Electronic Supplementary Information

Hydrothermal Synthesis of Polydopamine functionalized Cobalt doped Lanthanum Nickelate Perovskite Nanorod for Efficient Water Oxidation in Alkaline Solution

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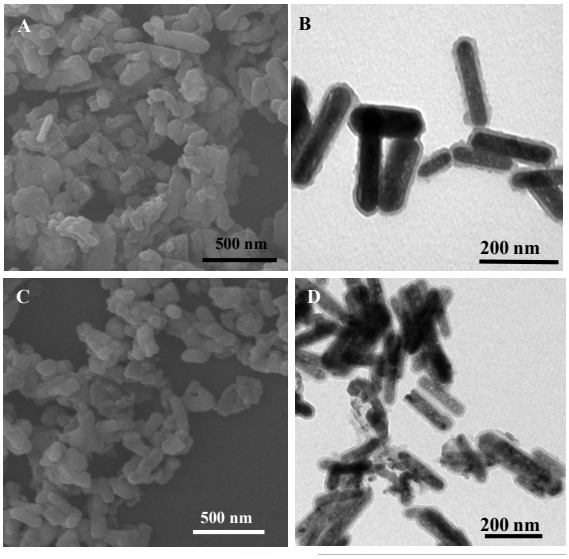

Fig. S1 SEM and TEM images of PDA/$La_5Ni_3Co_{2\text{-}500N}$ before (A, B) and after (C, D) 1000 CV cycles in 1.0 M KOH.

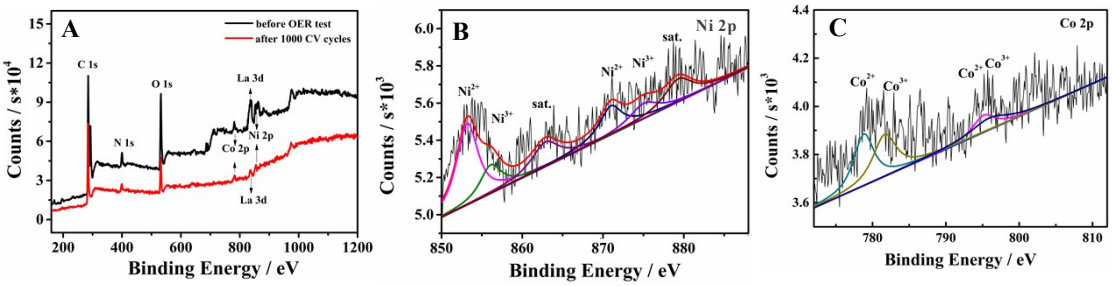

Fig. S2 XPS spectra of PDA/Co_2-$La_5Ni_3O_{3\text{-}x\text{-}500N}$ before and after durablility test (A), deconvoluted XPS spectra of Ni 2p (B) and Co 2p (C).

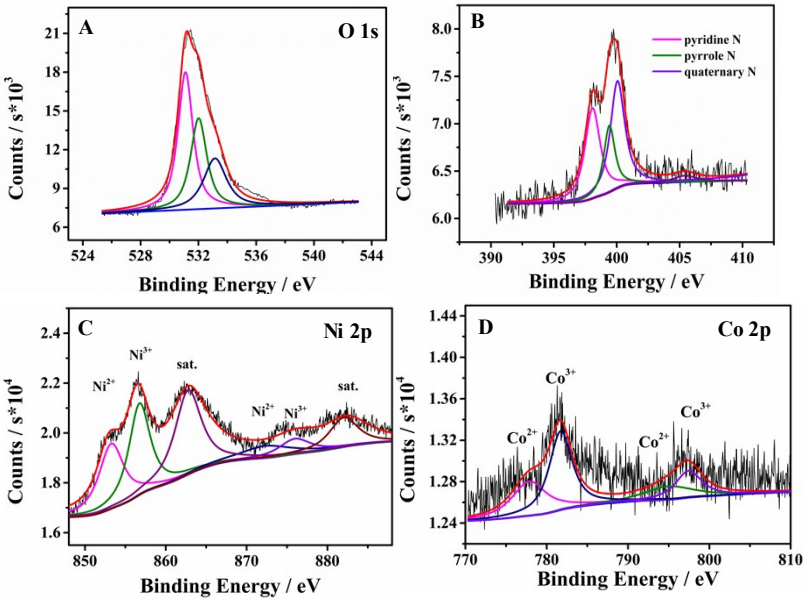

Fig. S3 XPS spectra of O 1s (A), N 1s (B), Ni 2p (C), Co 2p (D) on the surface of PDA/$La_5Ni_3Co_{2\text{-}500N}$ after 1000 CV cycles in 1.0 M KOH.

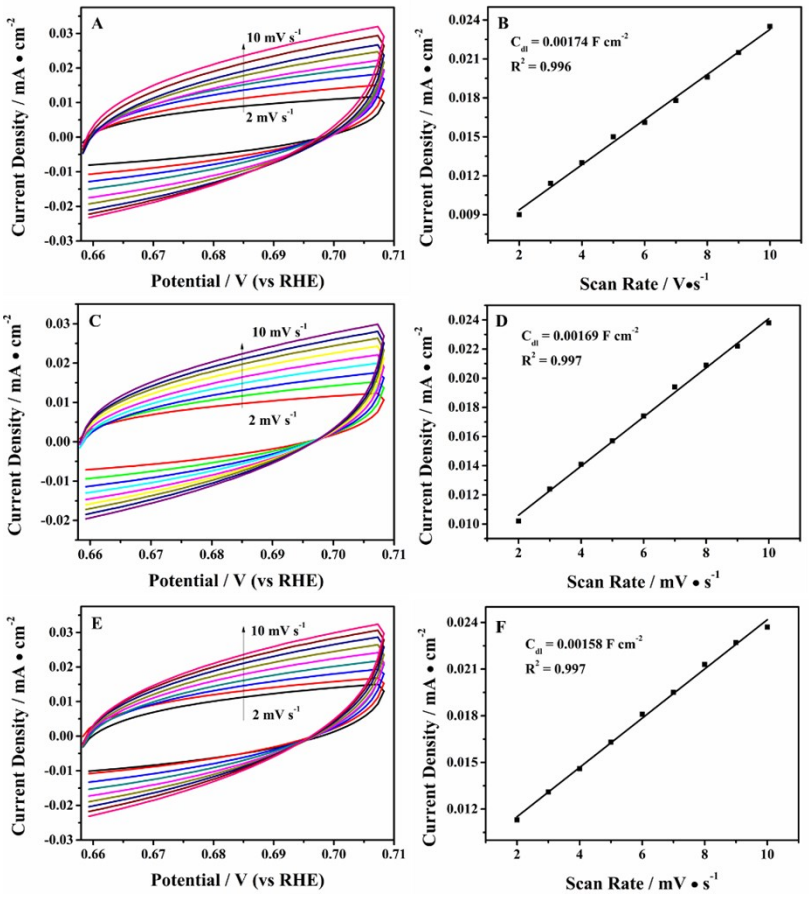

Fig. S4 Cyclic voltammograms (A, C and E) and corresponding linear fitting curves between current density and scan rate (B, D and F) of PDA/$L_5N_3C_{2\text{-}500N}$ (A and B), PDA/$L_5N_3C_{2\text{-}600N}$ (C and D), and PDA/$L_5N_3C_{2\text{-}700N}$ (E and F) in the non-Faradaic capacitance current range at scan rates from 2 to 10 mV·s^{-1}.

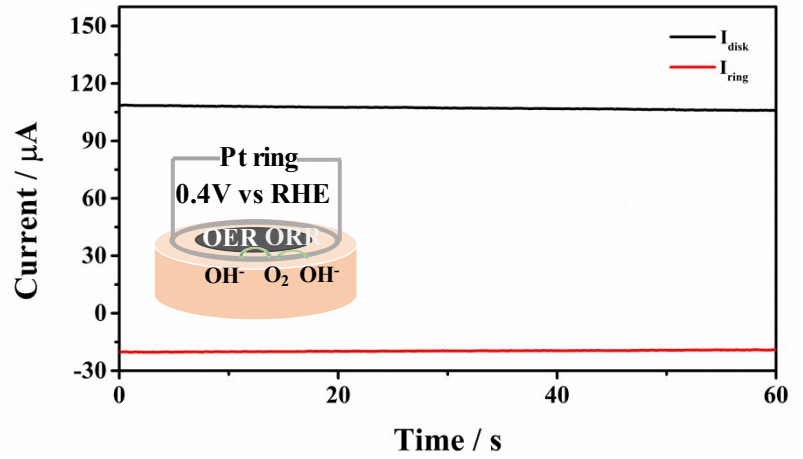

Fig. S5 Faradaic efficiency testing of PDA/$La_5Ni_3Co_{2\text{-}500N}$ for OER using RRDE measurements; ring current curve on a RRDE (1600 rpm) in N_2-saturated 1.0 M KOH solution (ring potential: 0.40 V vs RHE).

Table S1 Corresponding contents of different elements.

as-prepared composites	N	O	Co	Ni	La
PDA/$La_5Ni_3Co_2$	2.34	21.12	0.04	0.12	0.24
PDA/$La_5Ni_3Co_{2\text{-}500N}$	4.59	14.44	0.33	0.30	0.54
PDA/$La_5Ni_3Co_{2\text{-}600N}$	2.68	16.62	0.29	0.26	0.74
PDA/$La_5Ni_3Co_{2\text{-}700N}$	2.05	16.86	0.21	<0.10	1.62

Table S2 The contents of different species of O.

as-prepared composites	H_2O	–OH/O_2	O_2^{2-}/O^-
PDA/$La_5Ni_3Co_2$	41.1	58.9	—
PDA/$La_5Ni_3Co_{2\text{-}500N}$	20.7	41.7	36.6
PDA/$La_5Ni_3Co_{2\text{-}600N}$	33.4	40.0	26.6
PDA/$La_5Ni_3Co_{2\text{-}700N}$	26.9	47.3	25.8

Table S3 The contents of different species of N.

as-prepared composites	pyridine N	pyrrole N	graphite N	quaternary N
PDA/$La_5Ni_3Co_2$	17.9	34.9	35.4	11.8
PDA/$La_5Ni_3Co_{2\text{-}500N}$	50.4	21.4	—	28.2
PDA/$La_5Ni_3Co_{2\text{-}600N}$	47.0	23.7	19.7	11.7
PDA/$La_5Ni_3Co_{2\text{-}700N}$	24.7	15.9	25.2	34.2

Table S4 Comparison of OER activity data for various electrocatalyst.

electrocatalyst	electrolyte	Overpotential at 10 mA·cm^{-2} (V)	Tafel slope (mV· dec^{-1})	references
NiO–$(La_{0.613}Ca_{0.387})_2NiO_{3.562}$ nanohybrid	0.1 M KOH	0.373	42	1
BCFSn-721	0.1 M KOH	0.450	69	2
$LiCo_{0.8}Fe_{0.2}O_2$	0.1 M KOH	0.340	50	3
$Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$	0.1 M KOH	0.350	70	4
IrO_x	1.0 M NaOH	0.32±0.04	—	5
PDA/$La_5Ni_3Co_{2\text{-}500N}$	1.0 M KOH	0.360	48.1	This work

References

1. R. Liu, F. Liang, W. Zhou, Y. Yang and Z. Zhu, *Nano Energy*, 2015, **12**, 115-122.
2. X. Xu, C. Su, W. Zhou, Y. Zhu, Y. Chen and Z. Shao, *Adv. Sci.*, 2016, **3**, 1500187.
3. Y. Zhu, W. Zhou, Y. Chen, J. Yu, M. Liu and Z. Shao, *Adv. Mater.*, 2015, **27**, 7150-7155.
4. W. Zhou, M. Zhao, F. Liang, S. C. Smith and Z. Zhu, *Mater. Horiz.*, 2015, **2**, 495-501.
5. C.C.L. McCrory, S. Jung, J.C. Peters, and T.F. Jaramillo *J. Am. Chem. Soc.*, 2013, **135**, 16977-16987.