Supporting Information for

High-density Surface Protuberances Endow Ternary PtFeSn Nanowires with High Catalytic Performance for Efficient Alcohol Electrooxidation

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Supporting Figures and Tables

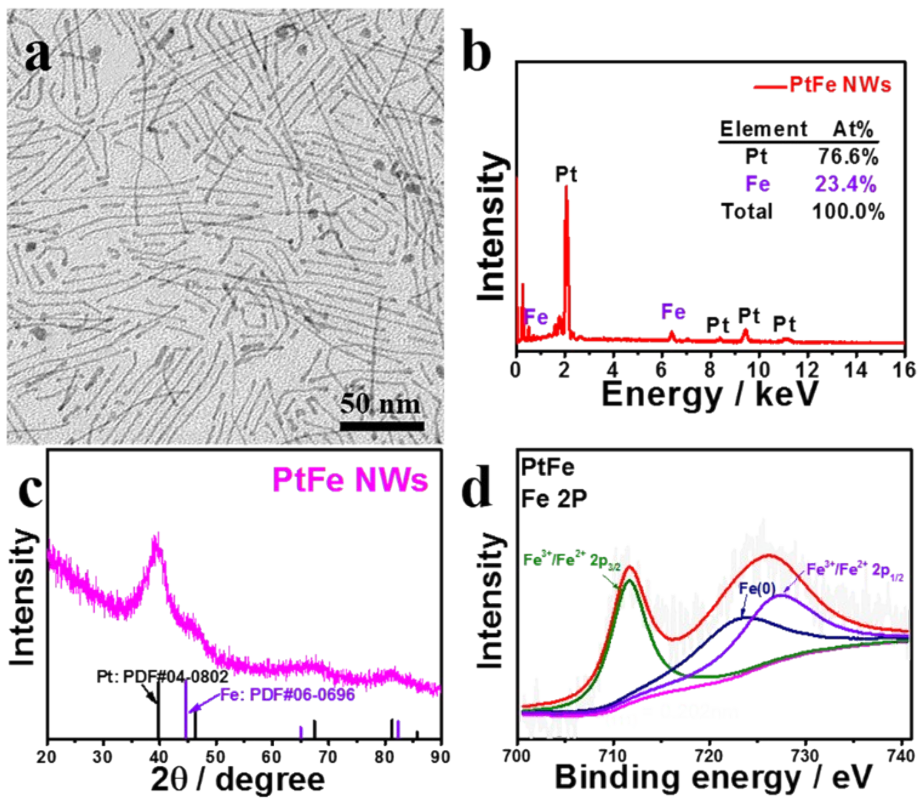

Fig. S1 (a) The TEM image, (b) SEM-EDS spectrum, (c) XRD pattern and (d) XPS pattern of the PtFe NWs.

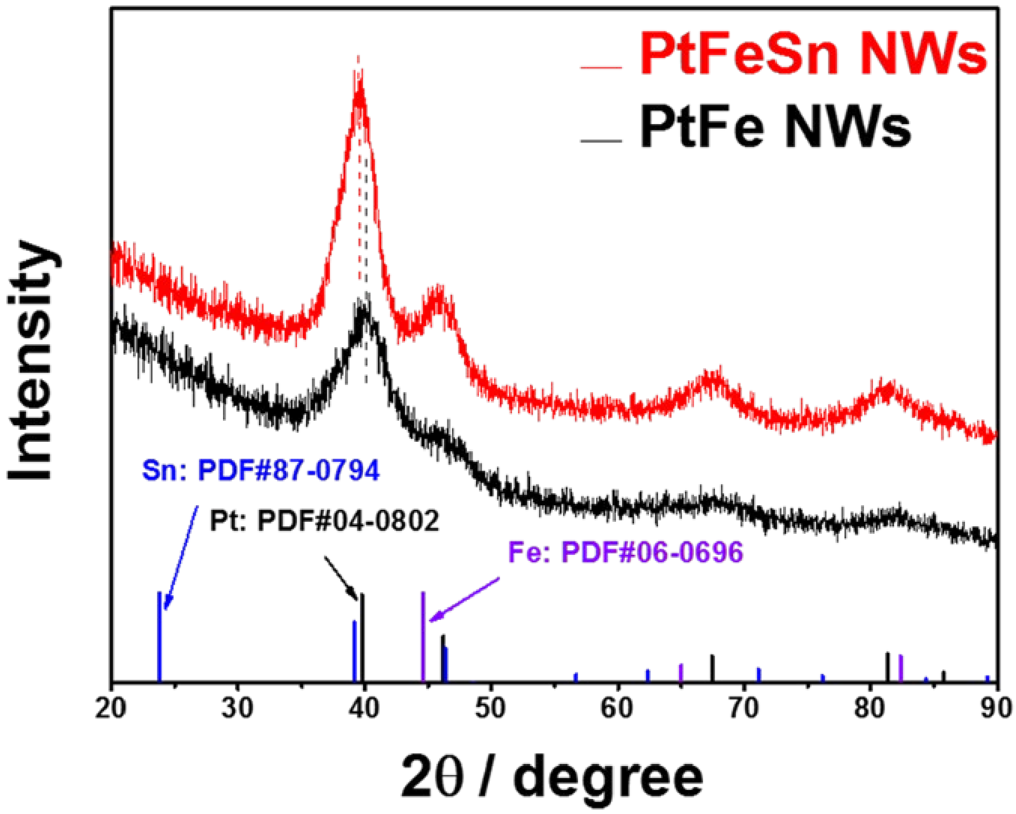

Fig. S2 XRD patterns of PtFeSn and PtFe NWs.

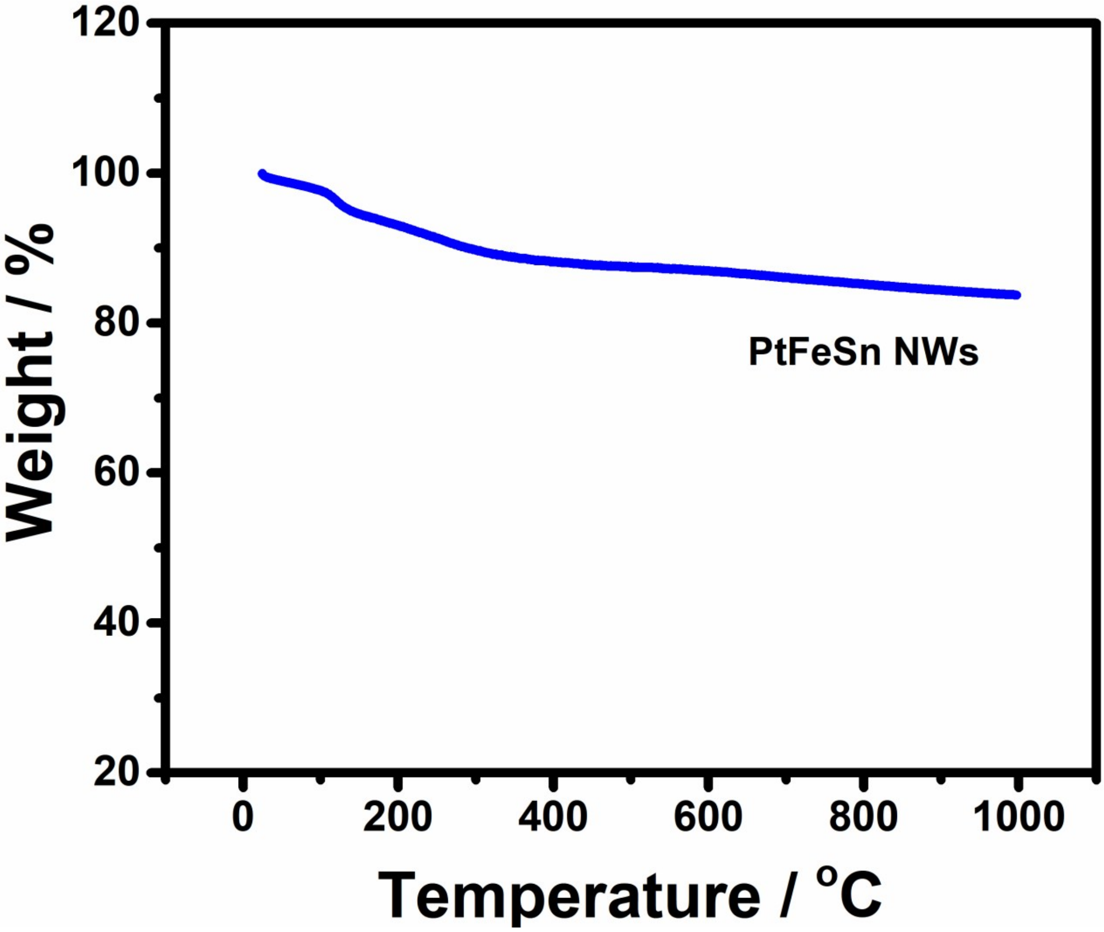

Fig.S3 TGA curve of PtFeSn NWs.

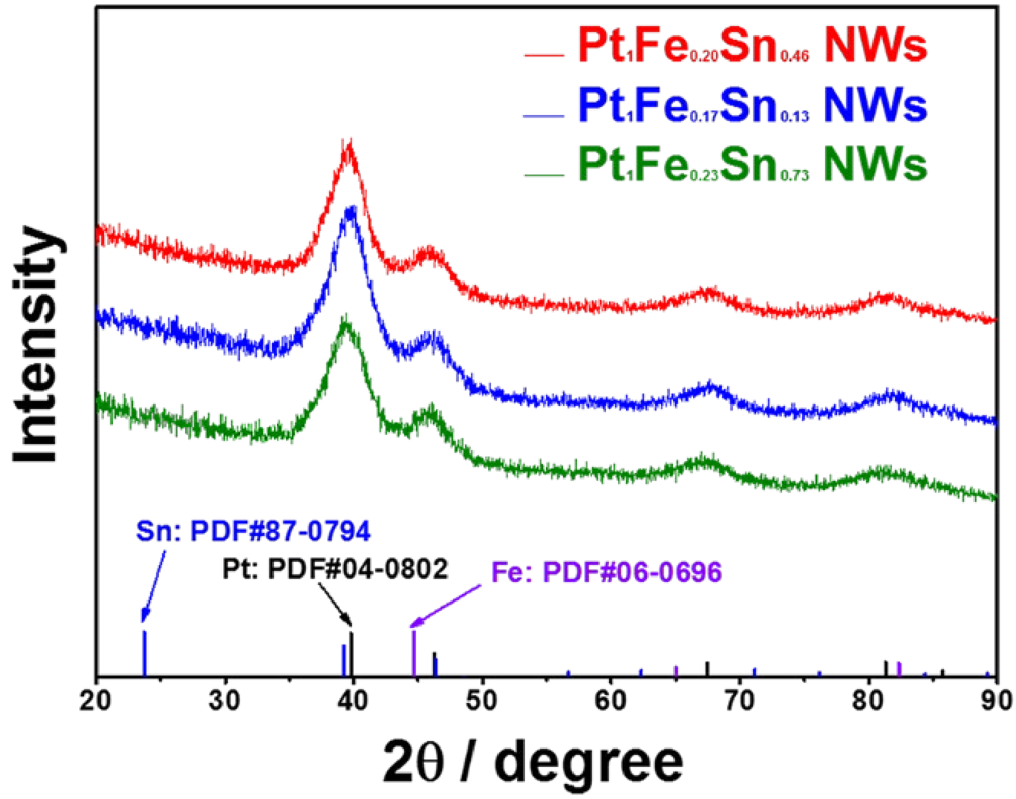

Fig. S4 XRD patterns of $Pt_1Fe_{0.20}Sn_{0.46}$, $Pt_1Fe_{0.17}Sn_{0.13}$ and $Pt_1Fe_{0.23}Sn_{0.73}$ NWs.

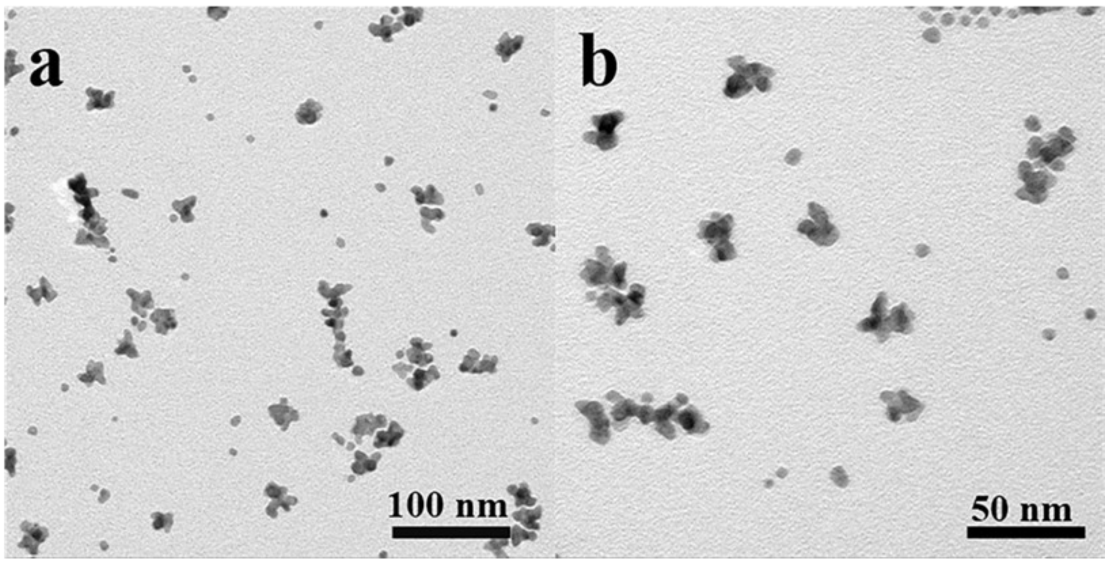

Fig. S5 (a, b) The TEM images of PtFeSn NPs.

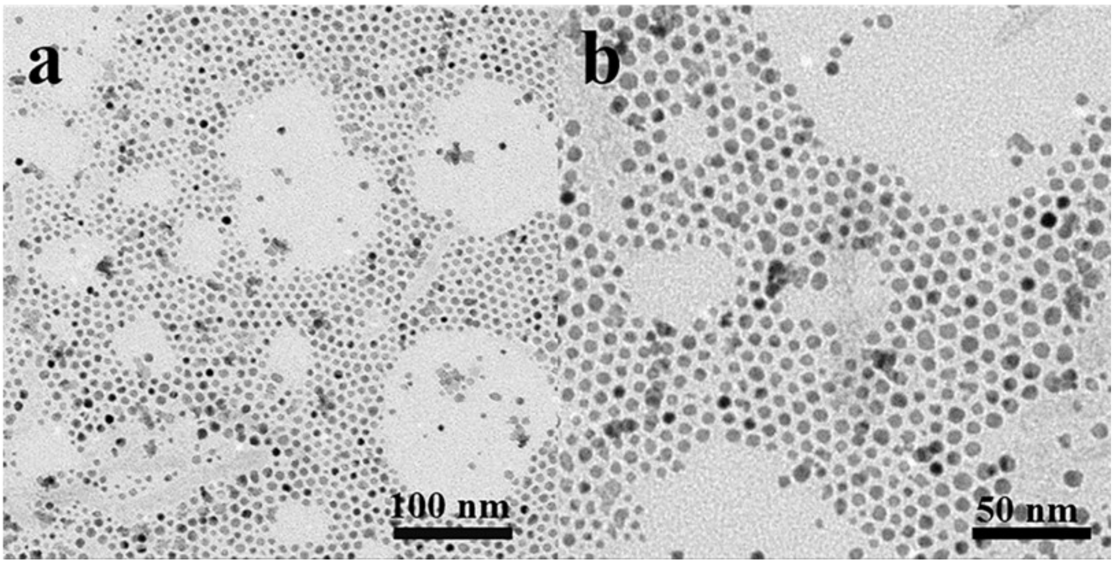

Fig. S6 (a, b) The TEM images of PtSn NPs.

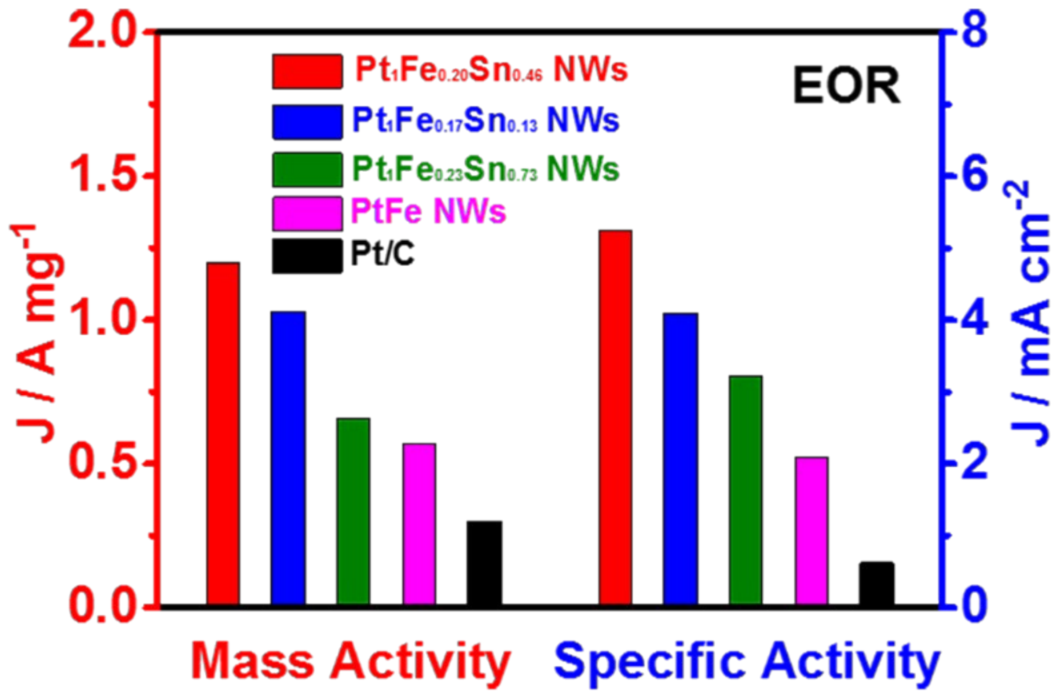

Fig. S7 The mass and specific activities of different catalysts operated in 0.1 M $HClO_4$ + 0.5 M C_2H_5OH solution.

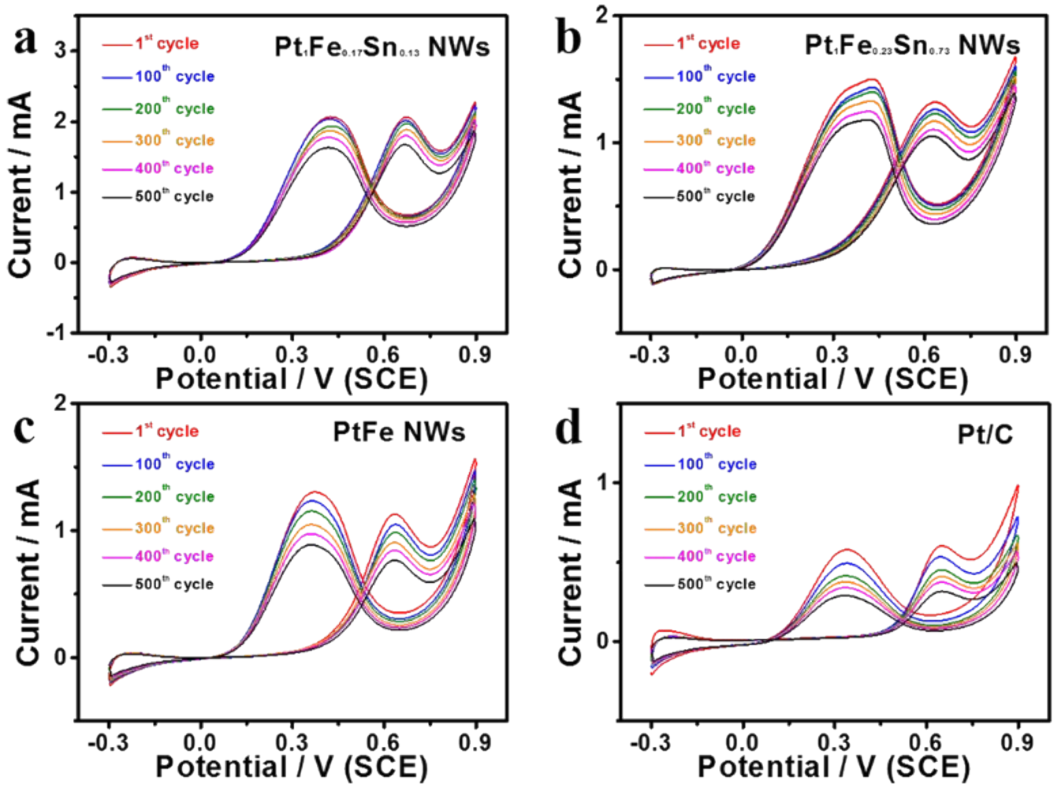

Fig. S8 CV curves of (a) $Pt_1Fe_{0.17}Sn_{0.13}$ NWs, (b) $Pt_1Fe_{0.23}Sn_{0.73}$ NWs, (c) PtFe NWs and (d) commercial Pt/C for the EOR over 500 cycles.

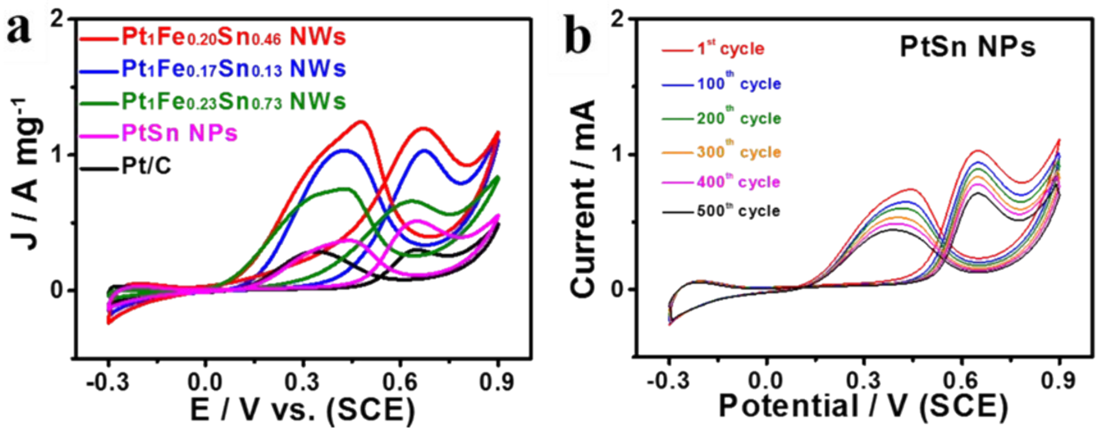

Fig. S9 (a) CV curves of different catalysts operated in 0.1 M $HClO_4$ + 0.5 M C_2H_5OH solution. (b) CV curves of the PtSn NPs for the EOR over 500 cycles.

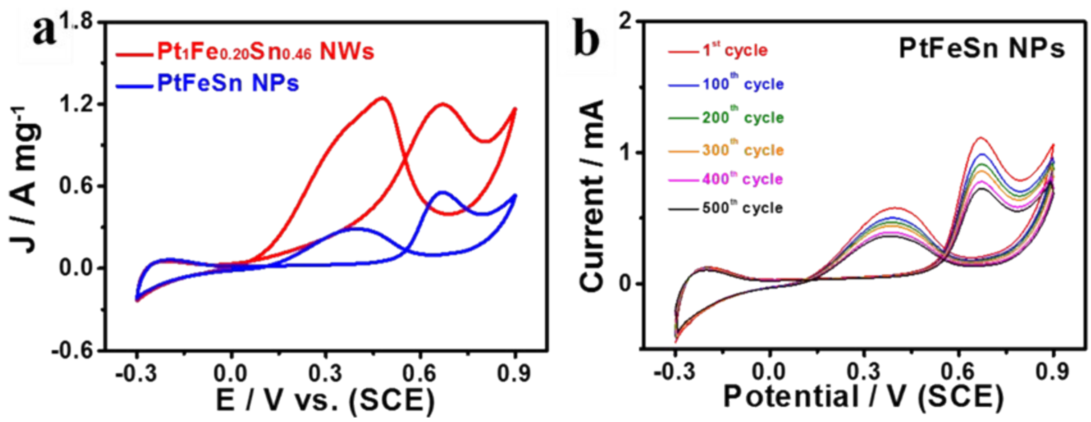

Fig. S10 (a) CV curves of different catalysts operated in 0.1 M $HClO_4$ + 0.5 M C_2H_5OH solution. (b) CV curves of the PtFeSn NPs for the EOR over 500 cycles.

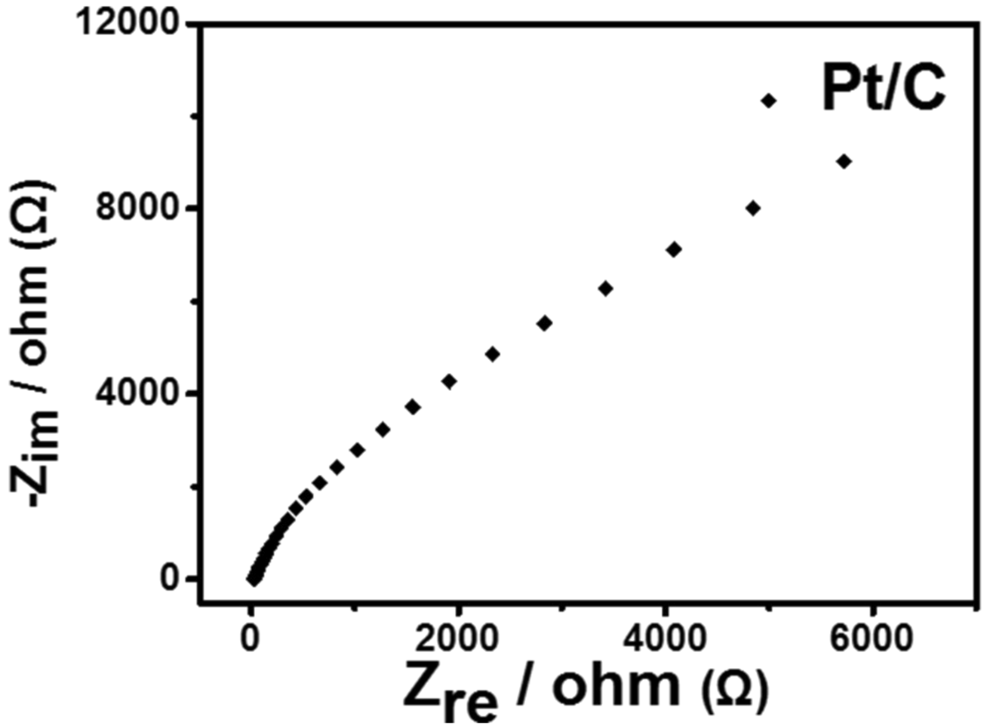

Fig. S11 Nyquist plot of commercial Pt/C operated in the solution of 0.1 M $HClO_4$ + 0.5 M C_2H_5OH at the potential of 0.25 V.

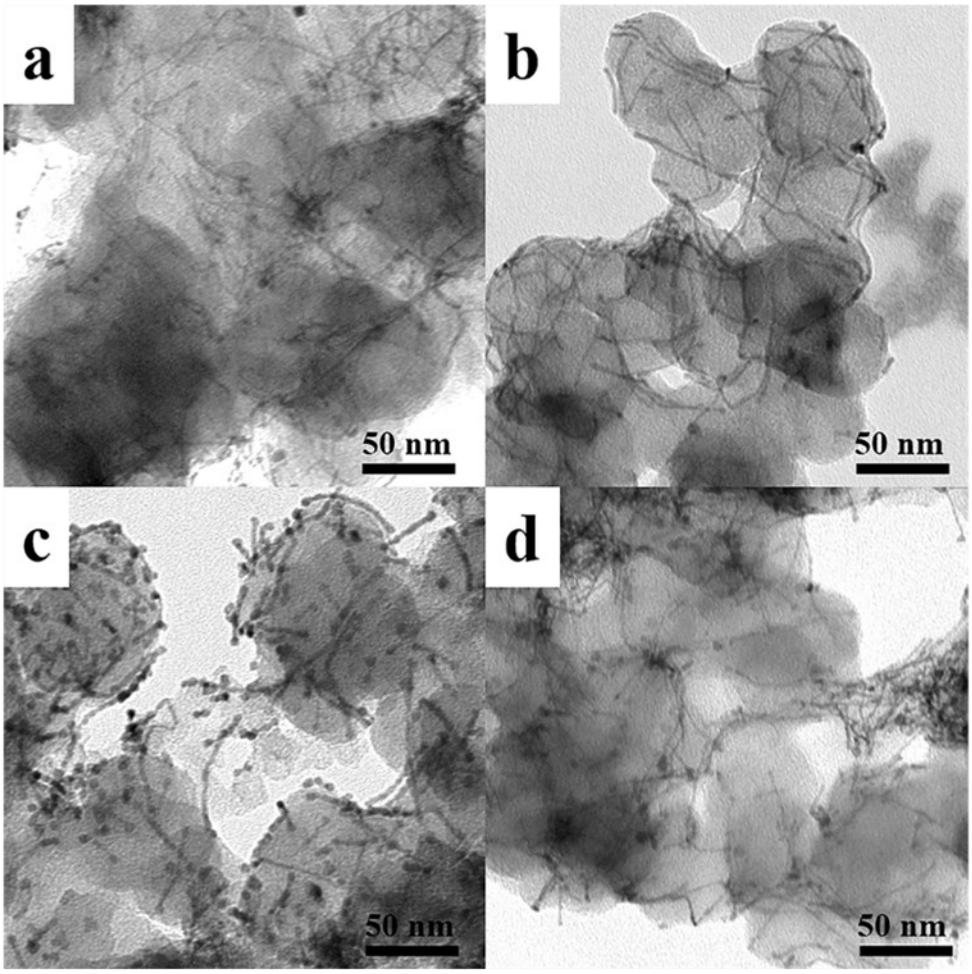

Fig. S12 The TEM images of (a) $Pt_1Fe_{0.17}Sn_{0.13}$ NWs/C, (b) $Pt_1Fe_{0.20}Sn_{0.46}$ NWs/C, (c) $Pt_1Fe_{0.23}Sn_{0.73}$ NWs/C and (d) PtFe NWs/C before electrochemical durability test.

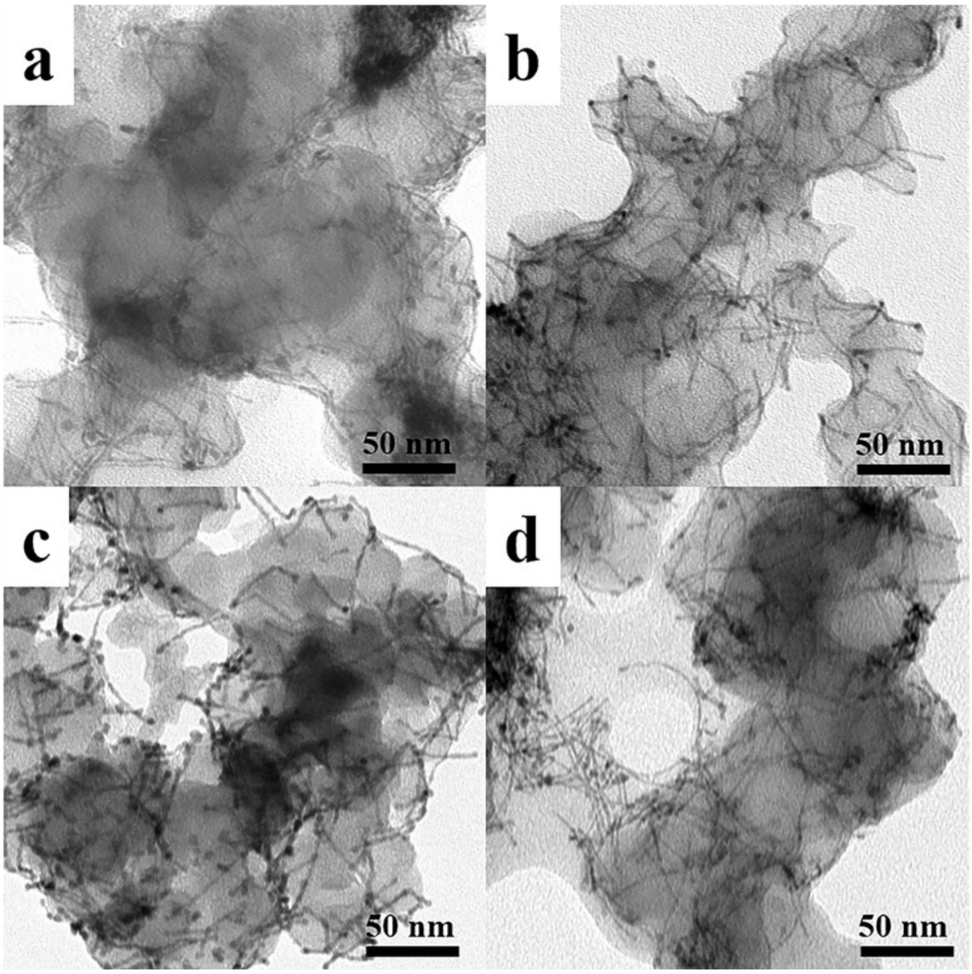

Fig. S13 The TEM images of (a) $Pt_1Fe_{0.17}Sn_{0.13}$ NWs/C, (b) $Pt_1Fe_{0.20}Sn_{0.46}$ NWs/C, (c) $Pt_1Fe_{0.23}Sn_{0.73}$ NWs/C and (d) PtFe NWs/C after 500 cycles in 0.1 M $HClO_4$ + 0.5 M C_2H_5OH solution at 50 mV s^{-1}.

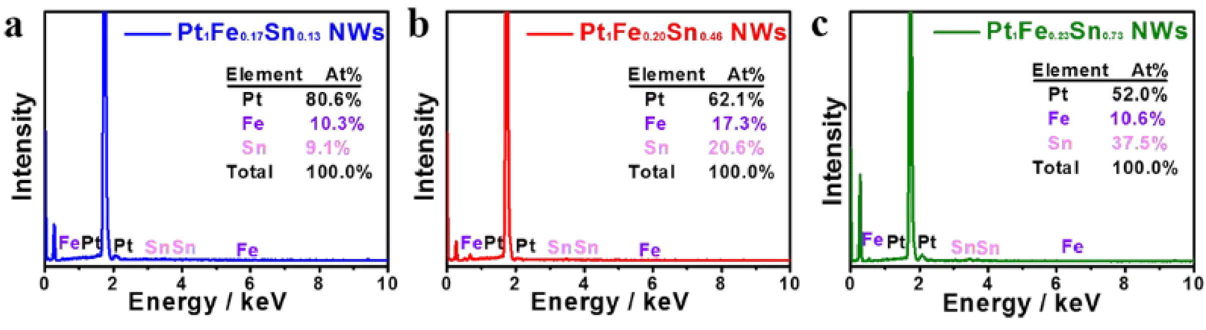

Fig. S14 SEM-EDS of $Pt_1Fe_{0.17}Sn_{0.13}$ NWs, (b) $Pt_1Fe_{0.20}Sn_{0.46}$ NWs and (c) $Pt_1Fe_{0.23}Sn_{0.73}$ NWs after 500 cycles in 0.1 M $HClO_4$ and 0.5 M C_2H_5OH at 50 mV s^{-1}.

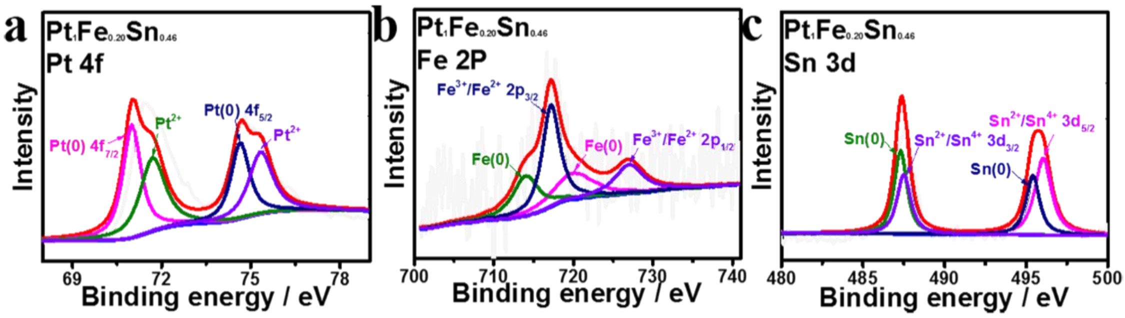

Fig.S15 XPS patterns of $Pt_1Fe_{0.20}Sn_{0.46}$ NWs. (a) Pt 4f, (b) Fe 2p and (c) Sn 3d of PtFeSn NWs after 500 cycles in 0.1 M $HClO_4$ and 0.5 M C_2H_5OH at 50 mV s^{-1}.

Table S1. Comparison of $Pt_1Fe_{0.20}Sn_{0.46}$ NWs with other Pt-based electrocatalysts for the EOR.

Catalysts	Peaks currents from CV curves J_m (A/mg)	Electrolyte	References
$Pt_1Fe_{0.20}Sn_{0.46}$ NWs	1.21	0.1 M $HClO_4$ + 0.5 M C_2H_5OH	**This work**
Pt–NiO/C2 NPs	0.64	0.5 M H_2SO_4 + 1 M C_2H_5OH	J. Power Sources **2015**, *278,* 119-127.
Au_2Pt_1 NWNs	0.57	0.5 M H_2SO_4 + 0.5 M C_2H_5OH	Int. J. Hydrogen Energy **2016**, *41*, 21, 8871-8880.
Pt/MV–RGO–CH	0.44	0.5 M H_2SO_4 + 1.3 M C_2H_5OH	Electron. Mater. Lett **2018**, *14*, 616-628.
$Pt_{94}Zn_6$ NWs	0.40	0.1 M $HClO_4$ + 0.2 M C_2H_5OH	Nano. Res **2019**, *12*, 5, 1173-1179.
Pt–Sn–Ce/C (50:20:30)	0.38	0.5 M H_2SO_4 + 0.5 M C_2H_5OH	Appl. Catal. B-Environ **2015**, *165*, 176-184.
Pt/C-Cu3P 50%	0.41	0.5 M H_2SO_4 + 1 M C_2H_5OH	Electrochim. Acta **2016**, *220,* 193-204.
networked Pt_6Sn_3 NWs	1.08	0.1 M $HClO_4$ + 0.5 M C_2H_5OH	J. Mater. Chem. A **2017**, *5*, 24626–24630.

Table S2. Comparison of $Pt_1Fe_{0.20}Sn_{0.46}$ NWs with other Pt-based electrocatalysts for the MOR.

Catalysts	Peaks currents from CV curves J_m (A/mg)	Electrolyte	References
$Pt_1Fe_{0.20}Sn_{0.46}$ NWs	1.49	0.1 M $HClO_4$ + 0.5 M CH_3OH	**This work**
$Pt_{94}Zn_6$ NWs	0.51	0.1 M $HClO_4$ + 0.2 M CH_3OH	Nano. Res **2019**, *12*, 5, 1173-1179.
Pt/graphene-TiO_2-40%	0.42	0.5 M H_2SO_4 + 0.5 M CH_3OH	J. Power Sources **2015**, *279,* 210-217.
Pt/C/GA	0.41	0.5 M H_2SO_4 + 0.5 M CH_3OH	Electrochim. Acta **2016**, *189,* 175-183.
Pt–MoO_3–RGO HNRAs	0.81	0.5 M H_2SO_4 + 0.5 M CH_3OH	J. Mater. Chem. A **2016**, *4*, 1923–1930.
Pt/$Ti_{0.95}Fe_{0.05}$N NTs	0.72	0.5 M H_2SO_4 + 1.0 M CH_3OH	Int. J. Hydrogen Energy **2018**, *43*, 20, 9777-9786.
Pt/N-CNTs@TiNiN	0.86	0.5 M H_2SO_4 + 1.0 M CH_3OH	Int. J. Hydrogen Energy **2018**, *43*, 50, 22519-22528.
Pt/SPG	1.13	0.5 M H_2SO_4 + 0.5 M CH_3OH	Electrochim. Acta **2018**, *285,* 202-213.