Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Well-defined PtNiCo core-shell nanodendrites with enhanced catalytic performance for methanol oxidation

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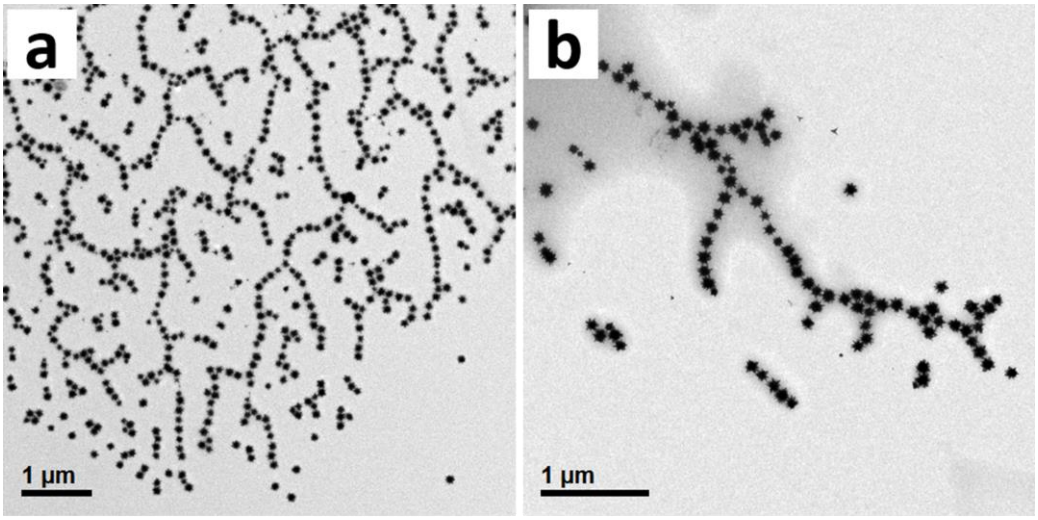

Fig. S1 (a, b) TEM images of the well-defined PtNiCo core-shell nanodendrites.

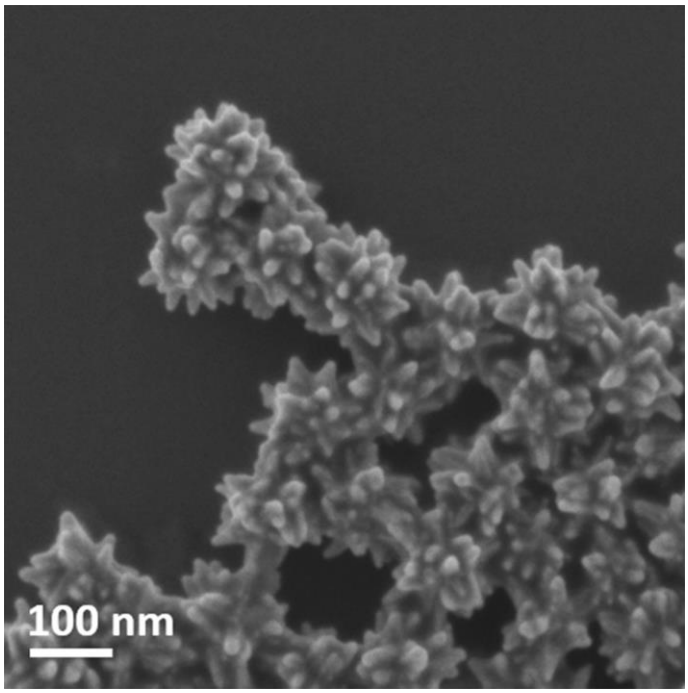

Fig. S2 SEM image of the well-defined PtNiCo core-shell nanodendrites.

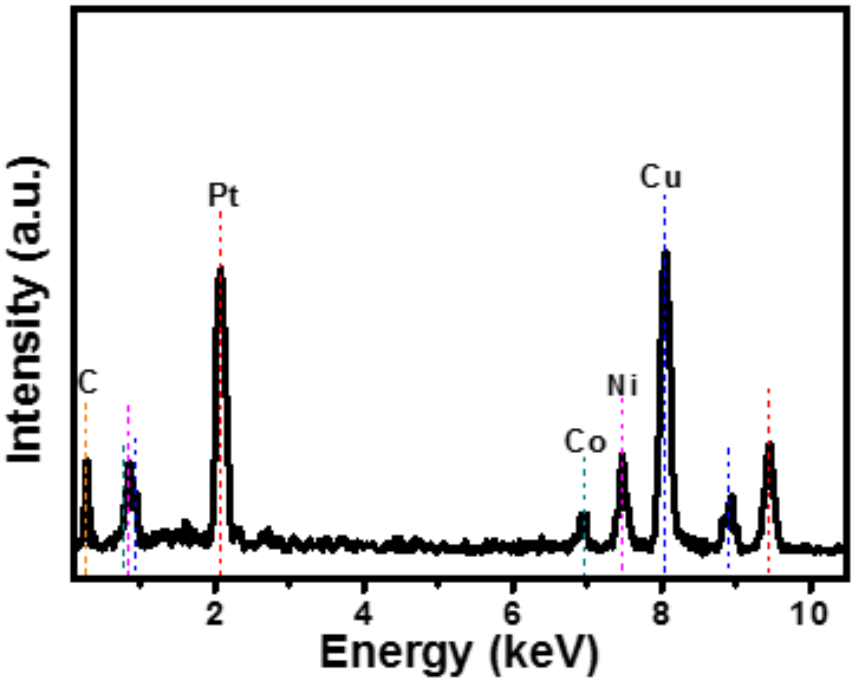

Fig. S3 TEM-EDS spectrum of the well-defined PtNiCo core-shell nanodendrites.

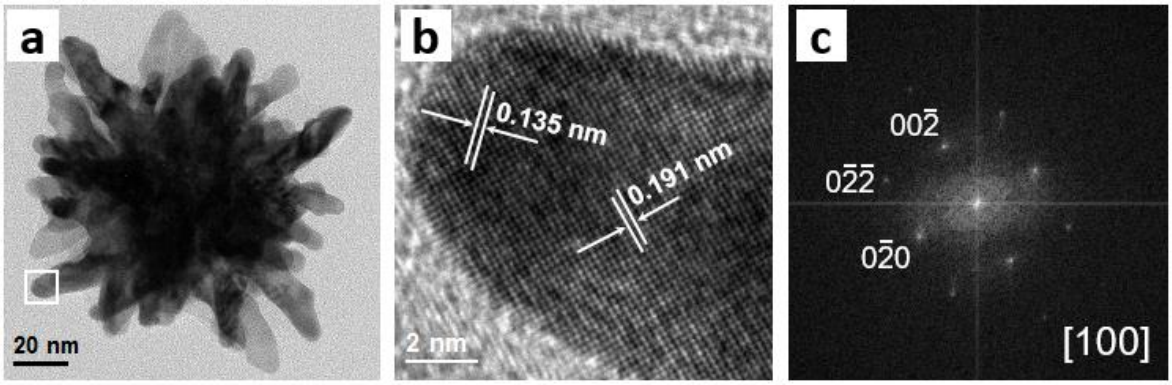

Fig. S4 (a, b) HRTEM images of well-defined PtNiCo core-shell nanodendrites. (c) The corresponding fast Fourier Transform (FFT) pattern.

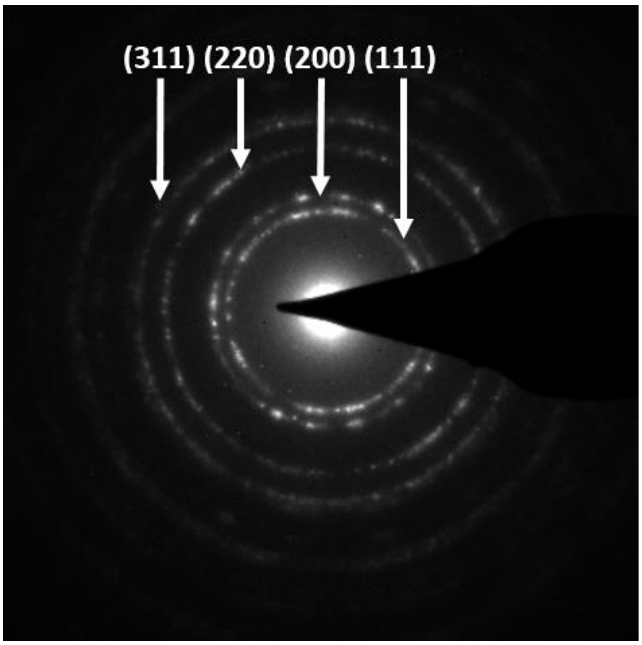

Fig. S5 The selected-area electron diffraction (SAED) pattern of the well-defined PtNiCo core-shell nanodendrites.

Table 1. The *d*-spacing of the well-defined PtNiCo core-shell nanodendrites. The standard *d*-spacing of PtNi and PtCo alloys are also shown for comparison.

	d-spacing (nm)		Ref.
PtNi	0.134	0.189	PDF Card #65-9445
PtCo	0.135	0.191	PDF Card #43-1358
PtNiCo core-shell nanodendrites	0.135	0.191	This work

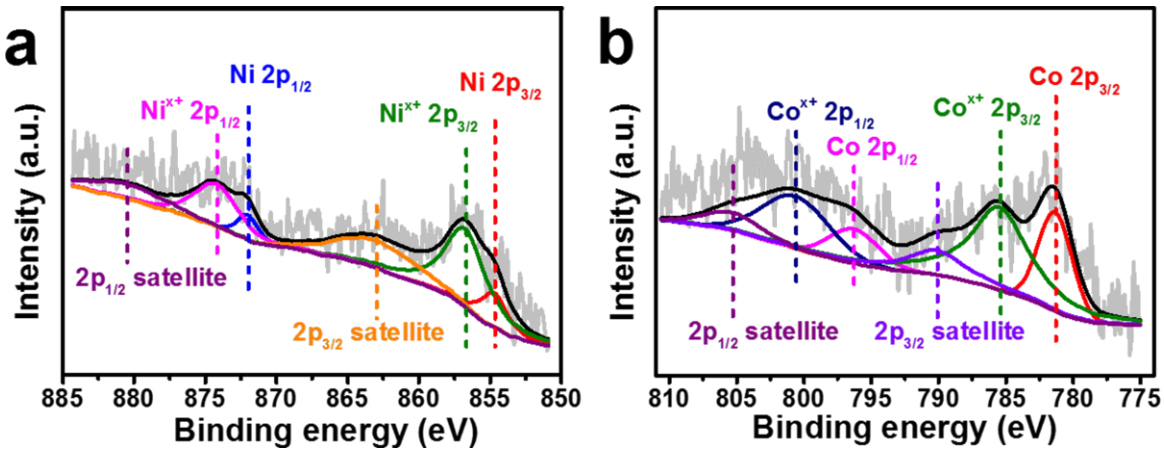

Fig. S6 (a) Ni 2p and (b) Co 2p XPS spectra of the well-defined PtNiCo core-shell nanodendrites.

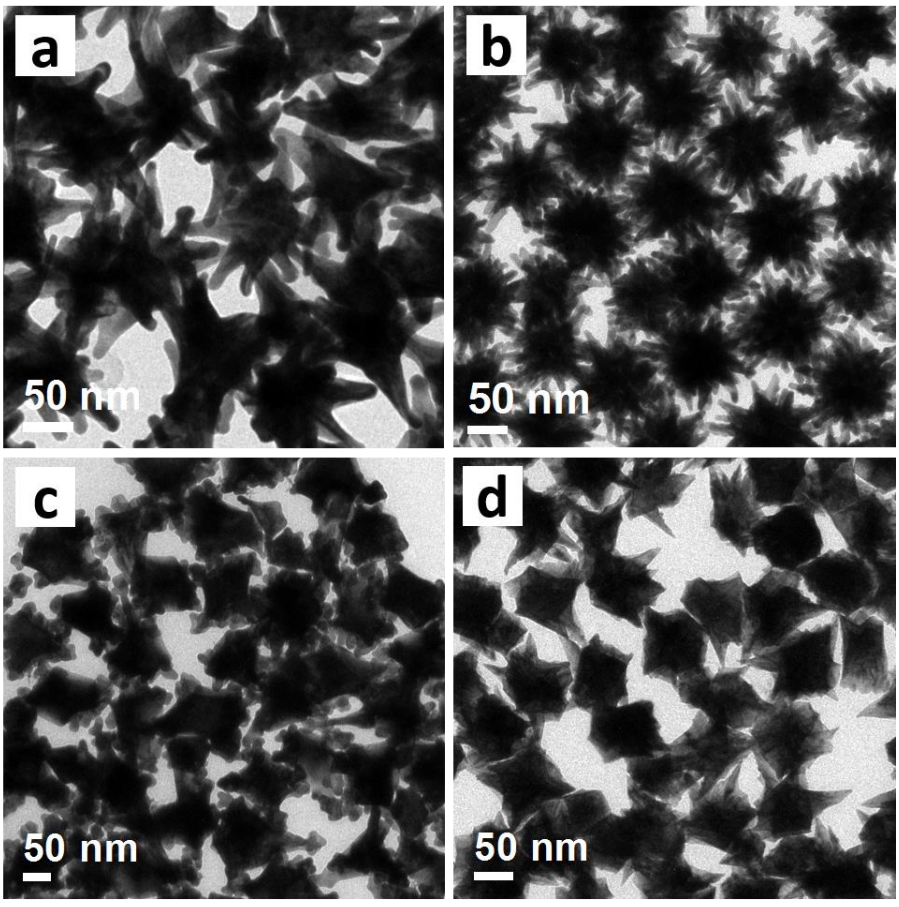

Fig. S7 TEM images of trimetallic PtNiCo nanocrystals prepared with (a) absence of

CTAC, (b) 150 mg CTAC, (c) 210 mg CTAC, and (d) 150 mg CTAB.

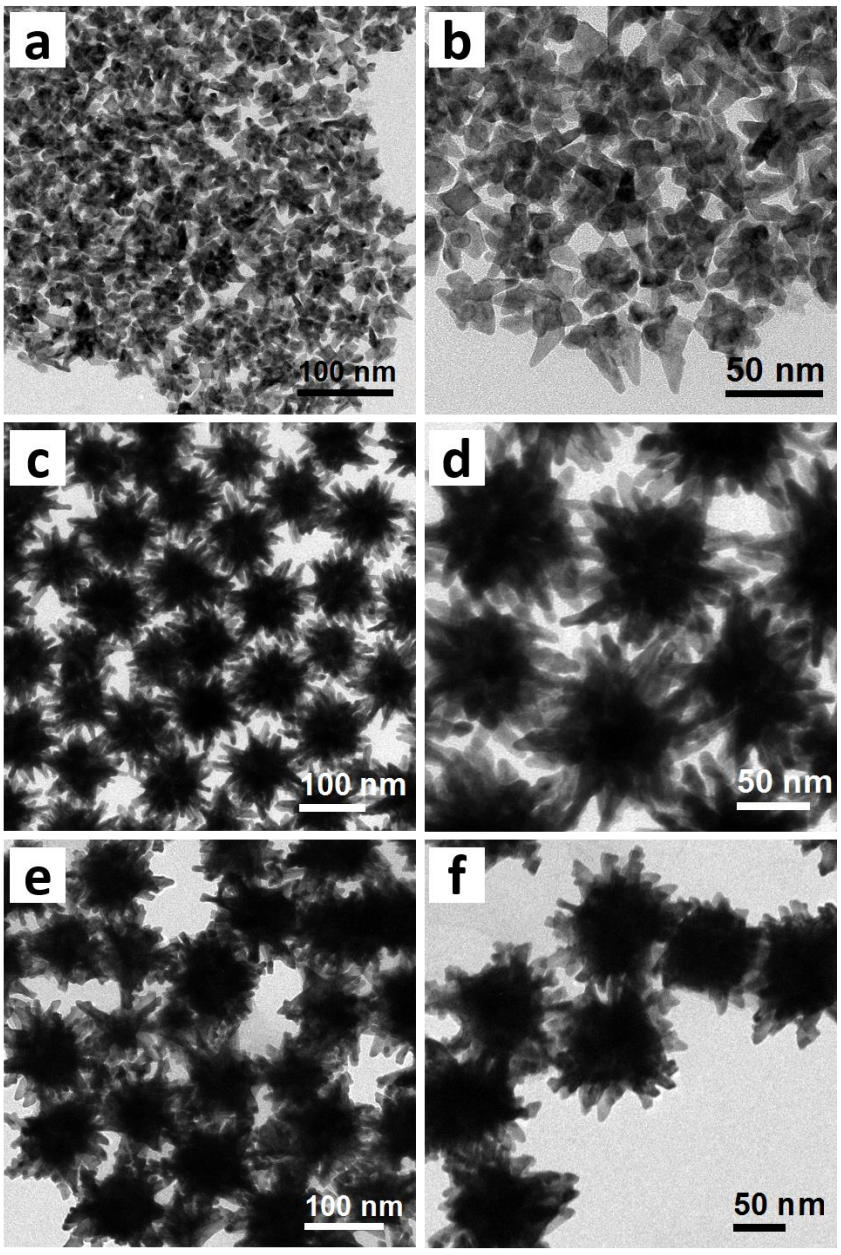

Fig. S8 TEM images of trimetallic PtNiCo nanocrystals prepared by varying reaction temperature at (a, b) 170 °C, (c, d) 200 °C, and (e, f) 210 °C.

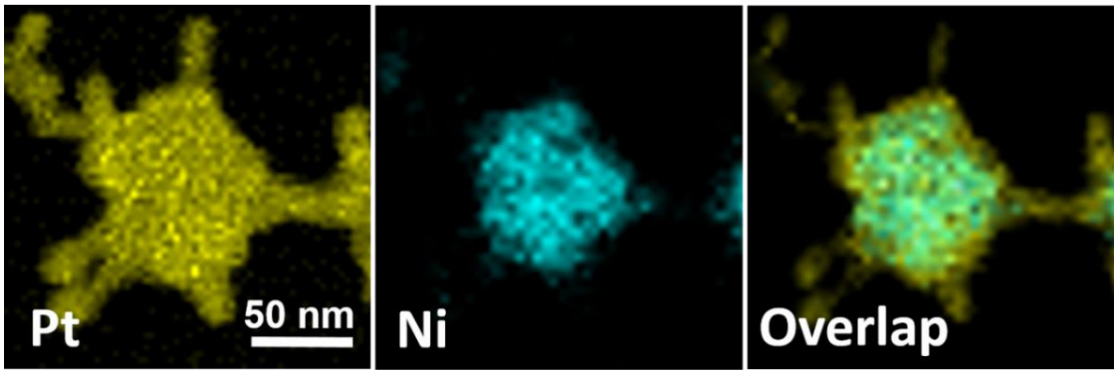

Fig. S9 The element distribution of Pt and Ni in EDS-mapping images for bimetallic Pt-Ni nanocrystals.

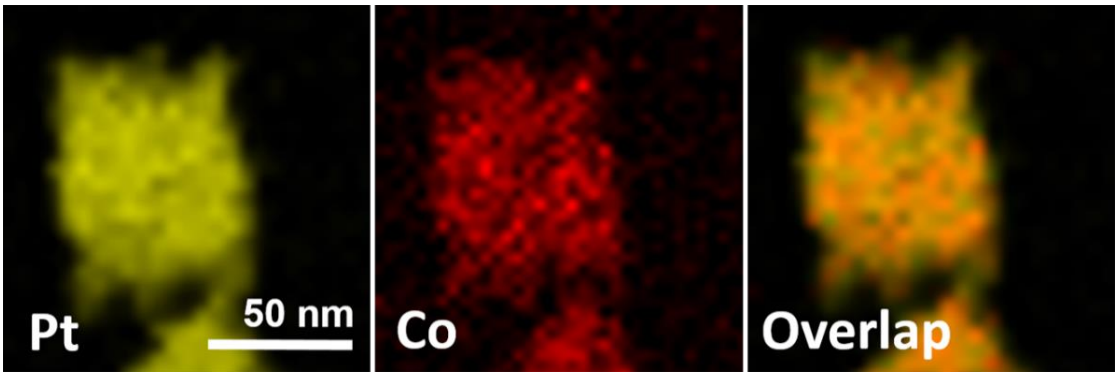

Fig. S10 The element distribution of Pt and Co in EDS-mapping images for bimetallic Pt-Co nanocrystals.

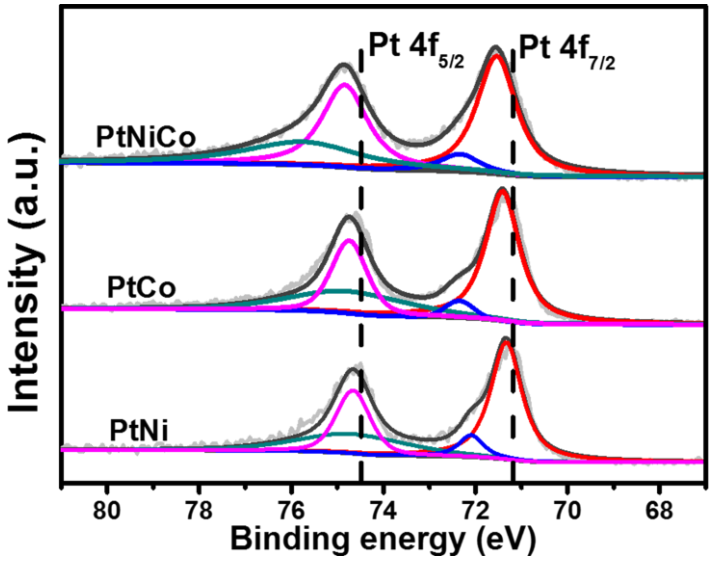

Fig. S11 Pt 4f spectra of well-defined PtNiCo core-shell nanodendrites, Pt-Ni nanocrystals, and Pt-Co nanocrystals.

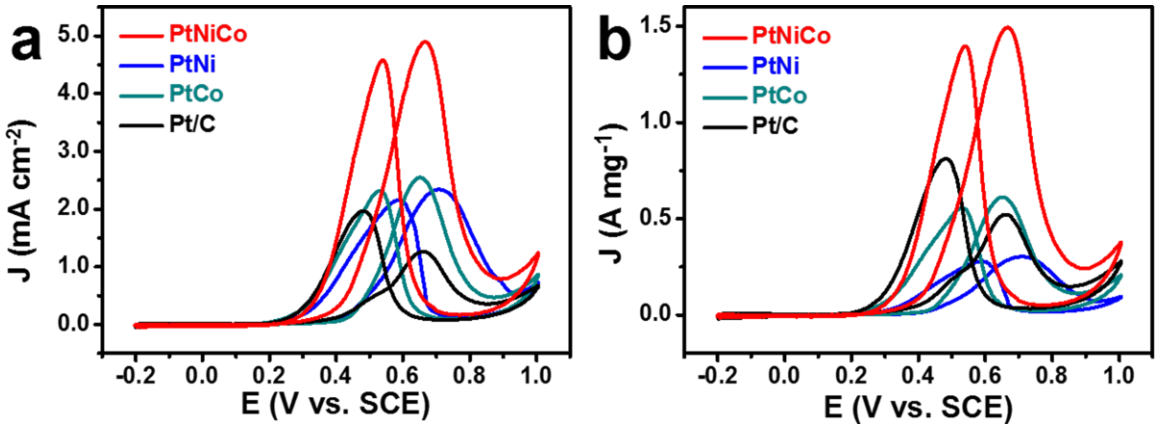

Fig. S12 (a) Specific activities and (b) mass activities of the well-defined PtNiCo core-shell nanodendrites, Pt-Ni nanocrystals, Pt-Co nanocrytals, and commercial Pt/C in 0.5 M H_2SO_4 + 1 M CH_3OH solution. The sweep rate is 50 mV s^{-1}.

Table S2. The specific activity and mass activity of different catalysts for methanol oxidation reaction. All these electrochemical measurements were carried out in 0.5 M H_2SO_4 + 1.0 M CH_3OH solution at a sweep rate of 50 mV s^{-1}.

Catalysts		Specific activity (mA cm^{-2})	Mass activity (A mg^{-1}_{Pt})	Ref.
Pt-Co nanoalloy	Pt–Co alloy networks	1.96		1
	PtCo nanocrystals	1.60		2
Pt-Ni nanoalloy	PtNi chain-like nanostructures	4.30		3
	Pt_3Ni nanoparticle networks	2.30		4
	PtNi nanoparticles		0.82	5
Pt-based nanodendrites	Pt-on-Pd nanodendrites		0.49	6
	PtFe@Pt nanodendrites		0.82	7
	Pt−Cu hierarchical branched nanoparticles	1.26	0.70	8
	PtRuFe nanodendrites	2.03	1.14	9
	PtNiCo core-shell nanodendrites	4.90	1.50	This work
	PtNi nanocrystals	2.30	0.30	This work
	PtCo nanocrystals	2.53	0.60	This work

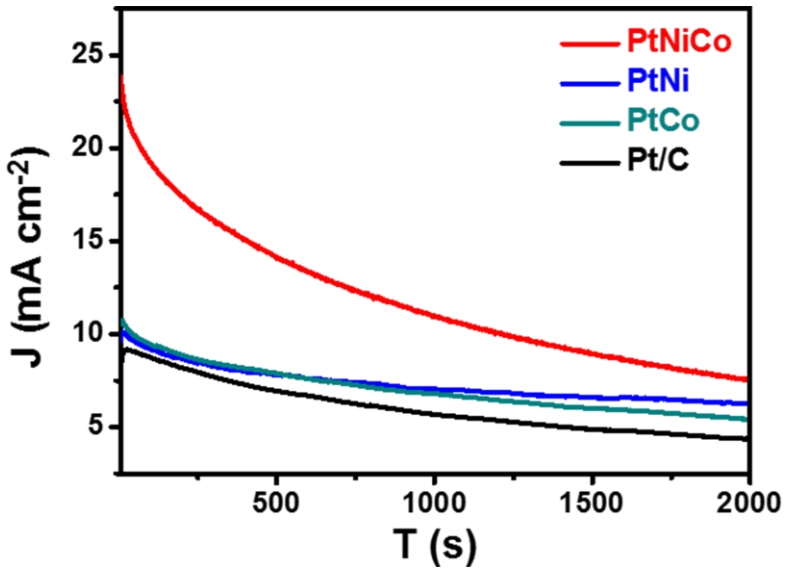

Fig. S13 Chronoamperommetry (CA) curves of PtNiCo core-shell nanodendrites, Pt-Ni nanocrystals, Pt-Co nanocrystals, and commercial Pt/C recorded in 0.5 M H_2SO_4 + 1.0 M CH_3OH aqueous solution at 0.5 V *vs.* SCE for 2,000 s.

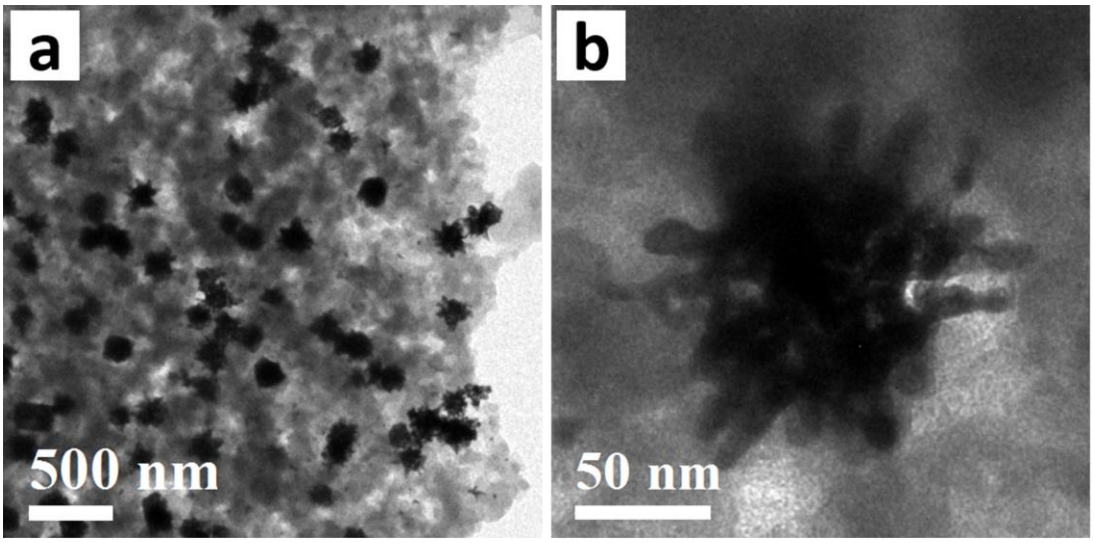

Fig. S14 a) Low-magnification and b) high-magnification TEM images of PtNiCo core-shell nanodendrites after stability test.

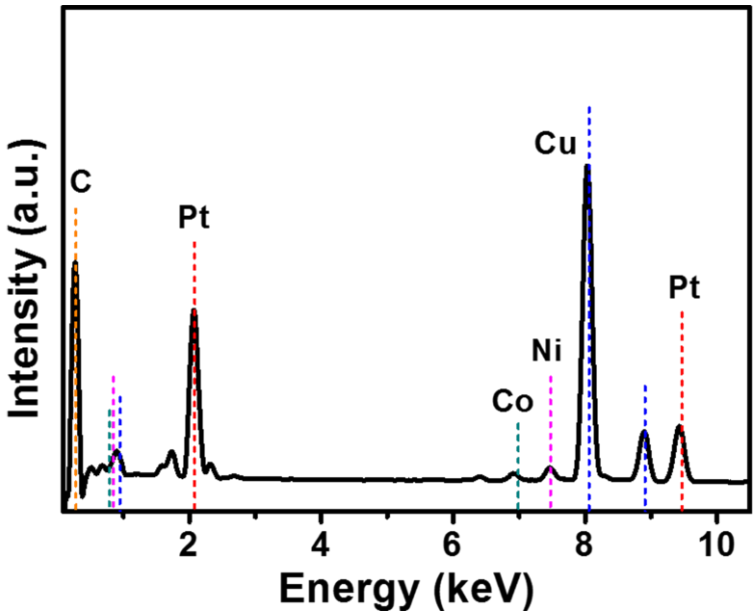

Fig. S15 TEM-EDS spectrum of the PtNiCo core-shell nanodendrites after stability test.

References

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