Supporting Information

Unusual Enhancement in the Electroreduction of Oxygen by NiCoPt by Surface Tunability through Potential Cycling

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Table S1. The activity comparison of various NCP catalysts

Catalyst	ECSA (m^2/g_{Pt})	Im (mA/mg_{Pt})	Is (mA/cm^2_{Pt})
NCP6/C	26.48	141.46	534.07
NCP8/C	13.169	96.24	729.97
NCP10/C	**68.18**	**505.24**	**741.31**
NCP16/C	21.7	271.36	651.709

Table S2. Comparison of electrochemical activity of Pt-based ternary alloy catalysts

S. No.	Catalyst	ECSA (m^2/g_{Pt})		MA (A/mg_{Pt})		Normalized MA loss or gain @ 0.9 V (%) /cycles (1k=1000)			Ref.
		Before stability	After stability	Before stability	After stability	Loss (%)	Gain (%)	Cycles (k)	
1	Pt65Ir11Co24/C – 400 ºC	70	25	0.41	0.06	85		20k	1
2	Pt-Rh-Ni/C	N/A	N/A	0.82	1.14		39	4k	2
3	Pt-Rh-Ni/C	N/A	N/A	0.82	0.72	12.2		8k	2
4	Pt-Rh-Ni/C	N/A	N/A	0.82	0.32	61		30k	2
5	Pt3Ni-Fe/C (13 nm)	28.9	27.46	0.37	N/A	25		16k	3
6	Mo-Pt3Ni/C	67.7	N/A	6.98	6.6	5.5		8k	4
7	Pt2CuNi/C	35.3	36.85	2.35	1.91	18.7		4k	5
8	Pt2CuNi/C	35.3	N/A	2.35	1.60	31.9		10k	5
9	PtCu3Co	112	N/A	0.37	N/A	N/A	N/A	N/A	6
10	PtCuCo3	111	N/A	0.49	N/A	N/A	N/A	N/A	6
11	Pt30Ni51Co19 – 1 step	8.6	N/A	N/A	N/A	47		4k	7
12	Pt48Ni27Co25 – 2 step	3	N/A	N/A	N/A	51		4k	7
13	Pt36Ni15Co49/C – 400 ºC	56.6	N/A	0.56	0.11	80.4		10k	8
14	Pt36Ni15Co49/C – 700 ºC	48.0	N/A	0.73	0.15	79.5		10k	8
15	Pt36Ni15Co49/C – 926 ºC	47.7	N/A	0.88	0.21	76.1		10k	8
16	Ni@Au@PtNi/C	51	50	0.38	0.35	<10		10k	9
17	PtCoMn	N/A	N/A	2.1	1.0	52.4		1.08k	10
18	PtCoMn	N/A	N/A	N/A	0.2.16	71.4		2.16k	10
19	Pt2FeCo/C –L10	2.6	3.2	0.51	0.4	21.6		2.16k	11

20	Pt6FeCo/C –L12	3.45	2	0.27	0.17	37.0		5k	11
21	Pt2FeCo/C – 800 ºC	60	52	0.505	0.38	24.8		5k	12
22	Pt2FeCo/C	4.51	3.87	0.0665	0.0286	57		5k	13
23	Pt2FeNi/C	4.25	5.12	0.0684	0.0286	58.2		2k	13
24	Pt2CoNi/C	3.97	3.10	0.0634	0.0298	53		2k	13
25	PtNiFe nanocubes	70.4	N/A	0.00534	0.00498	6.7		1k	14
26	PtNiFe octrahedran	73.3	N/A	0.0042	N/A	N/A		N/A	14
27	PtNiFe polyhedran	68.5	N/A	0.00467	N/A	N/A		N/A	14
28	PtNiFe nanowire	69.3	N/A	0.00399	N/A	N/A		N/A	14
29	Pt-Ni-Ir/C	49.45	44.51	0.511	0.337	34		10k	15
30	Fct-PtFeCu	43	36	0.5	0.38	24		10k	16
31	Fct-PtFeCo	52	37	0.48	0.32	33.3		10k	16
30	**PtNiCo/C**	**68.1**	**54.7**	**0.5052**	**0.5811**		**15**	**10k**	**This work**
31	**PtNiCo/C**	**68.1**	**52.3**	**0.505**	**0.6557**		**29.8**	**20k**	**This work**
32	**PtNiCo/C**	**68.1**	**51.5**	**0.505**	**0.6957**		**37.7**	**30k**	**This work**

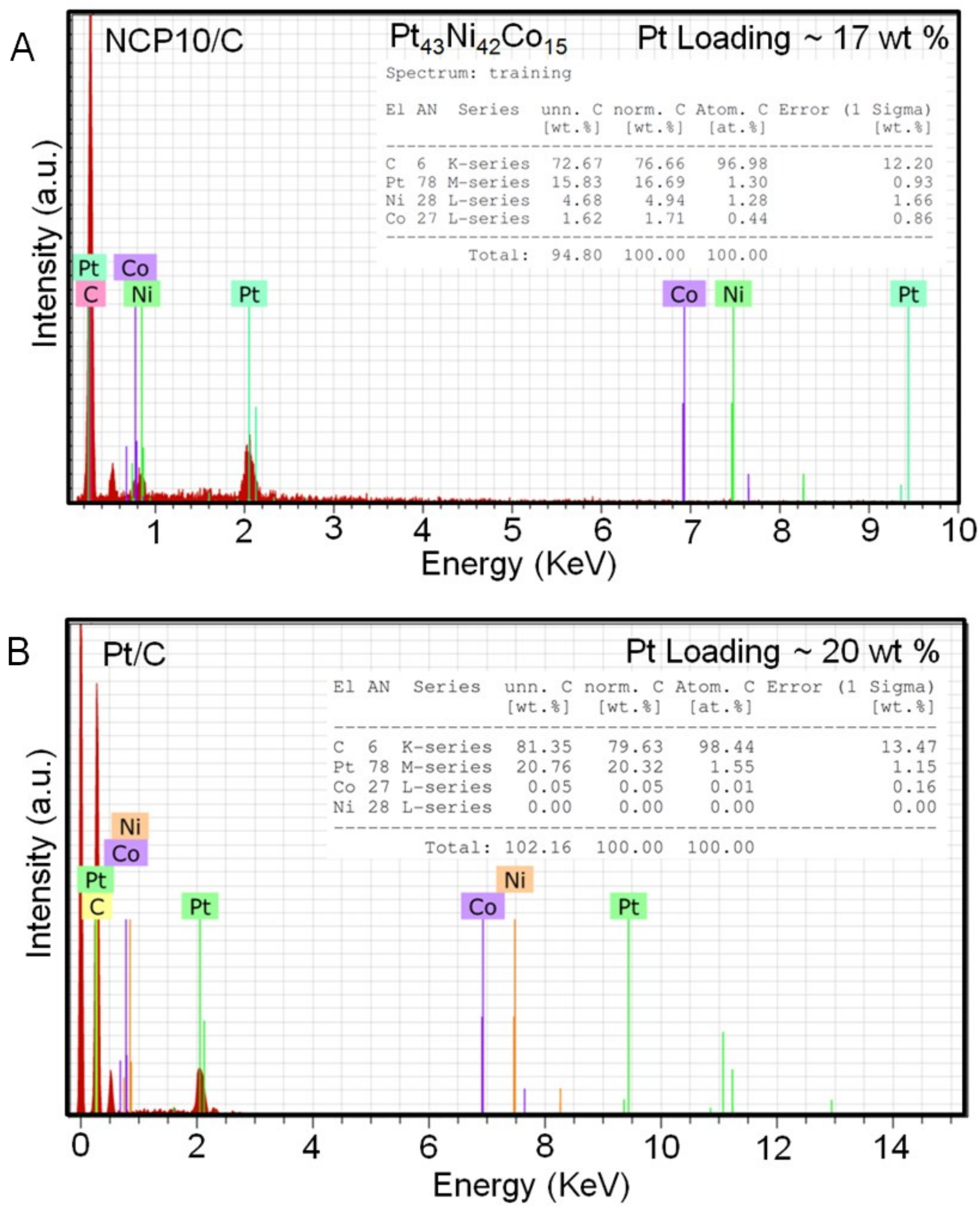

Figure S1. EDX patterns of (A) The NCP10/C catalyst and (B) commercial Pt/C.

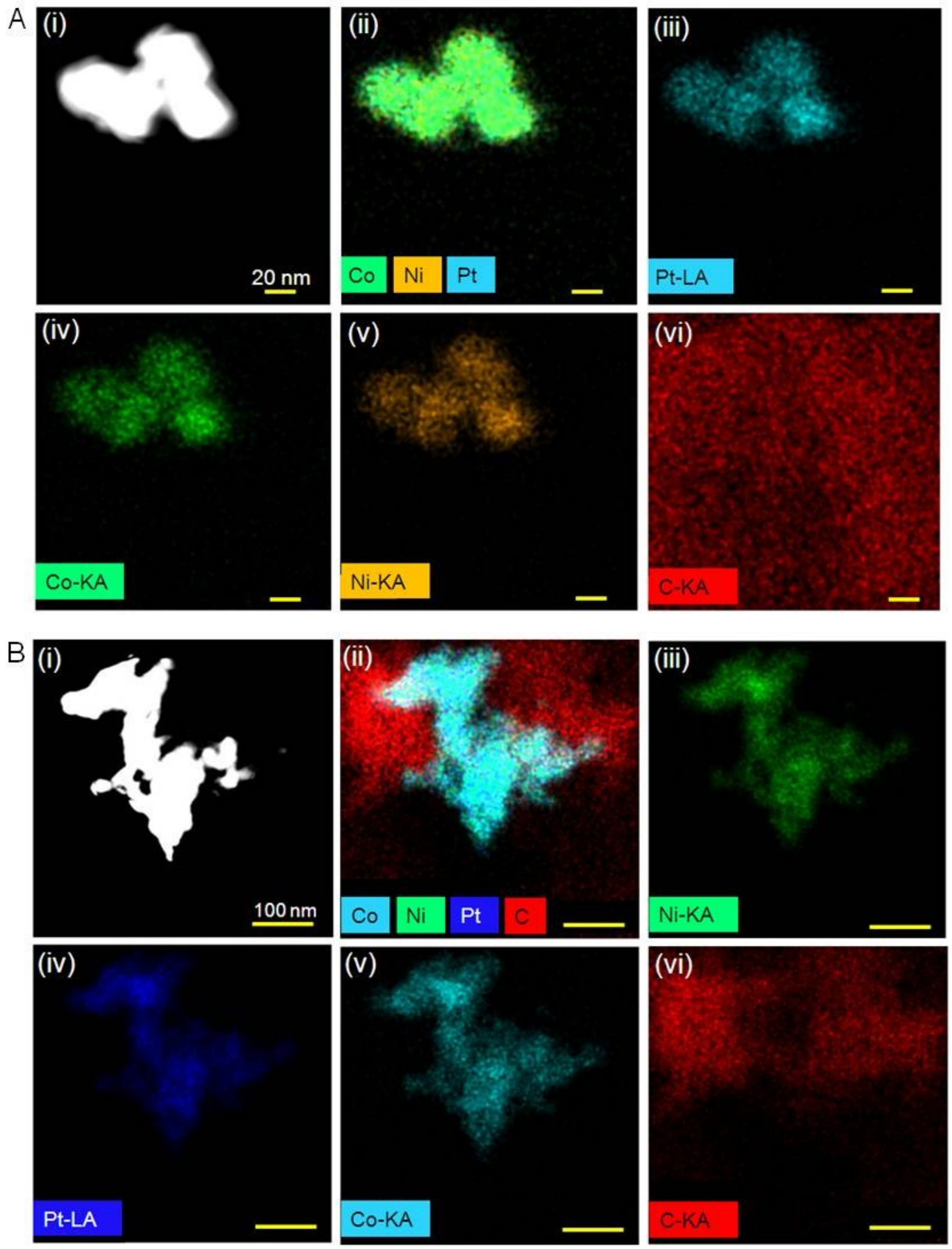

Figure S2. A (i) HAADF-STEM image of a NCP10/C before stability test. (ii-vi) EDS elemental mapping distributions for (ii) Co, Ni and Pt;(iii) Pt;(iv) Co; (v) Ni and (vi) C. B (i) HAADF-STEM image of a NCP10/C after stability test. (ii-vi) EDS elemental mapping distributions for (ii) Co, Ni, Pt and C;(iii) Ni;(iv) Pt;(v) Co and (vi) C.

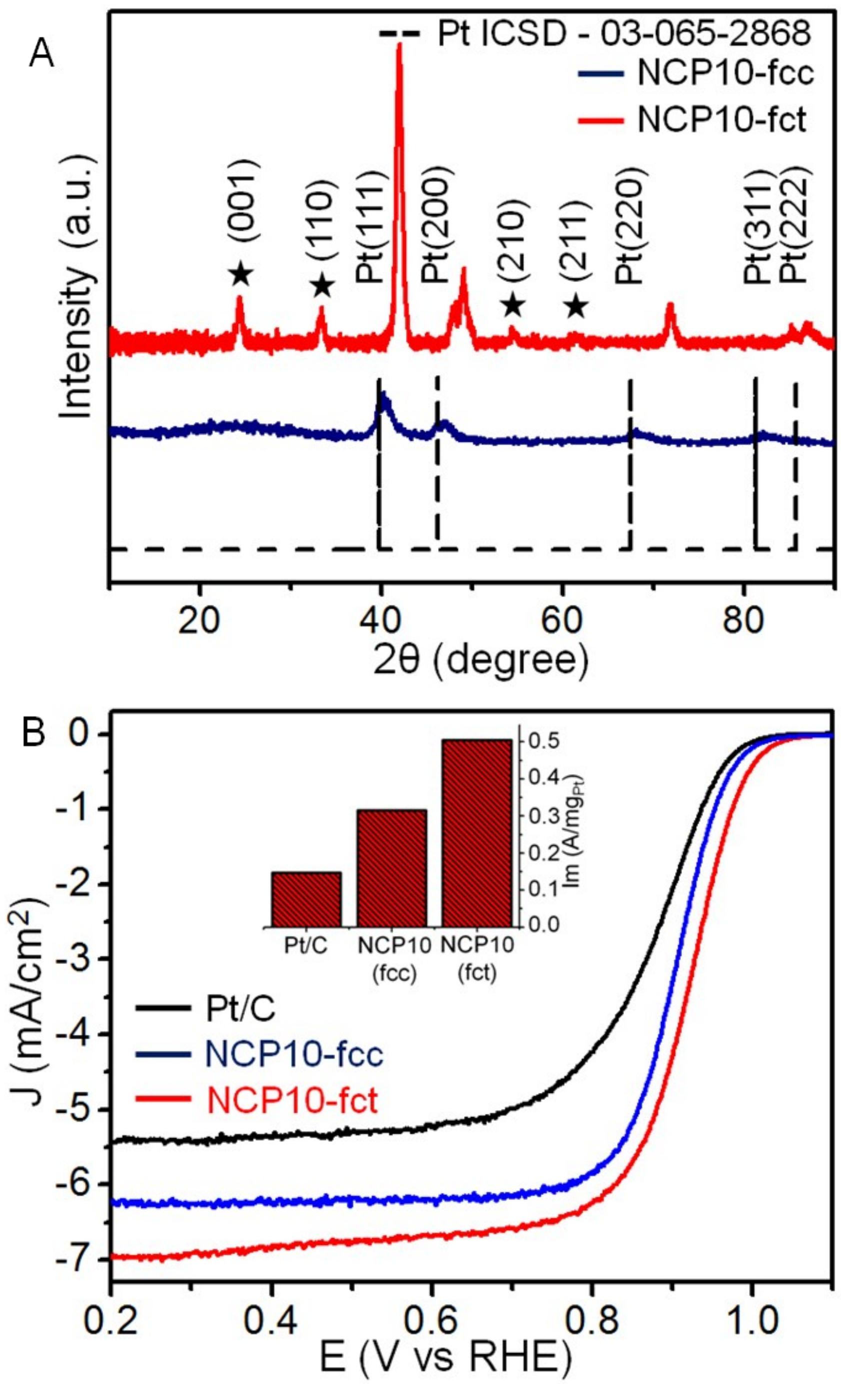

Figure S3. (A) Comparative XRD pattern of fcc and fct structure of NCP10/C catalyst with Pt ICSD-03-065-2868. (B) Linear sweep voltammograms of NCP10(fcc), NCP10(fct) and Commercial Pt/C catalyst, recorded in the presence of O_2-saturated 0.1 M $HClO_4$ at 25^{o}C at a sweep rate of 10 mVs^{-1} and rotation rate of 1600 rpm and inset shows the their comparative mass activity (Im).

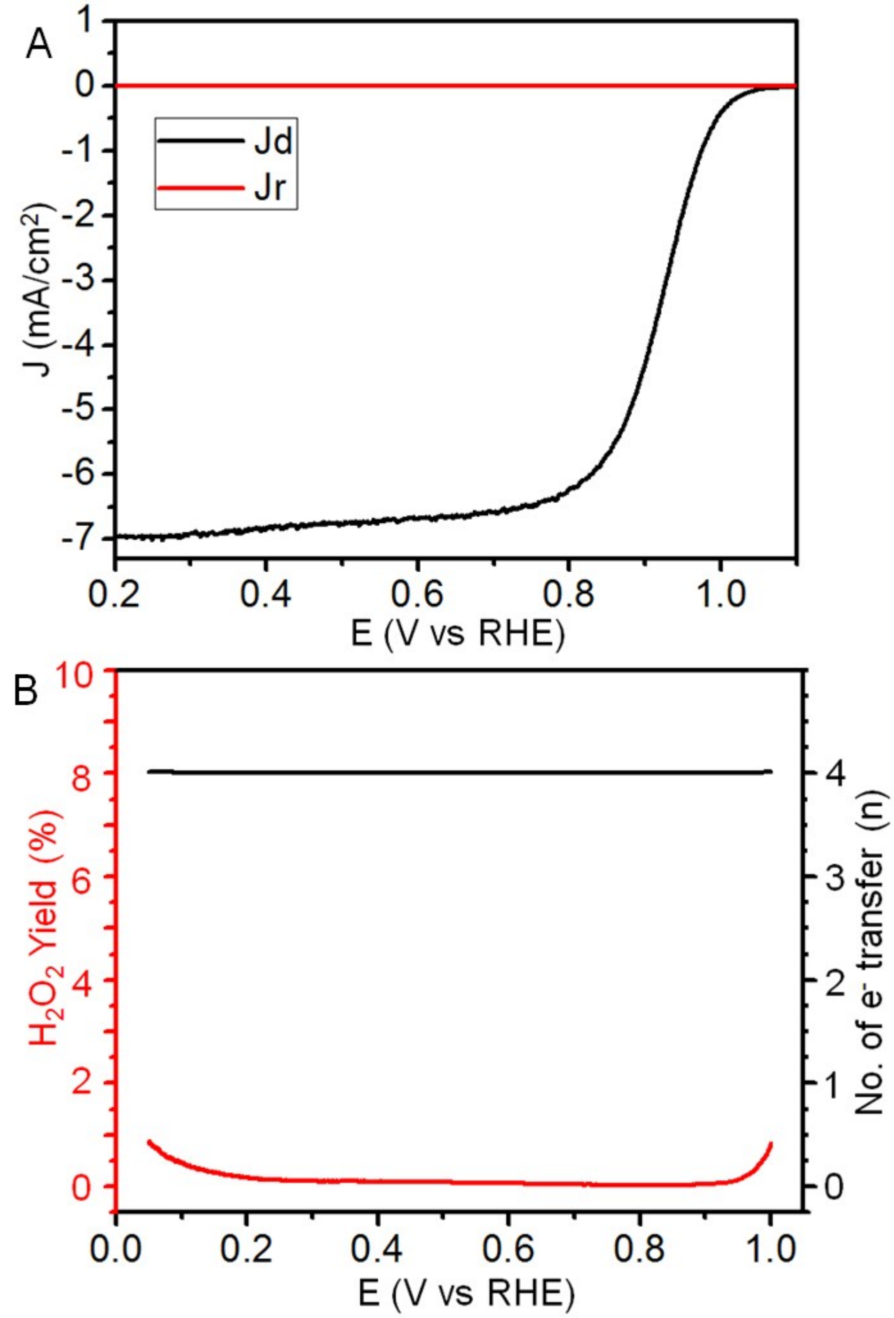

Figure S4. (A) Rotating ring-disk electrode (RRDE) voltammograms of NCP10/C catalyst. The disk electrode was scanned at a rate of 10 mV s^{-1} with 1600 rpm and the ring potential was kept constant at 1.3 V vs. RHE. (B) H_2O_2 percentage yield and no. of electron transfer during the reaction.

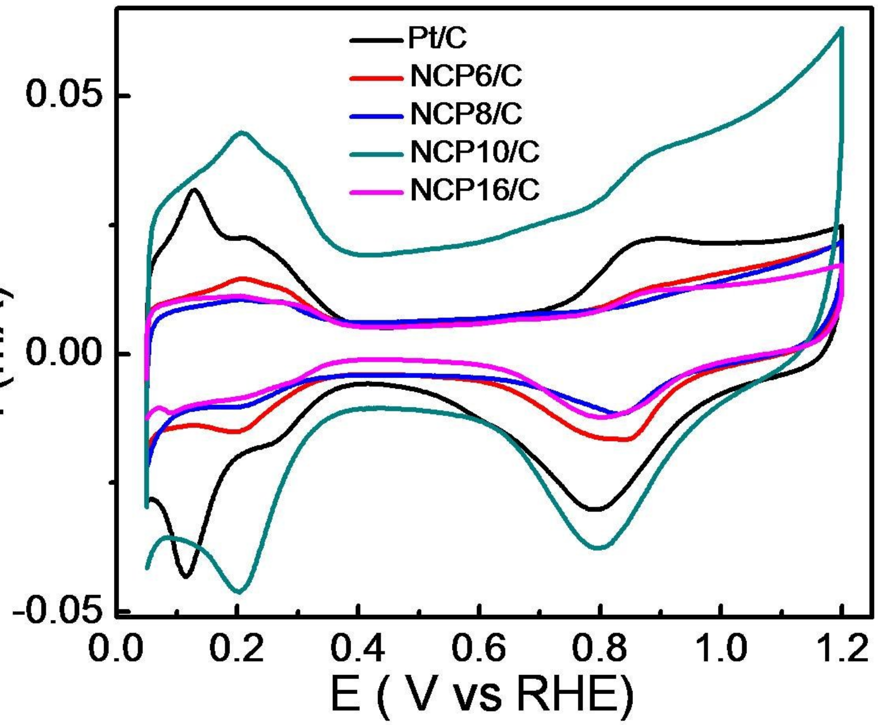

Figure S5. The Cyclic voltammograms comparison of NCP6/C, NCP8/C, NCP10/C, NCP16/C electrocatalyst with Commercial Pt/C catalyst, recorded in the presence of N_2-saturated 0.1 M $HClO_4$ at a sweep rate of 20 mVs^{-1}.

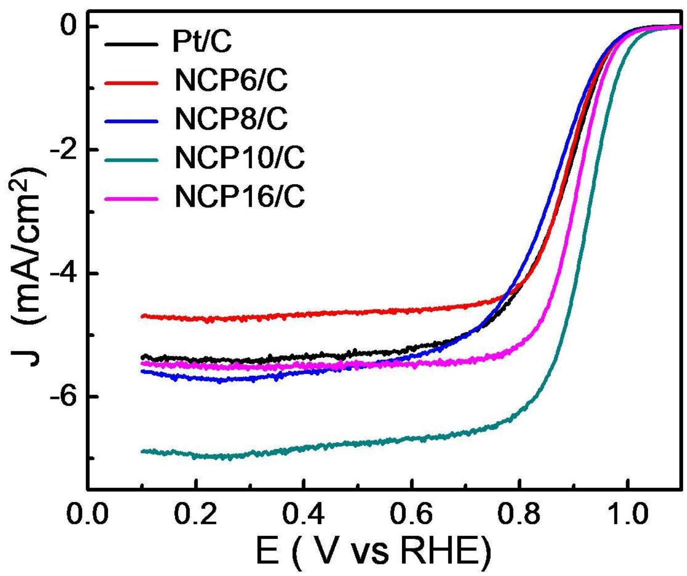

Figure S6. Linear sweep voltammograms of NCP6/C, NCP8/C, NCP10/C, NCP16/C and Commercial Pt/C catalyst, recorded in the presence of O_2-saturated 0.1 M $HClO_4$ at 25°C at a sweep rate of 10 mVs^{-1} and rotation rate of 1600 rpm

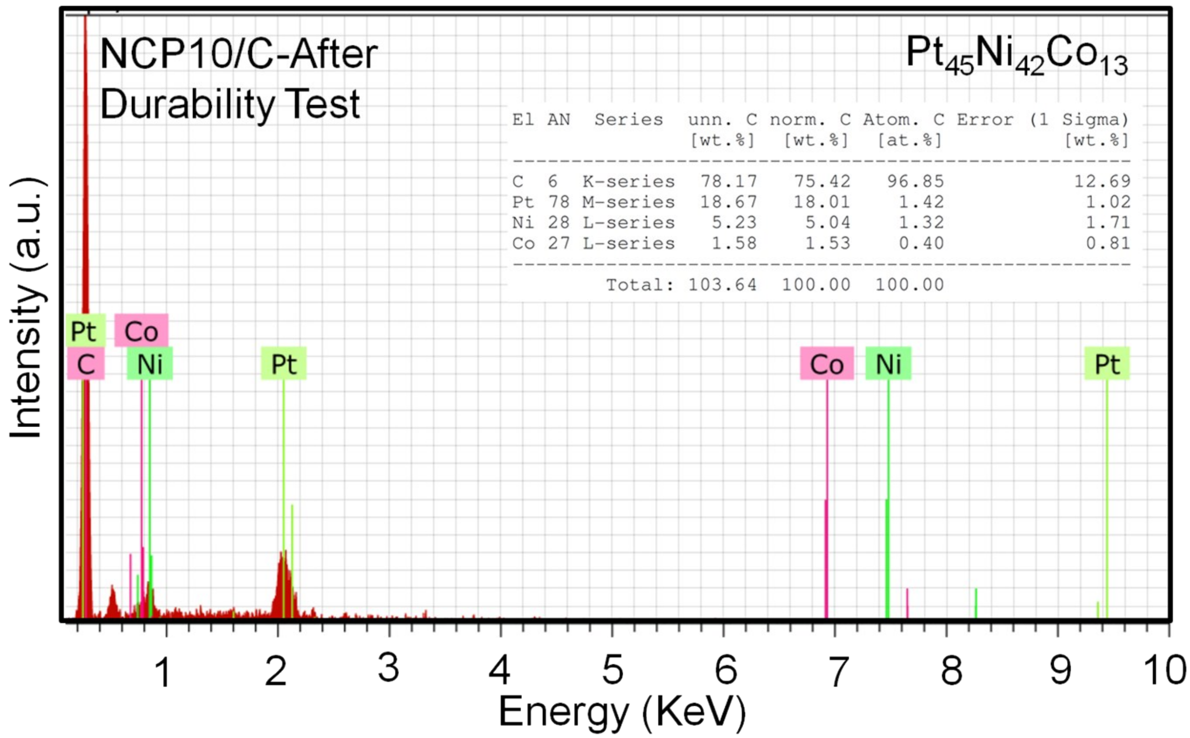

Figure S7. EDX patterns of the NCP10/C catalyst after 30 k durability cycles.

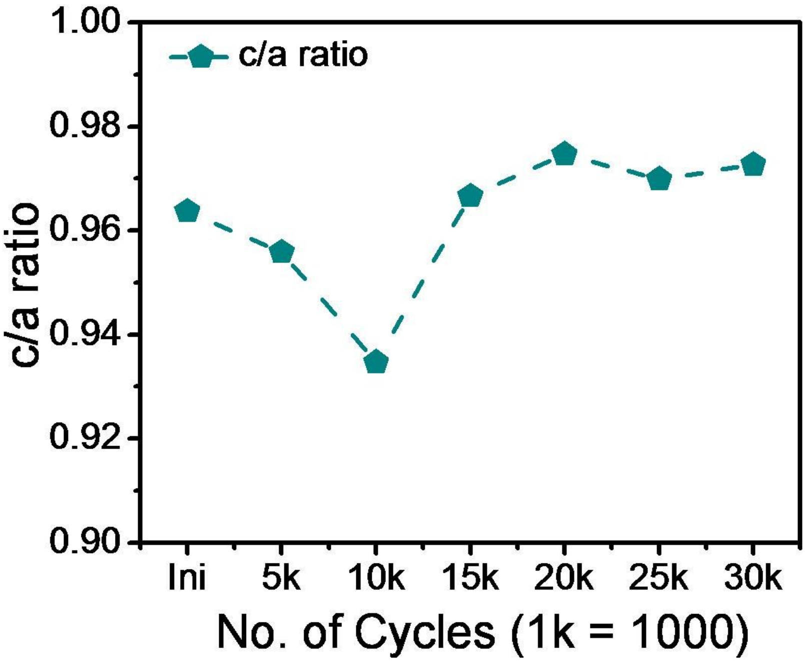

Figure S8. The c/a ratio of the NCP10/C catalyst calculated from the XRD pattern after different stability cycles.

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