Electronic Supplementary Information:

Hybrid catalyst of Pt/$CoNiO_2$ on carbon nanotubes and its synergetic effect towards remarkable ethanol electro-oxidation in alkaline media

Tingting Tang,[#a] Qiuping Gan,[#a] Xiaohui Guo,[a] Hailin Dong,*[b] Jifang Zhang,[a] Yanchun Zhao,*[a] Jianniao Tian,[a] Xiulin Yang*[a]

[a] *Key Laboratory for the Chemistry and Molecular Engineering of Medicinal Resources (Ministry of Education of China), College of Chemistry and Pharmacy, Guangxi Normal University, Guilin 541004, PR China.*

E-mail: xiulin.yang@kaust.edu.sa*;* yanchunzhao@aliyun.com

[b] *Catalysis and Chiral Technologies, Johnson Matthey (Shanghai) Catalyst Co.,Ltd., 586 Dong Xing Road, Songjiang Industrial Zone, Shanghai 201613 P.R.China*

E-mail: *donghl1980@126.com*

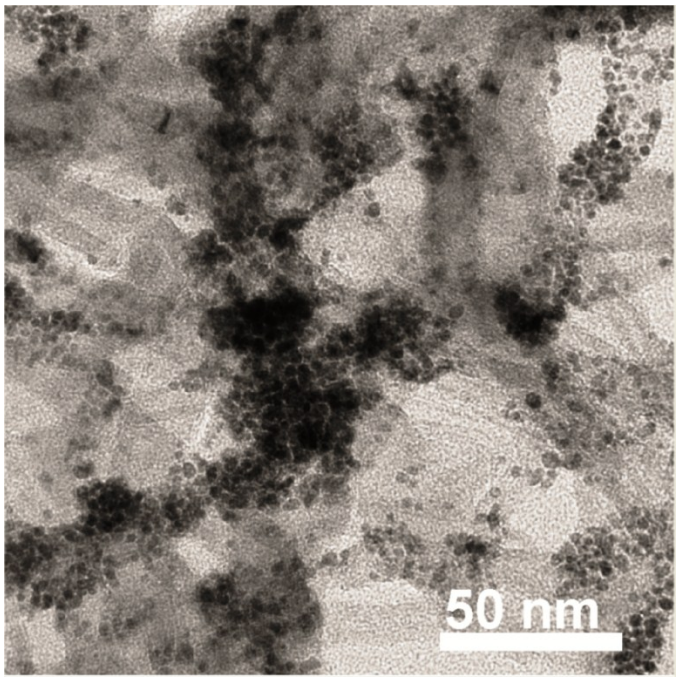

Fig. S1. TEM image of Pt/$CoNiO_2$-CNTs.

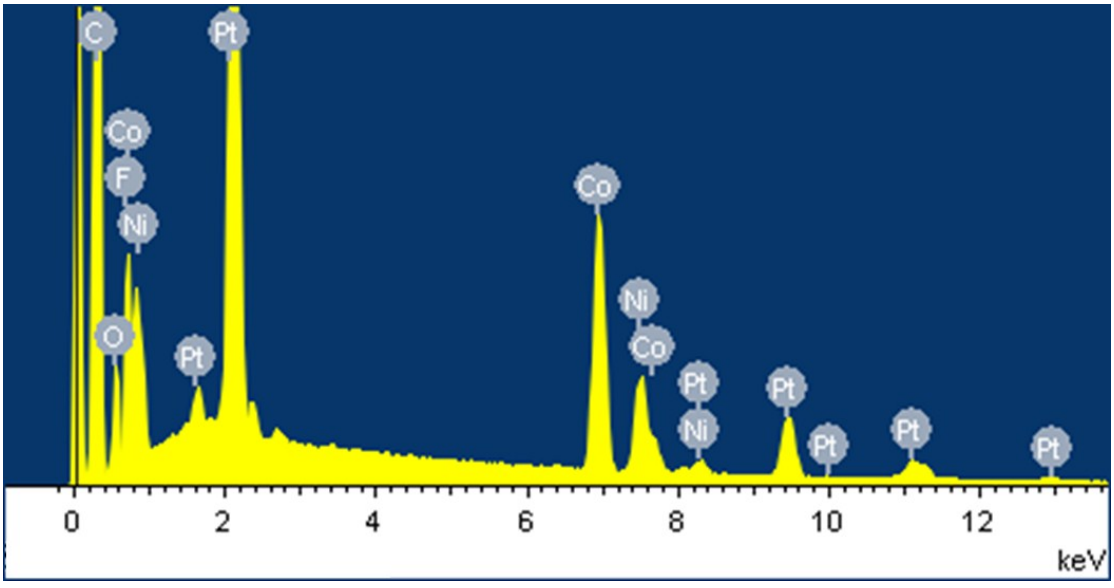

Fig. S2. EDS spectrum of Pt/$CoNiO_2$-CNTs composite.

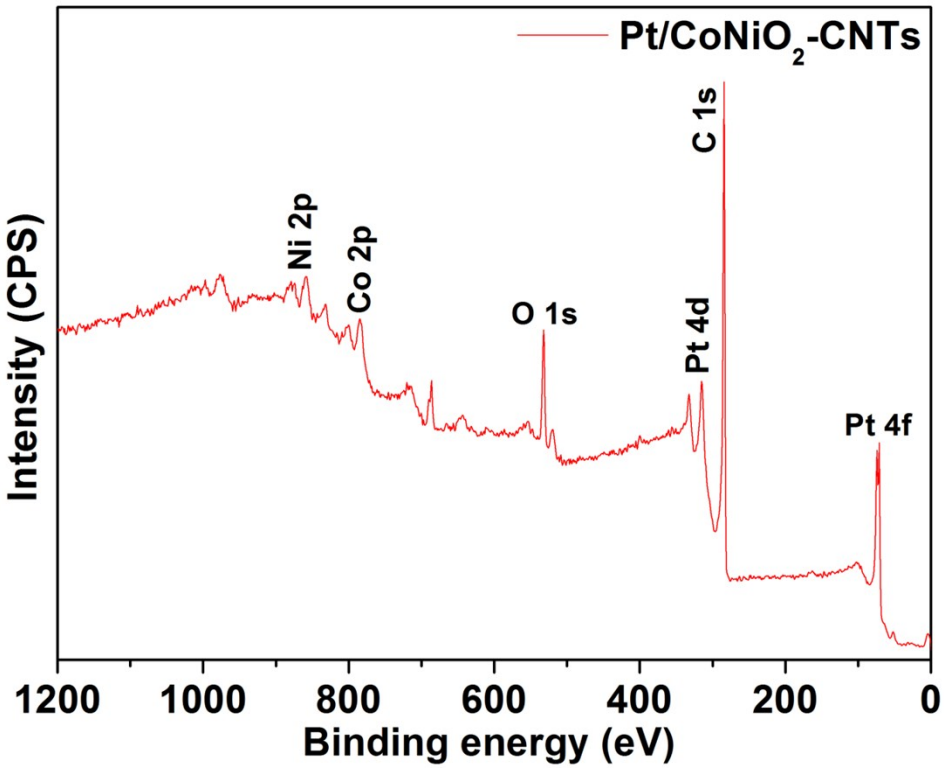

Fig. S3. Full XPS spectrum for Pt/$CoNiO_2$-CNTs composite.

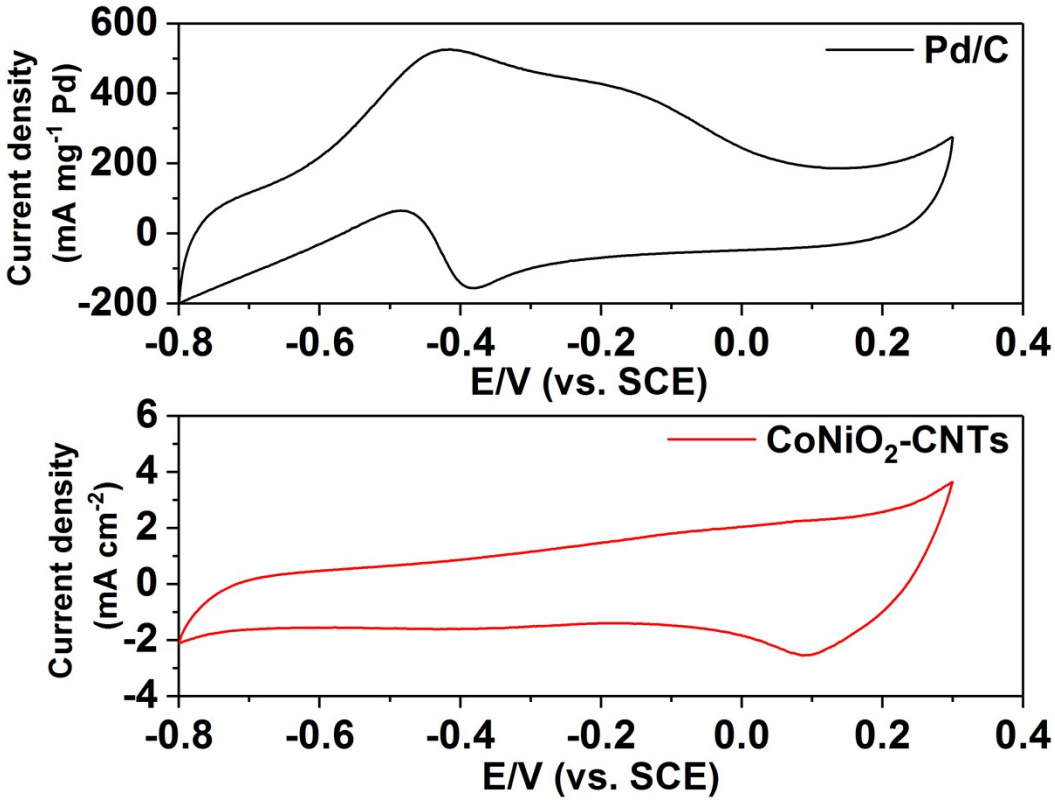

Fig. S4. CV curves of Pd/C and $CoNiO_2$-CNTs in 1.0 M KOH + 0.5 M CH_3CH_2OH solution with a scan rate of 50 mV s^{-1}.

Table S1. Summarized Pt-based catalysts for ethanol electro-oxidation in alkaline solution.

Catalysts	Loading	Forward peak current density	j_f/j_b	Electrolytes
Pt/$CoNiO_2$-CNTs (this work)	70.8 ug cm^{-2} Pt	1136.2 mA mg^{-1} Pt	1.22	1.0 M KOH + 0.5 M CH_3CH_2OH
Pt-Ni-Co/C[1]	N.A.	125 A g^{-1} metal	N.A.	0.10 M NaOH + 1.0 M ethanol
Pt/NiCe[2]	N.A.	87.6 mA mg^{-1} Pt	N.A.	1 M NaOH + 1 M C_2H_5OH
Ni@Pt/C[3]	0.6 mg cm^{-2}	15.75 mA cm^{-2}	5.51	0.5 M ethanol + 0.5 M NaOH
Cu@Pt NPs[4]	N.A.	10.9 mA mg^{-1}	N.A.	0.5 M ethanol + 0.5 M NaOH
Pt_3Mo_1/C[5]	0.486 mg cm^{-2}	5 mA cm^{-2}	1.62	0.5 M ethanol + 0.5 M KOH
Pt-Sn/CNF[6]	N.A.	2.25 mA cm^{-2}	N.A.	1.0 M ethanol + 0.1 M NaOH
Pt/C-TiO_2[7]	28 ug cm^{-2} Pt	5.4 mA	1.04	0.5 M ethanol + 0.1 M KOH
PtAu/C[8]	N.A.	42.5 mA g^{-1}	N.A.	1.0 M ethanol + 1.0 M KOH
Ru@PtPd/C[9]	0.425 mg cm^{-2}	3.6 A mg^{-1}	1.5	1.0 M ethanol + 1.0 M KOH
Pt/Au nanowires[10]	N.A.	6.2 mA cm^{-2}	4.77	1.0 M ethanol + 1.0 M KOH
Pt-PbO_x/C[11]	0.249 mg cm^{-2}	4.2 A mg^{-1}	0.89	1.0 M ethanol + 1.0 M NaOH
Hollow PtAu[12]	1.83 μg cm^{-2}	10.3 mA cm^{-2}	1.72	0.5 M ethanol + 0.5 M NaOH
Nano Pt(Ni)/Ti[13]	N.A.	12.5 mA cm^{-2}	1.32	2.0 M ethanol + 0.5 M NaOH
Ni/Pt[14]	N.A.	347.41 mA cm^{-2}	2.16	1.0 M ethanol + 1.0 M NaOH
Pt-Ni/C[15]	N.A.	480 mA cm^{-2}	N.A.	2.0 M ethanol + 1.0 M NaOH

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