Bimetallic Pt-M (M = Fe, Co, Ni) nanobunches assembed by ultrathin nanowires with strong synergy and rich surface defects for enhanced methanol oxidation electrocatalysis

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Table S1. Actual contents of elements in different catalysts as determined by EDS, XPS and ICP-MS results

Catalysts	Pt/M			
	Designed ratio	**EDS**	**ICP**	**XPS**
Pt_3Co	75.00/25.00	79.80/20.20	75.91/24.09	71.15/28.55
PtCo	50.00/50.00	52.61/47.39	51.87/48.13	46.06/53.94
$PtCo_3$	25.00/75.00	21.67/78.33	23.62/76.38	20.15/79.85
Pt_3Ni	75.00/25.00	77.16/22.84	72.49/27.51	70.33/29.67
PtNi	50.00/50.00	37.86/62.84	37.37/62.63	34.37/65.63
$PtNi_3$	25.00/75.00	21.32/78.68	23.35/76.65	19.71/80.29
Pt_3Fe	75.00/25.00	69.62/30.38	68.39/31.61	64.23/35.77
PtFe	50.00/50.00	45.92/54.08	46.28/53.72	42.34/57.66
$PtFe_3$	25.00/75.00	29.47/70.53	28.66/71.34	31.98/68.02

Table S2. The MOR performance of the catalysts in acidic and alkaline media

Catalyst	Media	Onset potential/ V	j_P/ mA·mg$^{-1}_{Pt}$	j_P/ mA·cm^{-2}	ECSA ($m^2 \cdot g^{-1}_{Pt}$)
Pt_3Co	0.5 M H_2SO_4	0.489	173.83	33.33	22.42
	1.0 M KOH	0.465	208.80	40.03	-
PtCo	0.5 M H_2SO_4	0.449	632.96	78.90	74.75
	1.0 M KOH	0.375	589.85	67.50	-
$PtCo_3$	0.5 M H_2SO_4	0.439	419.56	22.78	40.08
	1.0 M KOH	0.485	120.09	6.52	-
Pt_3Ni	0.5 M H_2SO_4	0.469	223.57	42.37	24.15
	1.0 M KOH	0.475	274.15	51.96	-
PtNi	0.5 M H_2SO_4	0.419	908.08	84.34	103.61
	1.0 M KOH	0.395	1162.21	107.65	-
$PtNi_3$	0.5 M H_2SO_4	0.519	13.15	0.7	1.59
	1.0 M KOH	0.565	6.31	0.34	-
Pt_3Fe	0.5 M H_2SO_4	0.479	225.82	39.09	23.17
	1.0 M KOH	0.455	348.92	60.39	-
PtFe	0.5 M H_2SO_4	0.469	502.60	57.35	46.87
	1.0 M KOH	0.395	543.85	67.30	-
$PtFe_3$	0.5 M H_2SO_4	0.539	140.74	12.15	18.78
	1.0 M KOH	0.415	360.48	31.06	-
Pt/C	0.5 M H_2SO_4	0.499	255.90	34.48	44.45
	1.0 M KOH	0.465	222.30	29.95	-

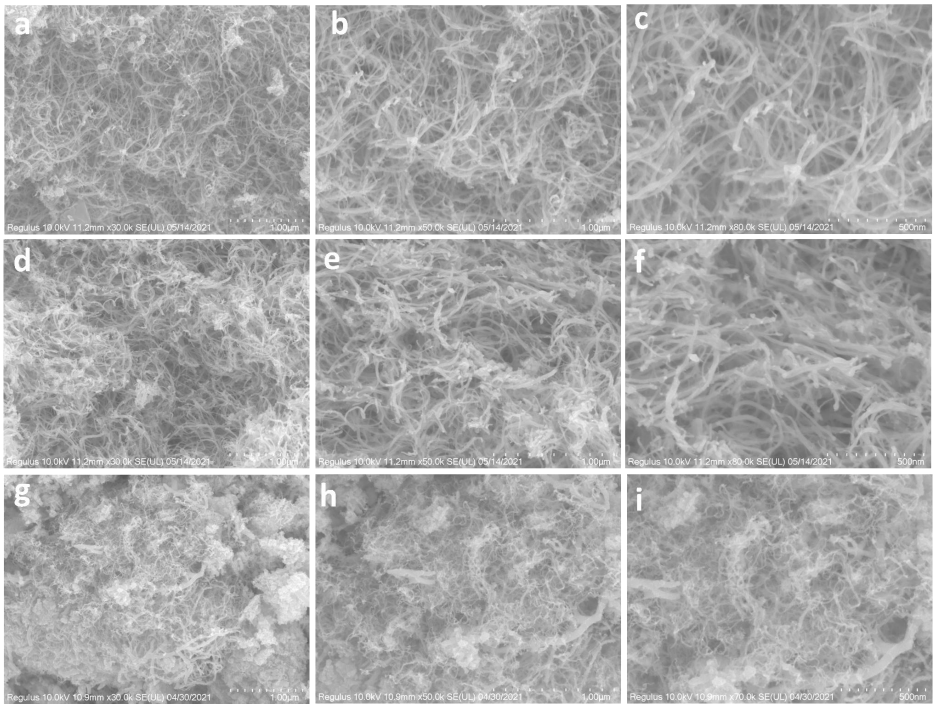

Figure S1. SEM images of Pt_3Co (a-c), Pt_3Fe (d-f) and Pt_3Ni NBs.

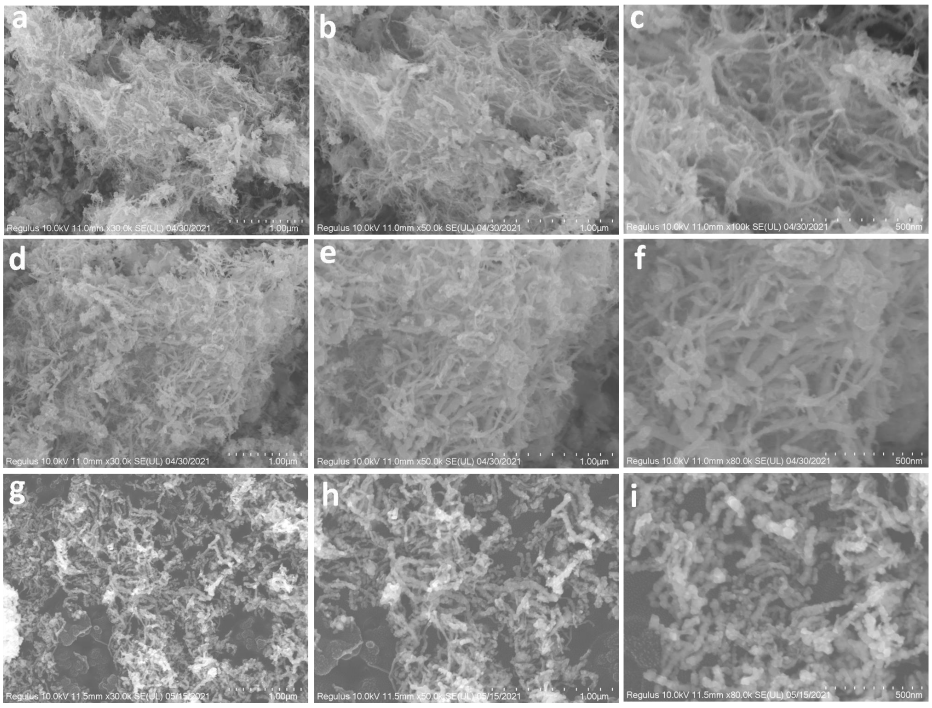

Figure S2. SEM images of $PtCo_3$ (a-c), $PtFe_3$ (d-f) and $PtNi_3$ NBs.

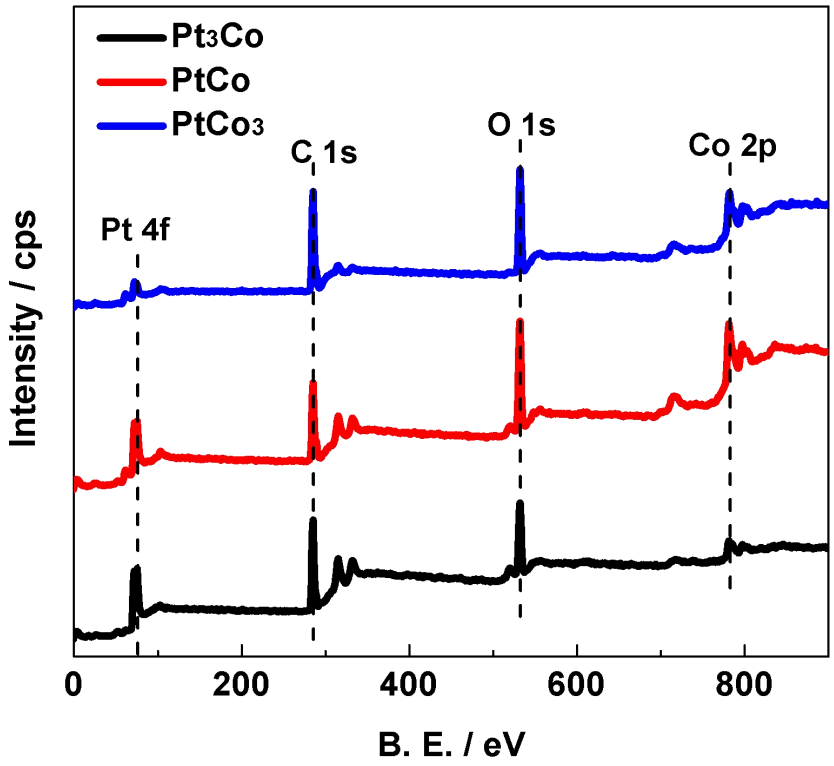

Figure S3. XPS survey spectra of PtCo NBs.

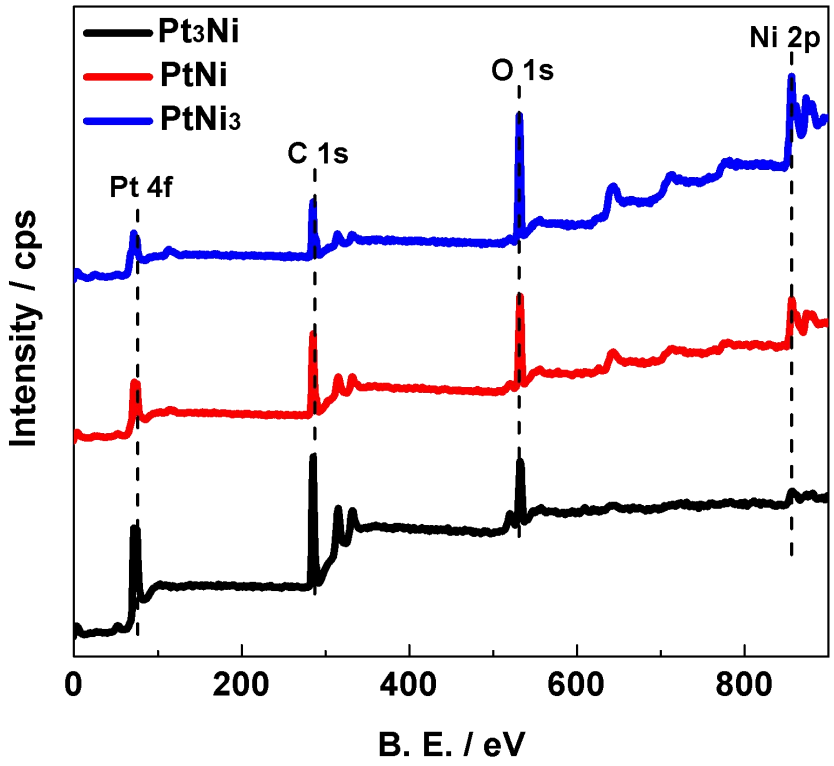

Figure S4. XPS survey spectra of PtNi NBs.

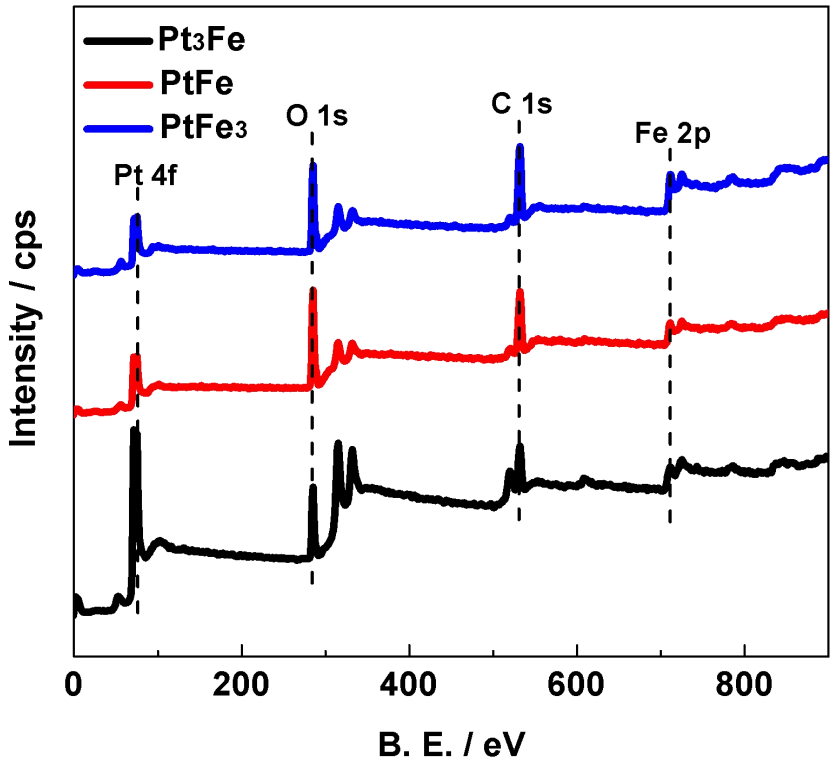

Figure S5. XPS survey spectra of PtFe NBs.

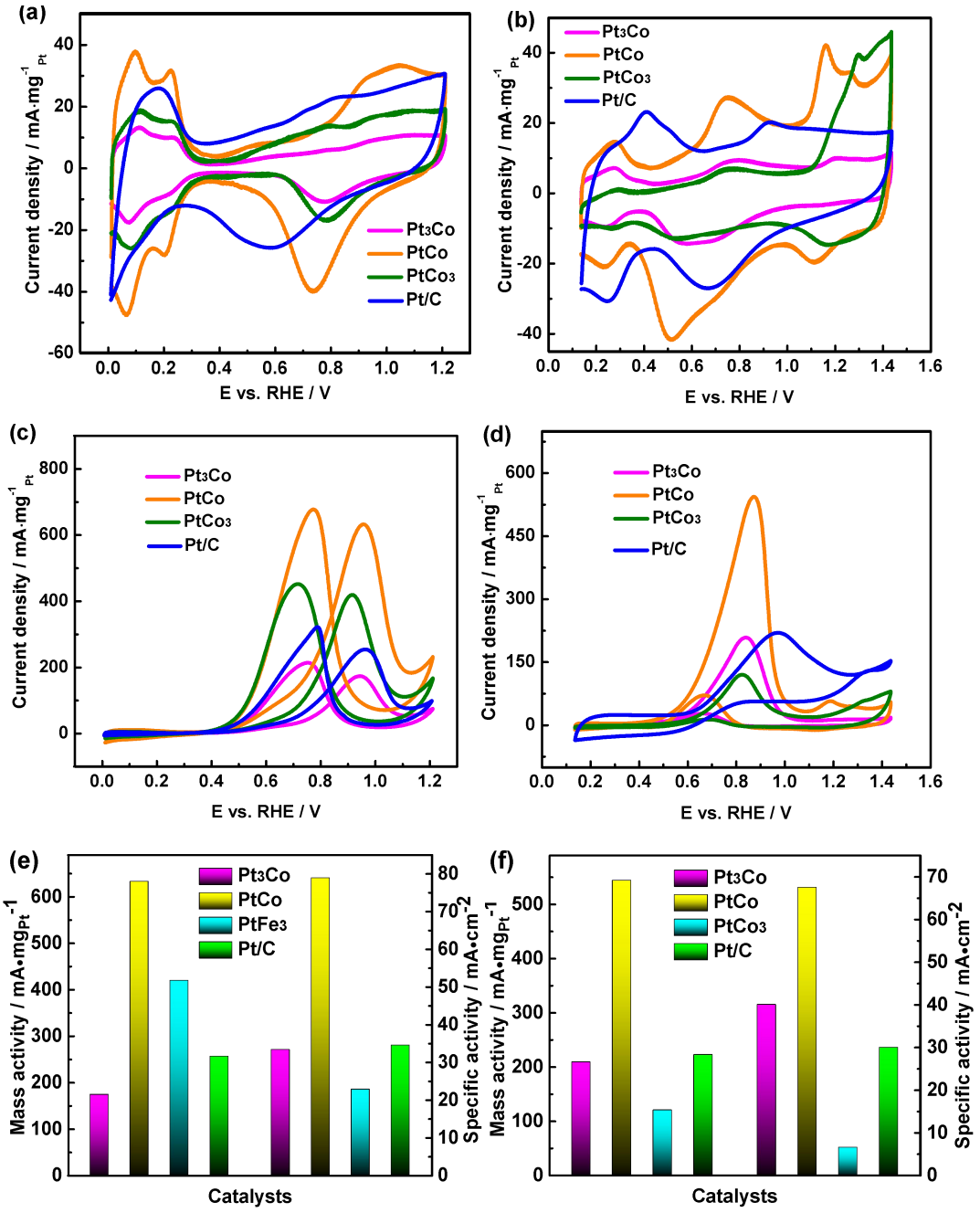

Figure S6. CVs of Pt-Co NBs in (a) 0.5 M H_2SO_4, (b) 0.5 M H_2SO_4 + 1.0 M CH_3OH, (c) 1.0 M KOH , and (d) 1.0 M KOH + 1.0 M CH_3OH. Mass- and area-specific activities of Pt-Co NBs at 0.929 and 0.835 V (vs. RHE) in (e) 0.5 M H_2SO_4 + 1.0 M CH_3OH and (f) 1.0 M KOH + 1.0 M CH_3OH, respectively.

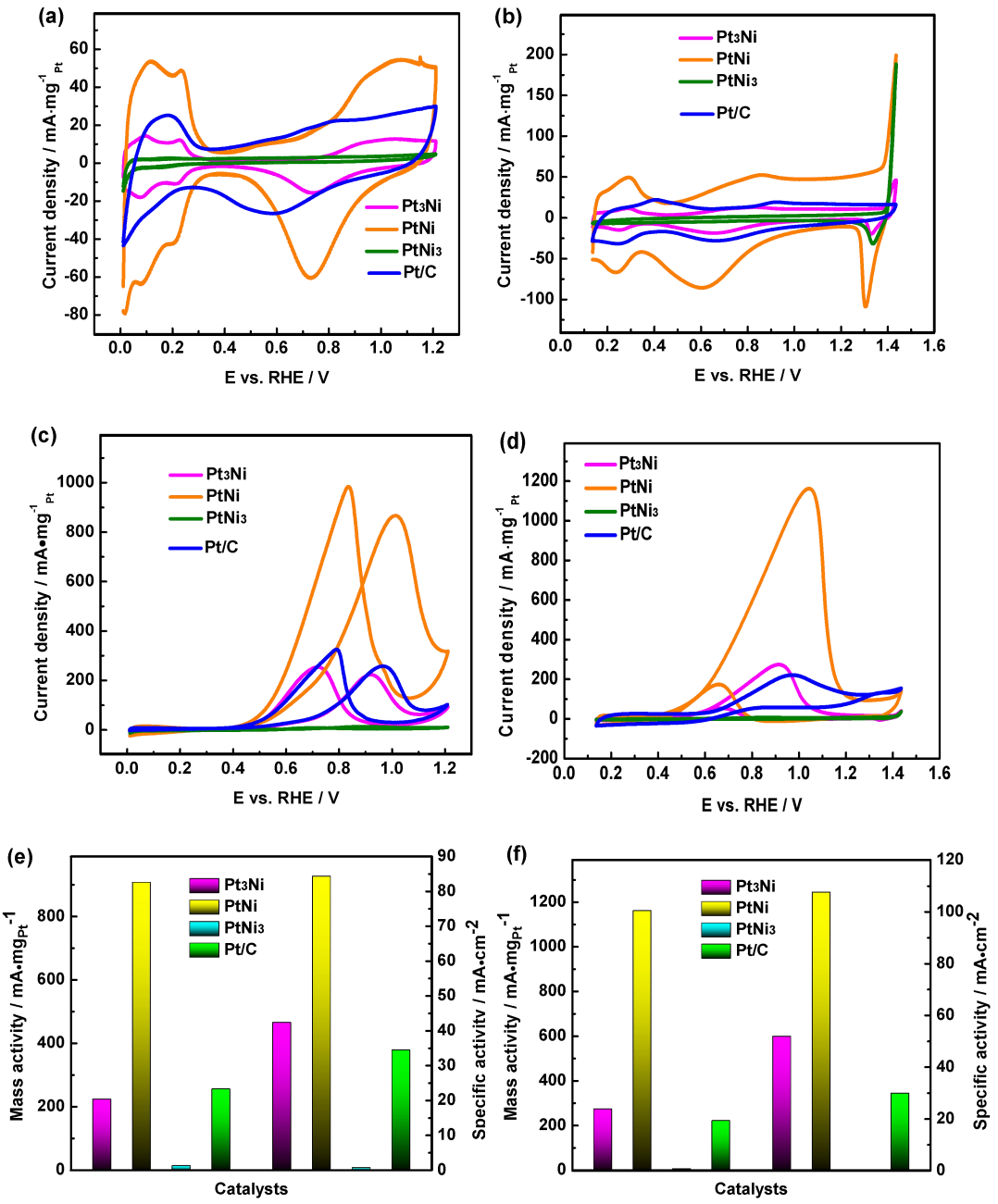

Figure S7. CVs of Pt-Ni NBs in (a) 0.5 M H_2SO_4, (b) 0.5 M H_2SO_4 + 1.0 M CH_3OH, (c) 1.0 M KOH , and (d) 1.0 M KOH + 1.0 M CH_3OH. Mass- and area-specific activities of Pt-Ni NBs at 0.929 and 0.835 V (vs. RHE) in (e) 0.5 M H_2SO_4 + 1.0 M CH_3OH and (f) 1.0 M KOH + 1.0 M CH_3OH, respectively.

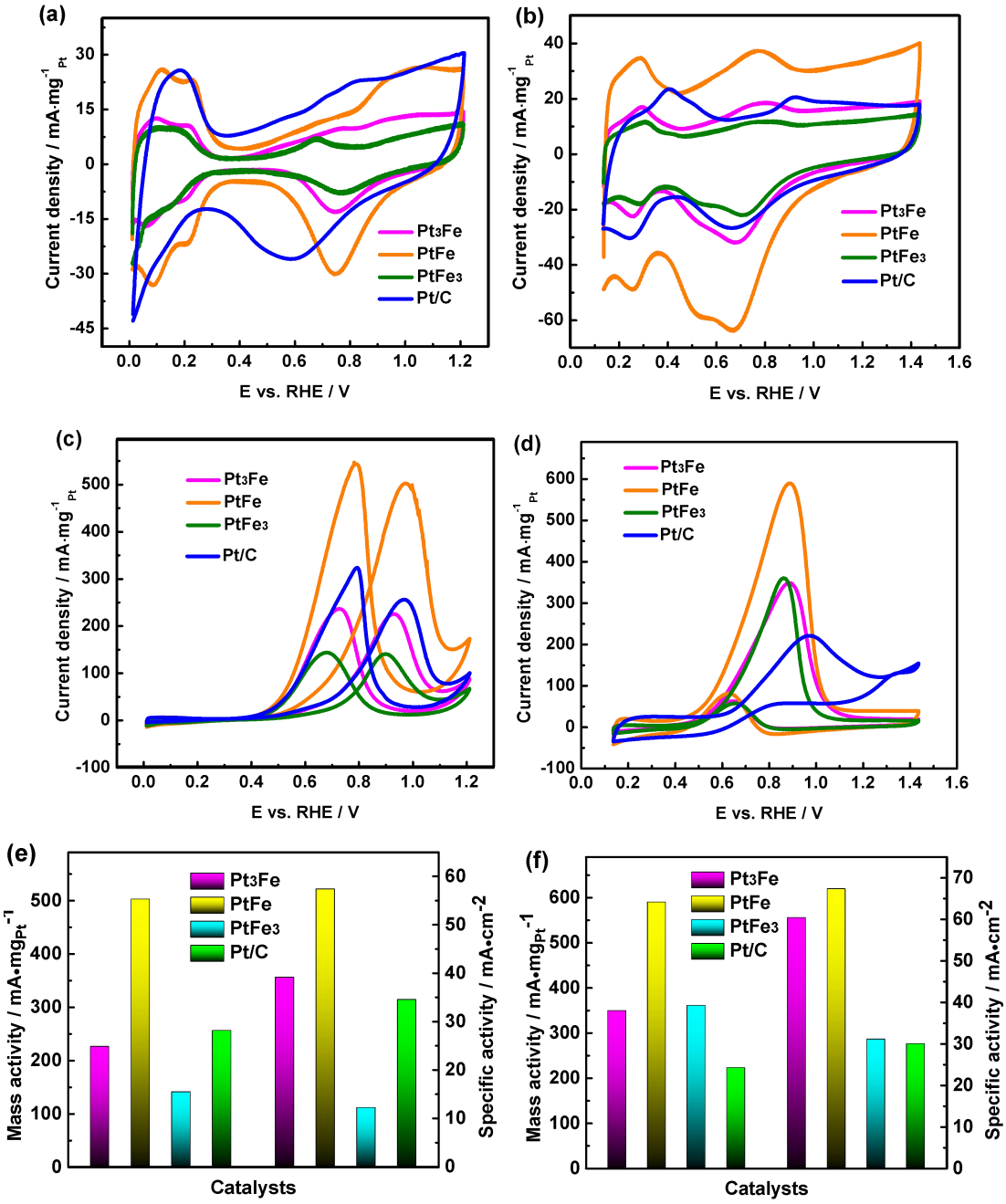

Figure S8. CVs of Pt-Fe NBs in (a) 0.5 M H_2SO_4, (b) 0.5 M H_2SO_4 + 1.0 M CH_3OH, (c) 1.0 M KOH , and (d) 1.0 M KOH + 1.0 M CH_3OH. Mass- and area-specific activities of Pt-Fe NBs at 0.929 and 0.835 V (vs. RHE) in (e) 0.5 M H_2SO_4 + 1.0 M CH_3OH and (f) 1.0 M KOH + 1.0 M CH_3OH, respectively.

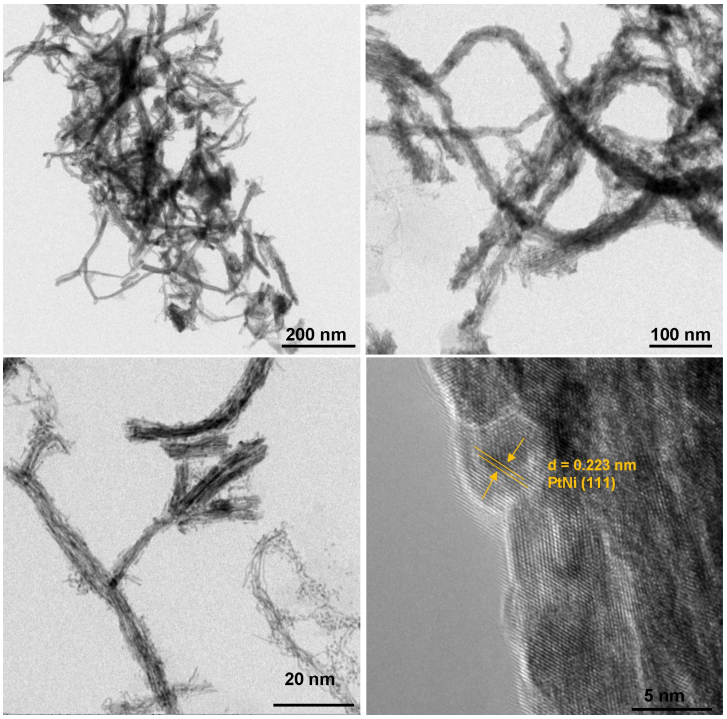

Figure S9. TEM and HRTEM images of PtNi NBs after 2000 cycles in 0.5 M H_2SO_4 + 1.0 M CH_3OH .