Electronic Supplementary Information

Nitrogen-doped hierarchically porous carbons for non-alkaline Zn-air battery cathodes

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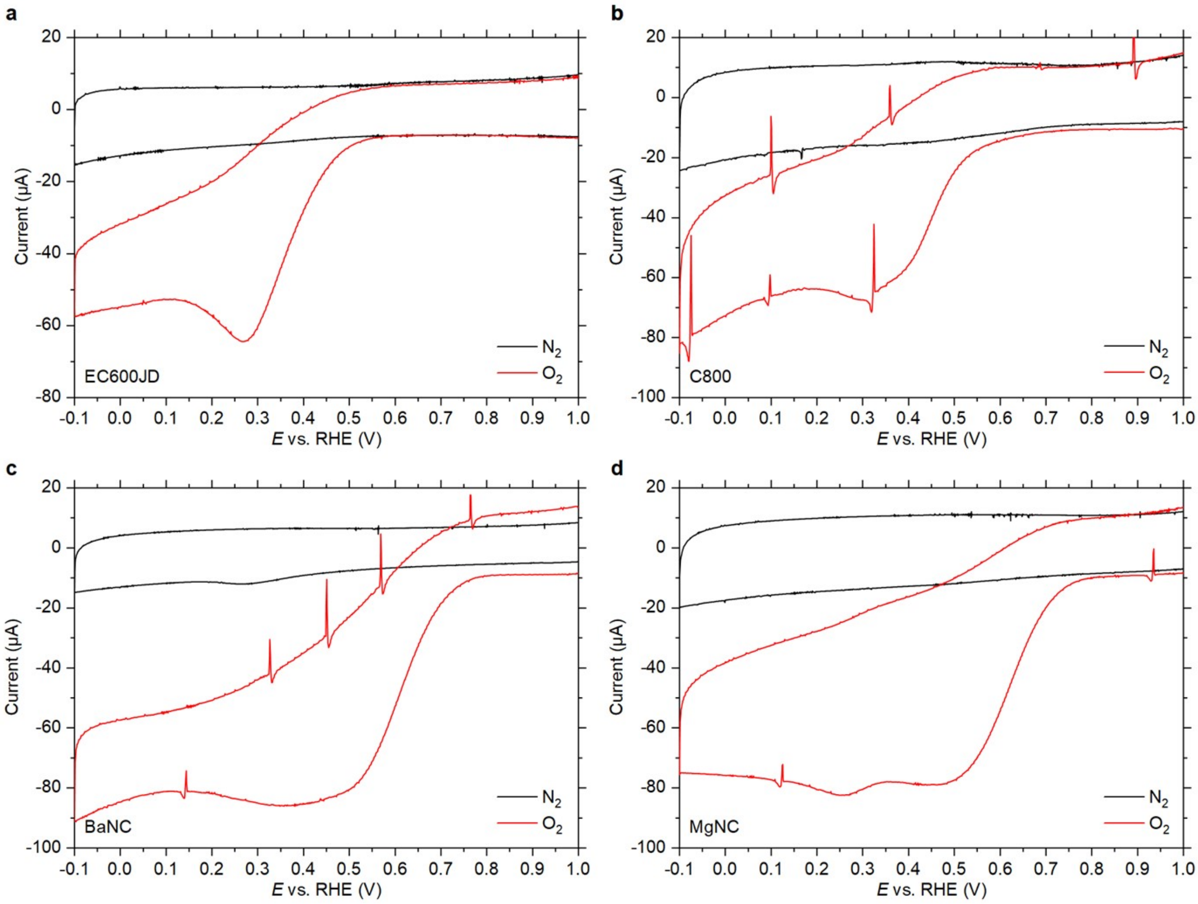

Fig. S1. CV response of EC600JD (a), C800 (b), BaNC (c) and MgNC (d) in nitrogen- and oxygen-saturated phosphate buffer solution (pH = 6.0).

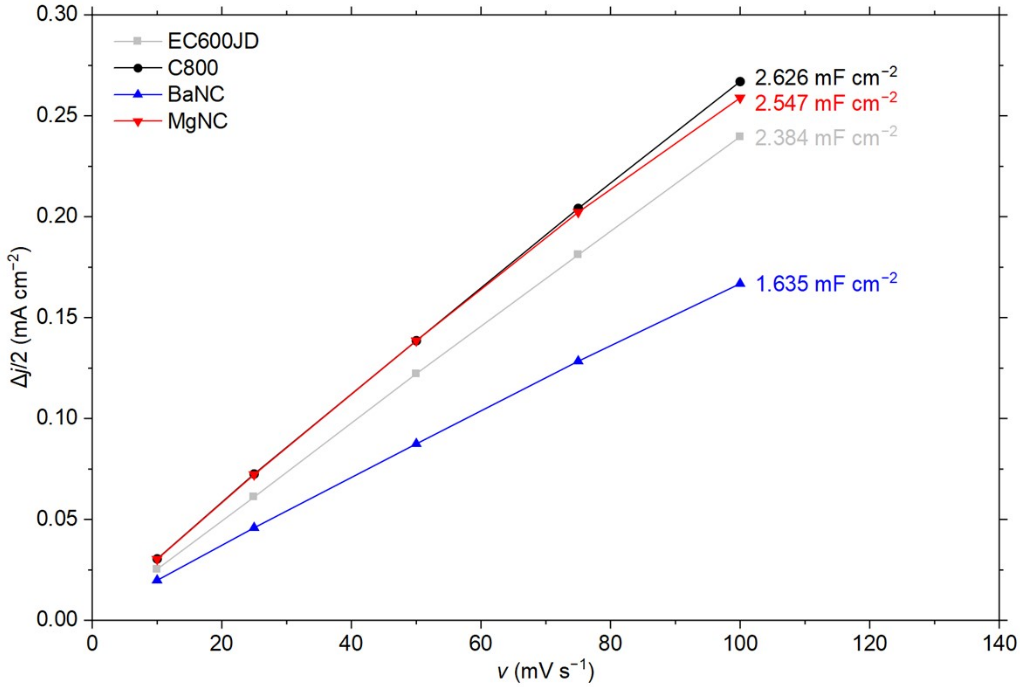

Fig. S2. Dependences between scan rate and supercapacitive current for carbon electrodes in nitrogen-saturated phosphate buffer solution (pH = 6.0).

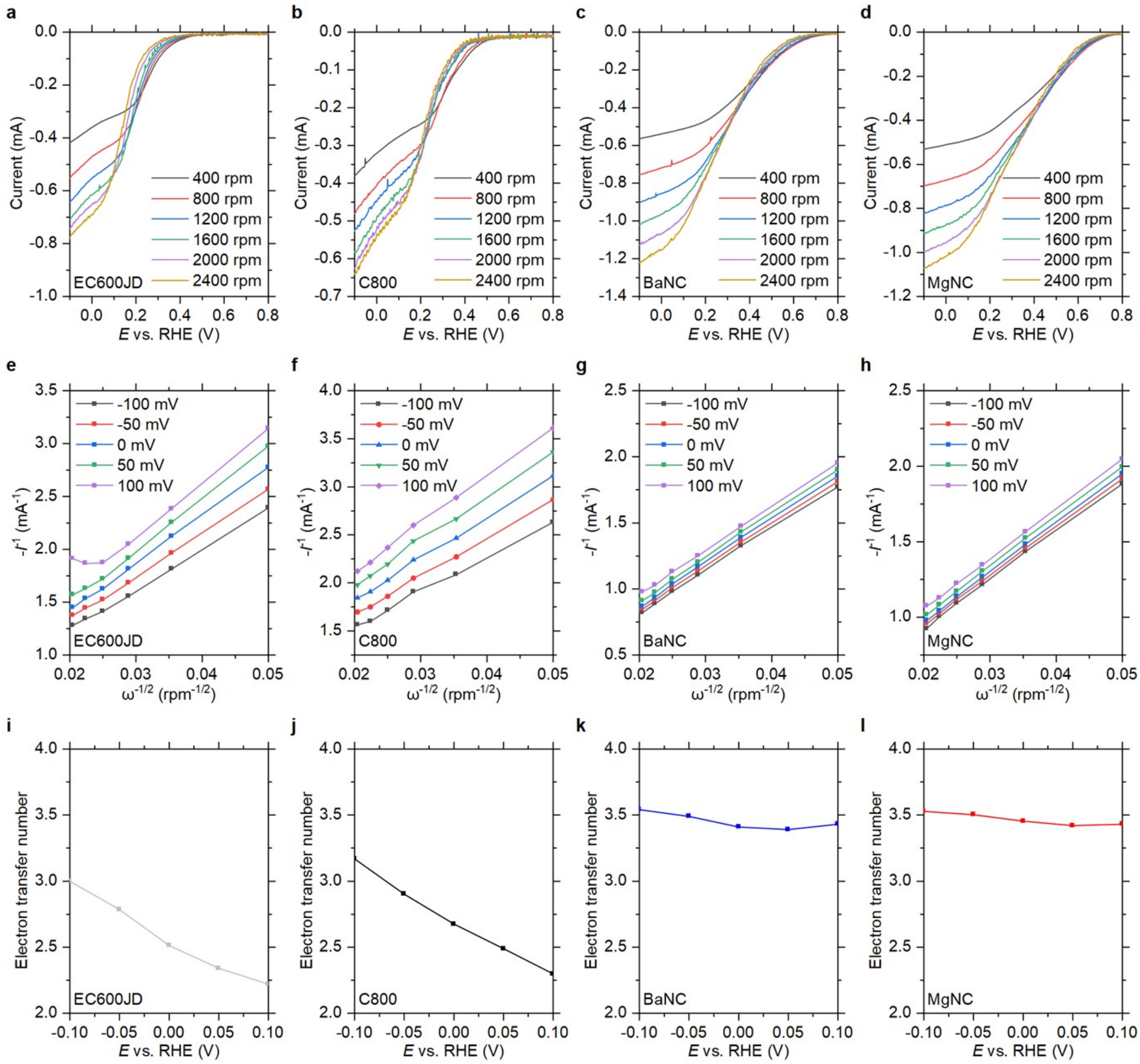

Fig. S3. RDE experiments (a-d), corresponding Koutecky–Levich plots for various potentials vs. RHE (e-h) and estimated electron transfer numbers (i-l) for EC600JD (a, e, i), C800 (b, f, j), BaNC (c, g, k) and MgNC (d, h, l), measured in oxygen-saturated phosphate buffer solution (pH = 6.0).

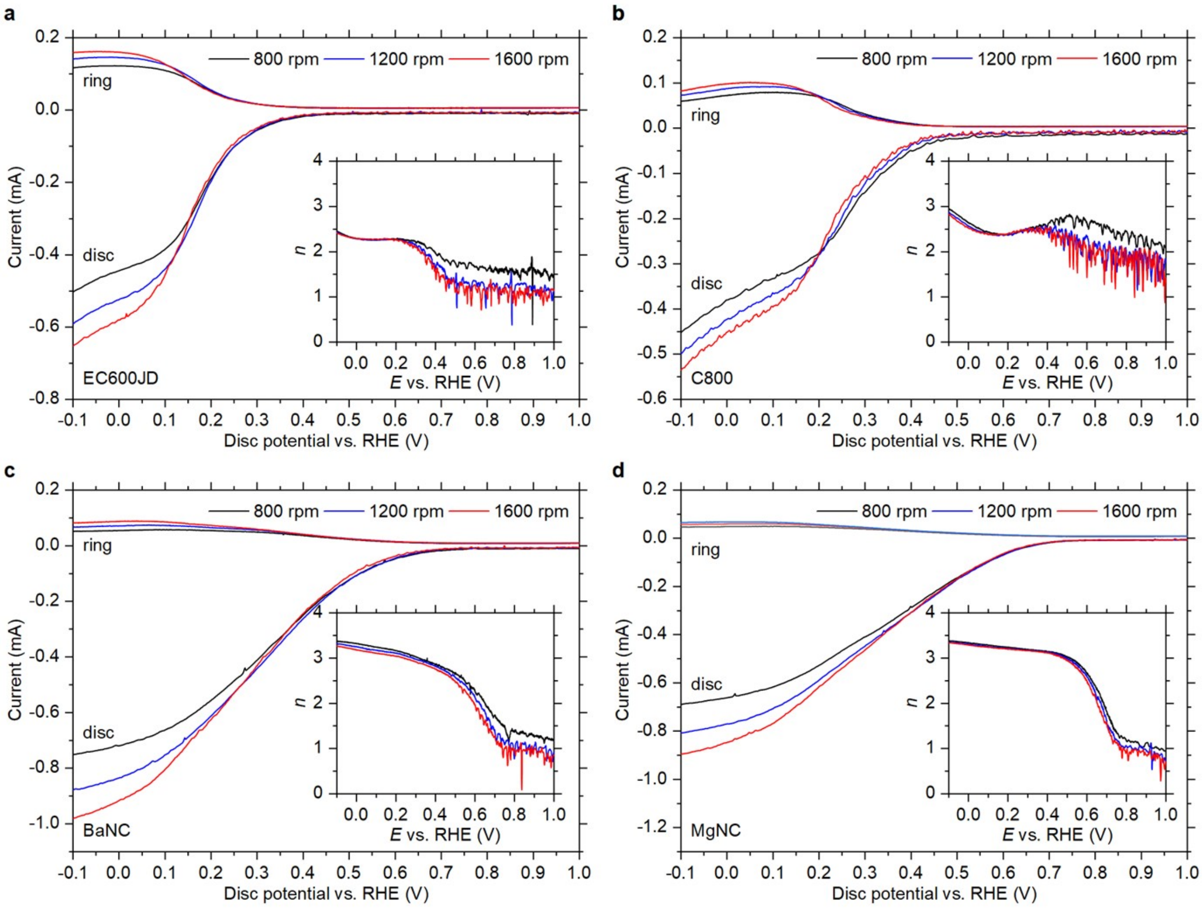

Fig. S4. Ring/disk currents and electron transfer numbers (insets) for EC600JD (a), C800 (b), BaNC (c) and MgNC (d) electrodes, measured in RRDE experiments with oxygen-saturated phosphate buffer solution (pH = 6.0).

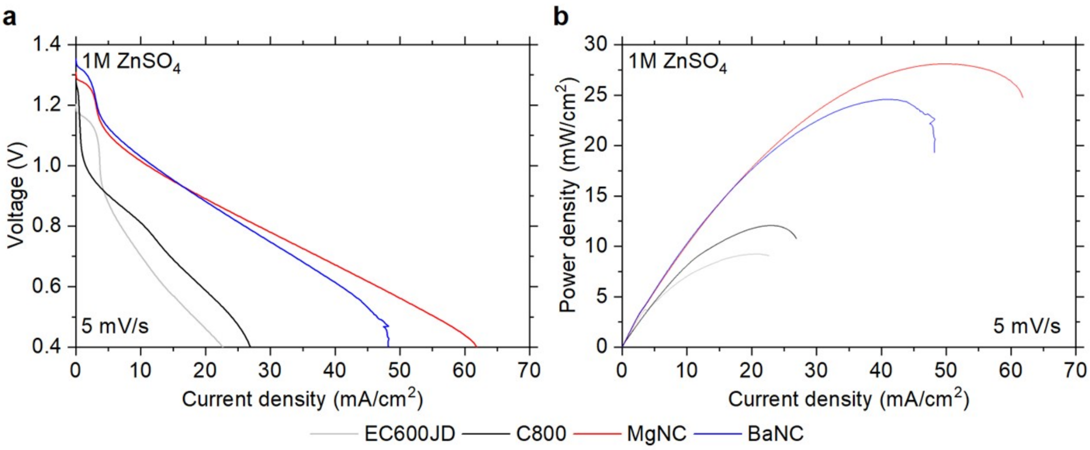

Fig. S5. Current-voltage (a) and current-power (b) plots for Zn-air cells with various cathode materials during an LSV scan (10 mV s^{-1}) with 1M $ZnSO_4$ electrolyte.

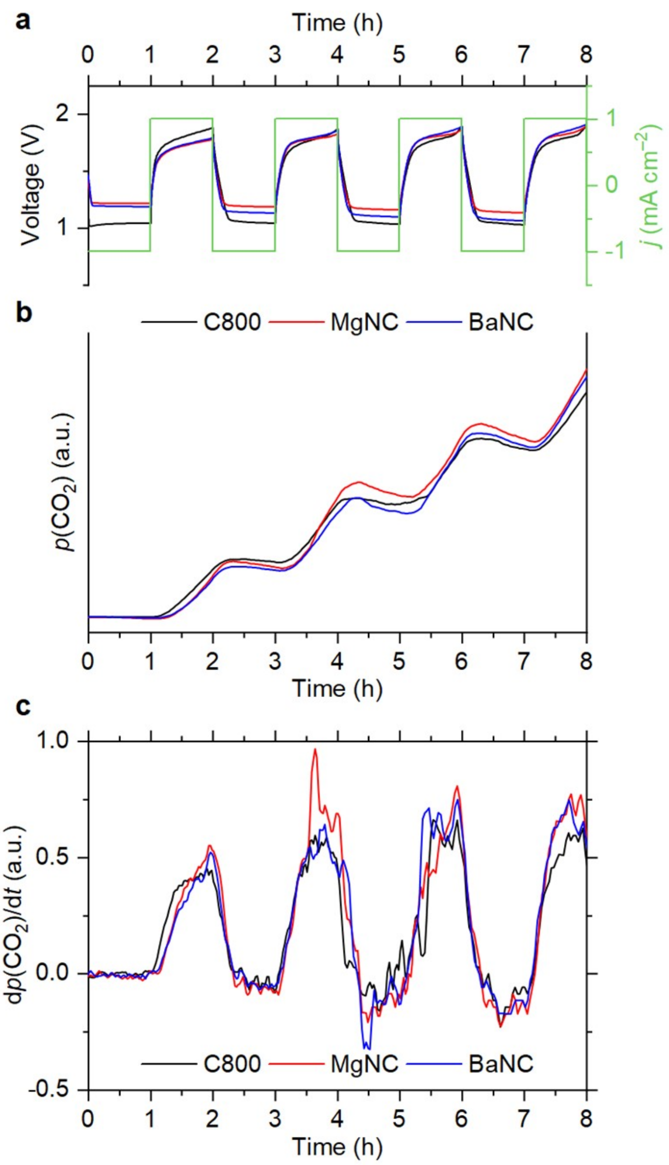

Fig. S6. Zn-air cell voltage and current density vs. time (a), evolution of CO_2 partial pressure (b) and its derivative (c) during the OEMS measurements.

Table S1. Performance of carbon-based materials in non-alkaline Zn-air batteries. The data (from this paper and ref. 14 in the main text) are reported for the ZAB setup that was used in this work; the current density is 0.1 mA cm^{-2}, the capacity is 1 mAh cm^{-2}. Reported roundtrip energy efficiencies, charge and discharge voltages are reported as average values for the first three cycles. Average voltage was calculated as charge or discharge energy (mWh cm^{-2}) divided by capacity (mAh cm^{-2}).

Material	**Electrolyte**	**Avg. discharge voltage (V)**	**Avg. charge voltage (V)**	**Roundtrip energy efficiency (%)**	**Source**
MgNC	1M $ZnSO_4$	1.28	1.63	78.8	This work
	1M $Zn(OAc)_2$	1.28	1.54	83.6	
BaNC	1M $ZnSO_4$	1.23	1.67	73.5	This work
	1M $Zn(OAc)_2$	1.24	1.53	80.9	
C800	1M $ZnSO_4$	1.16	1.58	73.5	This work
	1M $Zn(OAc)_2$	1.13	1.52	74.1	
Ketjenblack EC600JD	1M $ZnSO_4$	1.10	1.67	65.8	This work
	1M $Zn(OAc)_2$	1.10	1.59	68.8	
Ketjenblack EC600JD	1M $ZnSO_4$	1.10	1.68	65.5	Ref. 14
	1M $Zn(OAc)_2$	1.10	1.61	68.4	
YP80	1M $ZnSO_4$	1.16	1.62	71.6	Ref. 14

	1M $Zn(OAc)_2$	1.11	1.55	71.8	
YP50F	1M $ZnSO_4$	1.17	1.66	70.2	Ref. 14
	1M $Zn(OAc)_2$	1.12	1.57	71.1	
BP2000	1M $ZnSO_4$	1.11	1.66	67.0	Ref. 14
	1M $Zn(OAc)_2$	1.09	1.58	69.1	
Graphene C500	1M $ZnSO_4$	1.11	1.70	65.6	Ref. 14
	1M $Zn(OAc)_2$	1.08	1.64	66.0	
Ketjenblack EC300J	1M $ZnSO_4$	1.08	1.74	61.9	Ref. 14
	1M $Zn(OAc)_2$	1.07	1.65	64.4	
Vulcan XC72R	1M $ZnSO_4$	1.01	1.78	56.8	Ref. 14
	1M $Zn(OAc)_2$	1.01	1.75	57.7	
Multiwalled carbon nanotubes	1M $ZnSO_4$	1.01	1.80	56.0	Ref. 14
	1M $Zn(OAc)_2$	1.00	1.84	54.1	
Carbon nanofibers	1M $ZnSO_4$	0.82	2.09	39.2	Ref. 14
	1M $Zn(OAc)_2$	0.75	2.11	35.7	

Super P	1M $ZnSO_4$	0.88	1.92	45.5	Ref. 14
	1M $Zn(OAc)_2$	0.90	1.90	47.1	