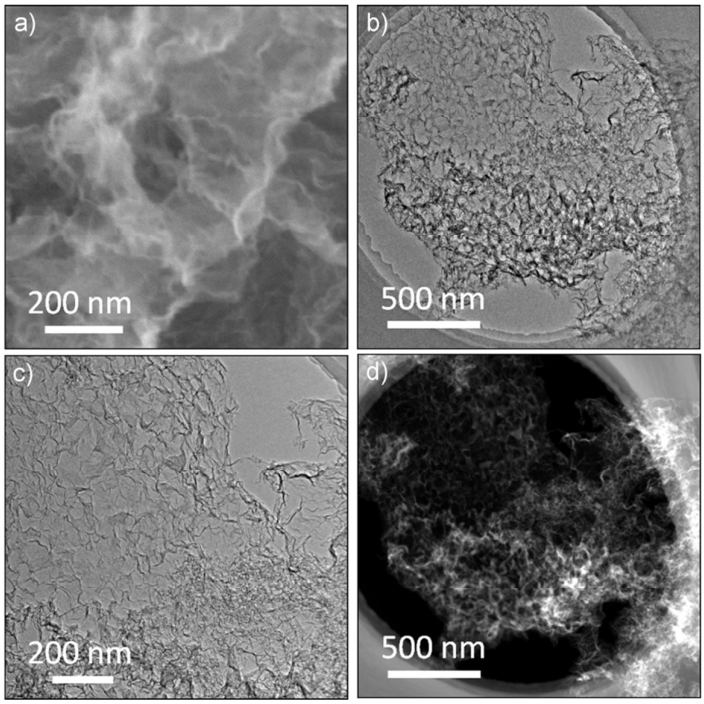

Figure S3. Typical SEM a), TEM b,c), and STEM d) images of NG1000.

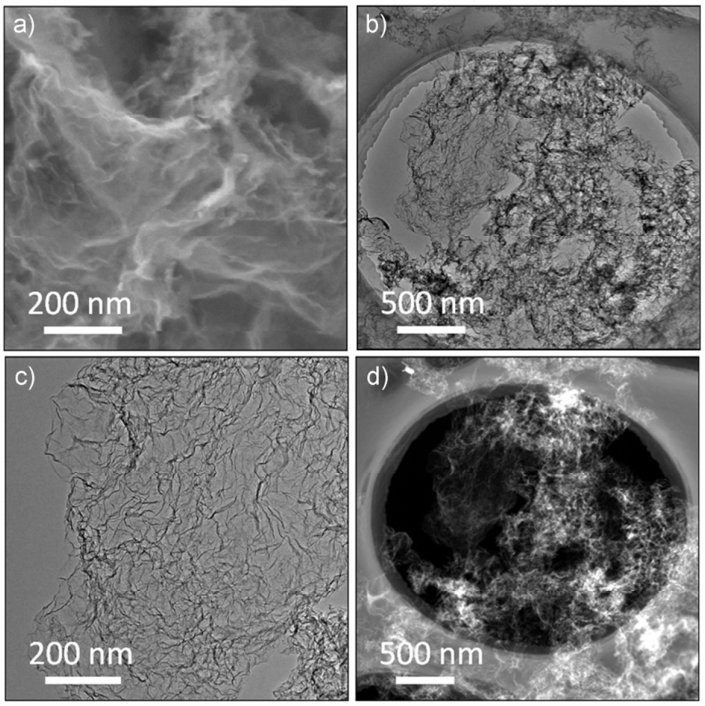

Figure S4. Typical SEM a), TEM b,c), and STEM d) images of NG900.

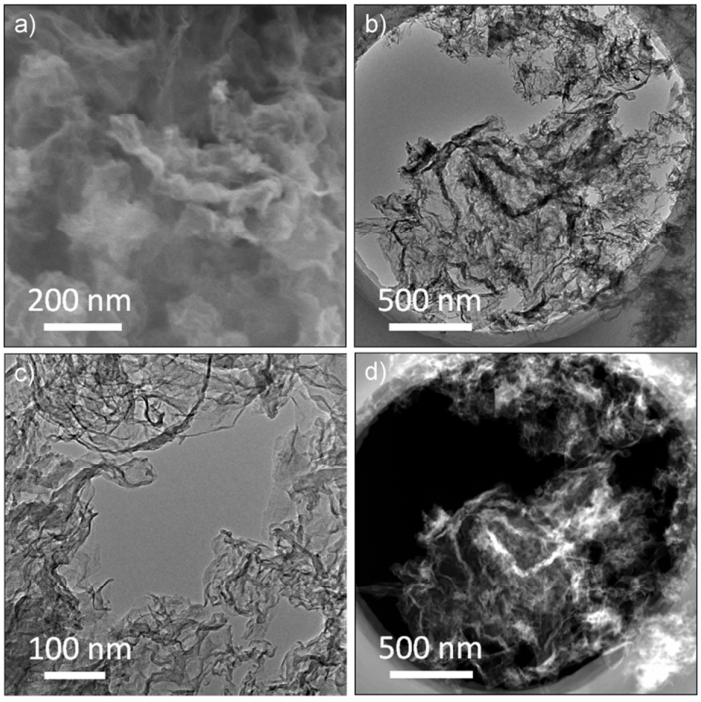

Figure S5. Typical SEM a), TEM b,c), and STEM d) images of NG800.

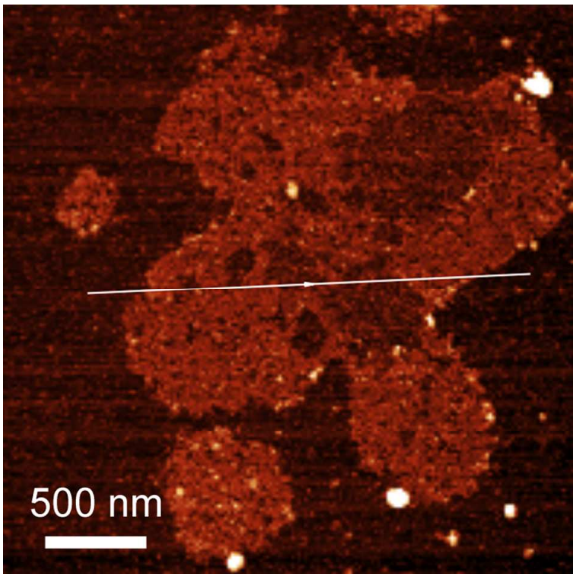

Figure S6. Typical AFM image of NG1000.

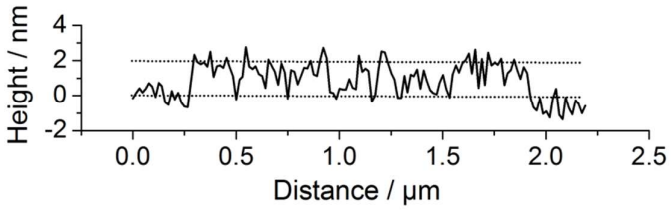

Figure S7. Height measurement of AFM image corresponding to the line shown in Figure S6.

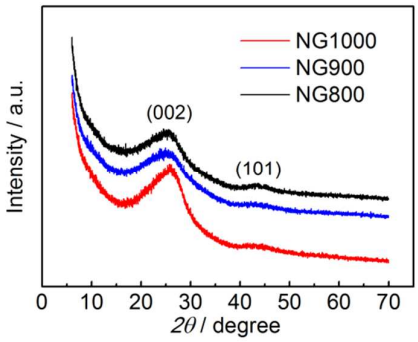

Figure S8. XRD profiles for NG

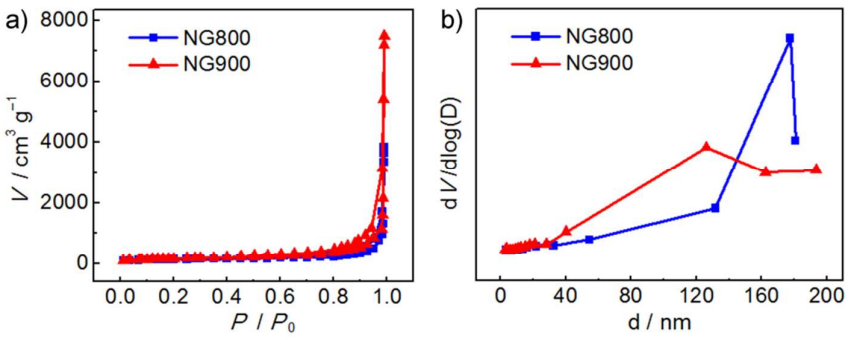

Figure S9. Nitrogen adsorption/desorption isotherm plot a) and BJH desorption pore size distribution plot b) for NG.

Sample	BET surface area (m^2/g)	Pore volume (cm^3/g)	Average pore size (nm)
NG800	461.9	1.17	52.5
NG900	579.4	1.76	51.9
NG1000	565.1	2.04	12.9

Table S1. Textural properties of the NG.

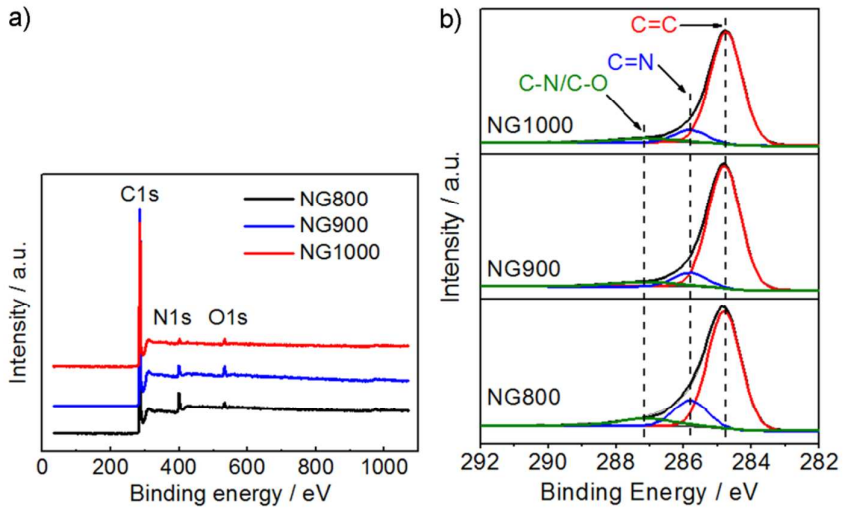

Figure S10. XPS survey spectra a) and high-resolution C1s XPS spectra b) of as-prepared NG.

Sample	C (at%)	O (at%)	N (at%)	N content (at %)			
				N1	N2	N3	N4
NG800	86.03	2.77	11.20	5.49	2.24	2.91	0.67
NG900	91.59	2.96	5.45	2.18	0.76	2.23	0.22
NG1000	94.37	2.61	3.02	0.66	0.30	1.93	0.12

Table S2. Surface composition concentration of NG.

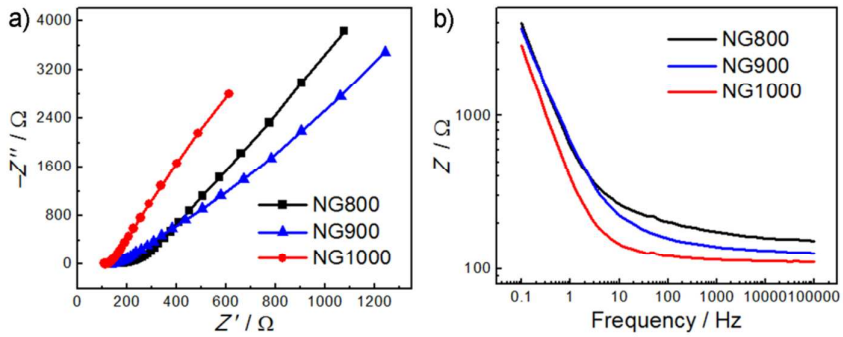

Figure S11. Nyquist a) and Bode b) curves of NG.

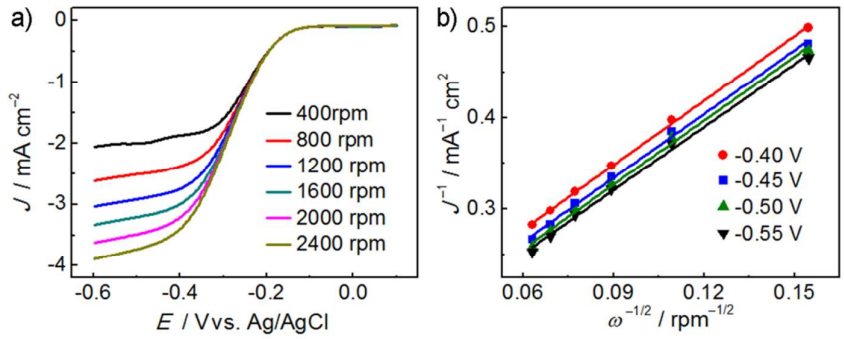

Figure S12. a) LSV curves of NG800 in O_2-saturated 0.1 M KOH electrolyte with a sweep rate of 10 mV s^{-1} at the different rotation rates. The catalyst loading is about 0.283 mg cm^{-2}. b) Corresponding Koutecky–Levich (K–L) plots (J^{-1} versus $\omega^{-1/2}$) at different potentials.

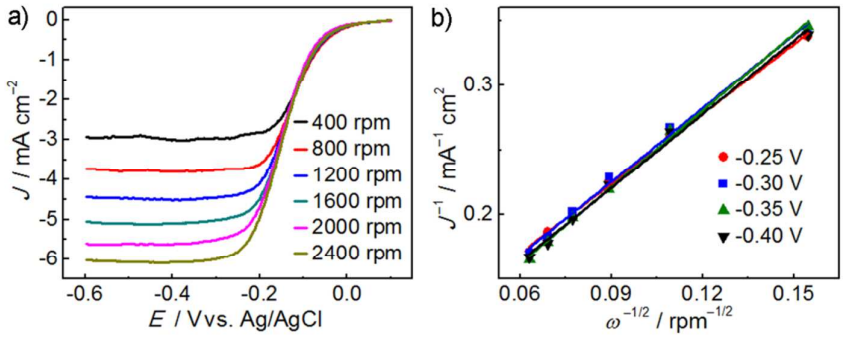

Figure S13. a) LSV curves of Pt/C in O_2-saturated 0.1 M KOH electrolyte with a sweep rate of 10 mV s^{-1} at the different rotation rates. The catalyst loading is about 0.283 mg cm^{-2}. b) Corresponding Koutecky–Levich (K–L) plots (J^{-1} versus $\omega^{-1/2}$) at different potentials.

Sample	Transferred electron number (n)			
NG800	3.17(-0.40 V)	3.20(-0.45 V)	3.19(-0.50 V)	3.22(-0.55 V)
NG900	3.36(-0.36 V)	3.38(-0.40 V)	3.39(-0.45 V)	3.41(-0.50 V)
NG1000	3.79(-0.25 V)	3.80(-0.30 V)	3.79(-0.35 V)	3.82(-0.40 V)
Pt/C	4.01(-0.25 V)	4.00(-0.30 V)	3.98(-0.35 V)	4.00(-0.40 V)

Table S3. Transferred electron number (n) on different potential for NG and Pt/C electrodes.

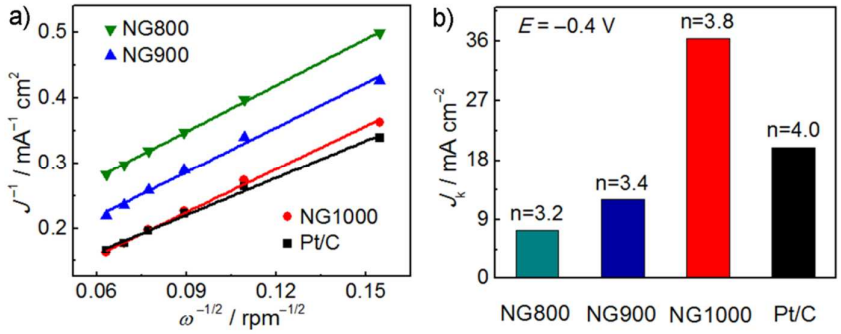

Figure S14. a) K-L plots of NG and Pt/C electrode at –0.4 V. b) The obtained kinetic current density as well as the corresponding transferred electron number at –0.4 V.