Electronic Supplementary Information for

Multinary PtPdNiP truncated octahedral mesoporous nanocages for enhanced methanol oxidation electrocatalysis

Hongjing Wang, Songliang Liu, Hugang Zhang, Shuli Yin, You Xu, Xiaonian Li,

Ziqiang Wang,* and Liang Wang*

State Key Laboratory Breeding Base of Green-Chemical Synthesis Technology, College of Chemical Engineering, Zhejiang University of Technology, Hangzhou 310014, P. R. China.

Corresponding authors' E-mails: zqwang@zjut.edu.cn; wangliang@zjut.edu.cn

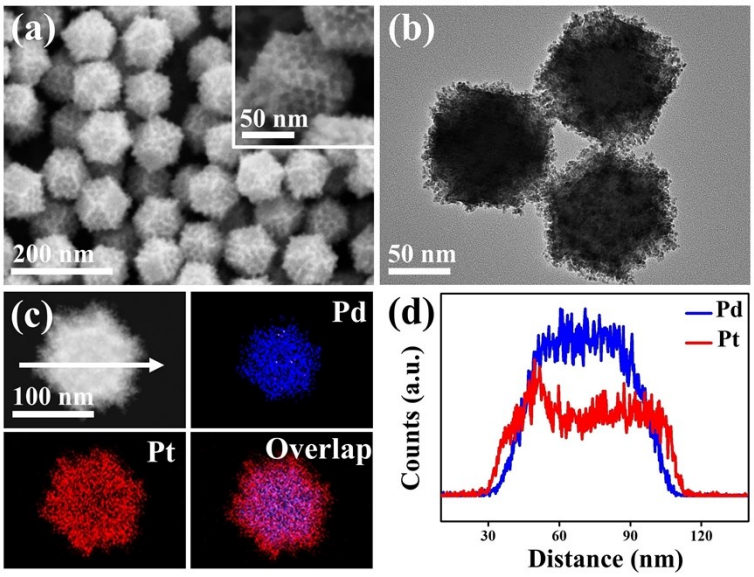

Fig. S1 (a) SEM and (b) TEM images of Pd@PtPd MTOs. (c) HAADF-STEM image and corresponding EDX elemental mappings images and (d) line-scanning profile of Pd@PtPd MTOs.

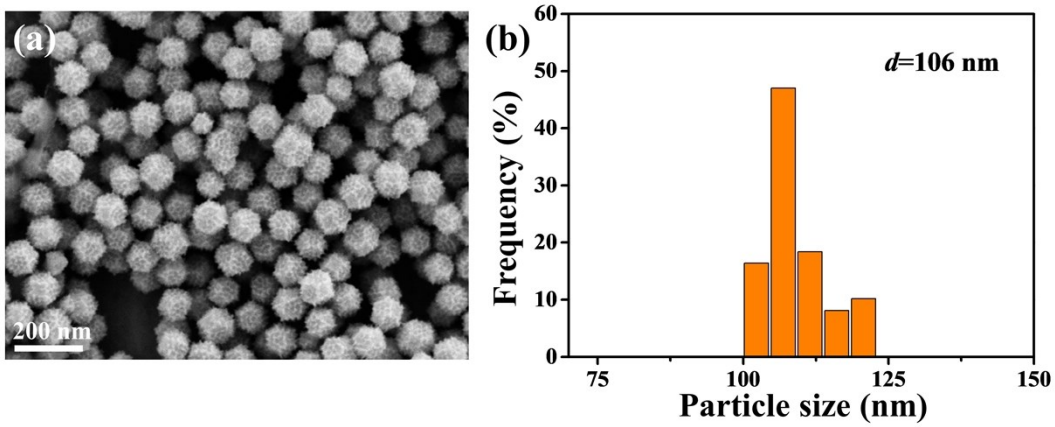

Fig. S2 Histogram of particle size distribution for the Pd@PtPd MTOs.

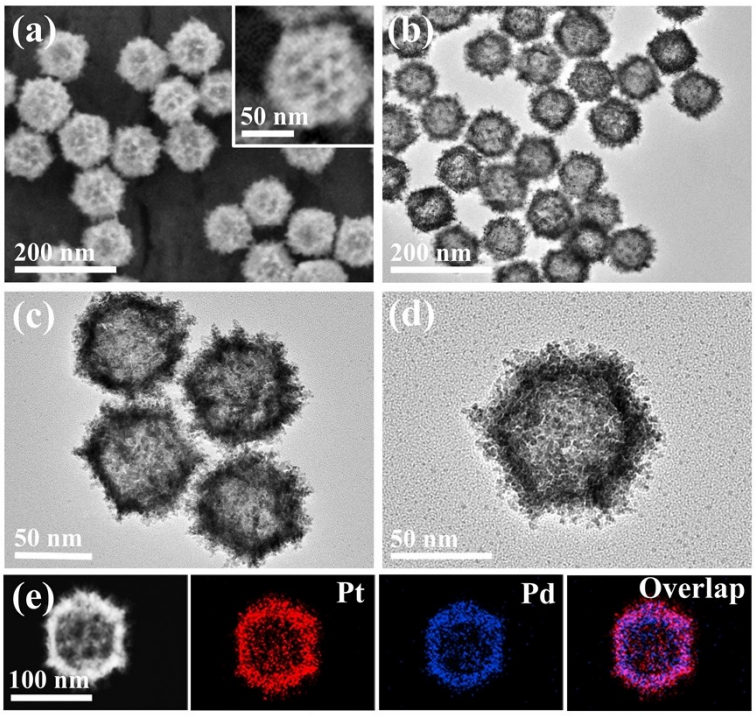

Fig. S3 (a) SEM and (b-d) TEM images of PtPd TOMNs. (e) HAADF-STEM image of one PtPd TOMN nanoparticle and corresponding EDX elemental mappings images.

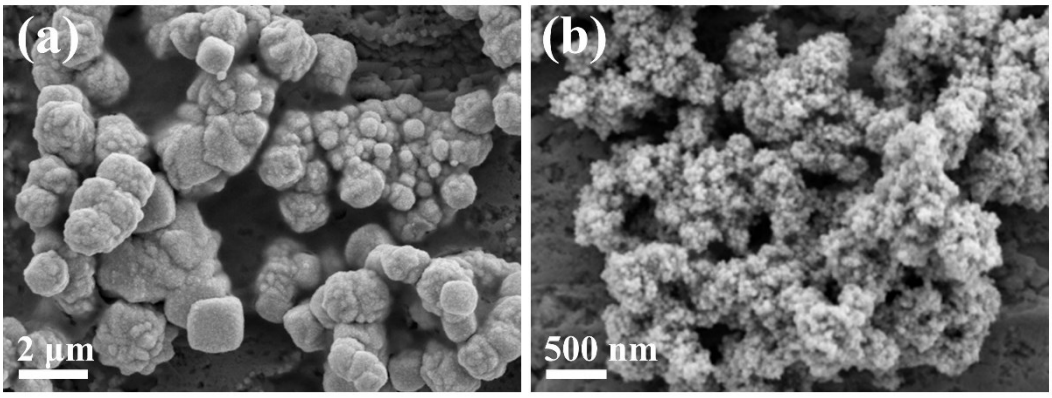

Fig. S4 SEM images of the samples prepared under the typical conditions without (a) F127 and by replacing F127 with (b) PVP.

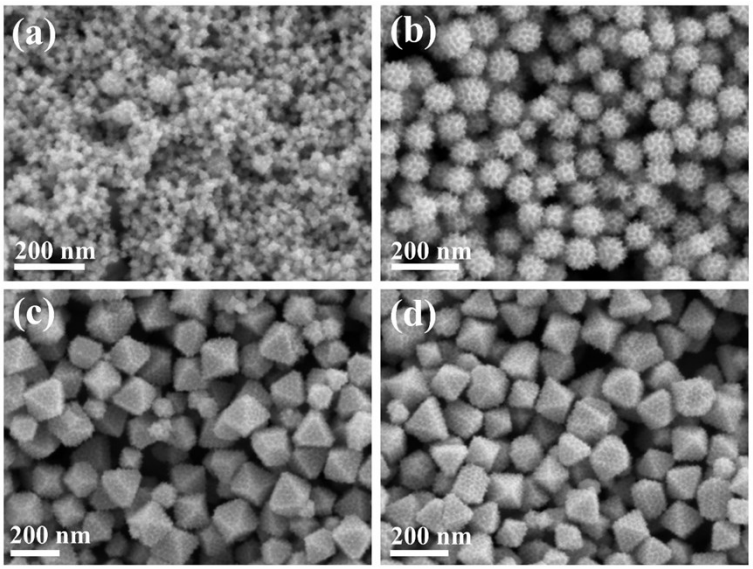

Fig. S5 SEM images of the samples prepared with different amounts of HCl under the typical synthesis: (a) 0 mL, (b) 0.1 mL, (c) 0.3 mL (d) 0.4 mL.

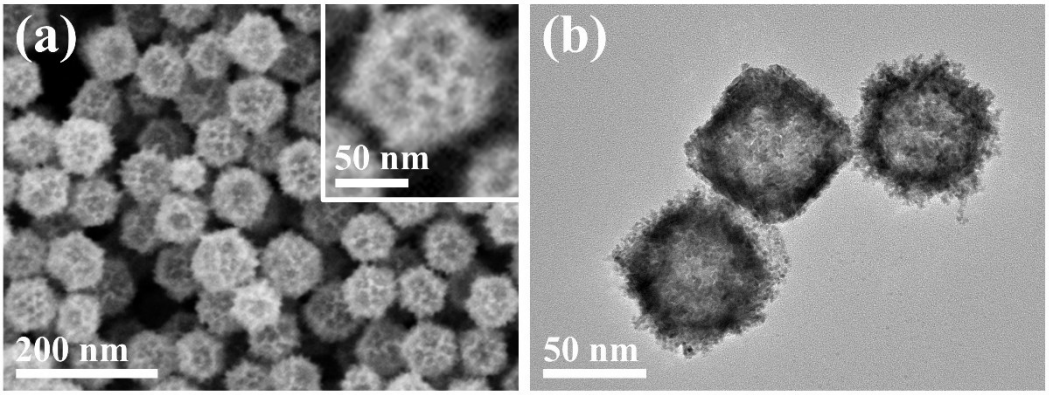

Fig. S6 (a) SEM and (b) TEM images of PtPdNi TOMNs.

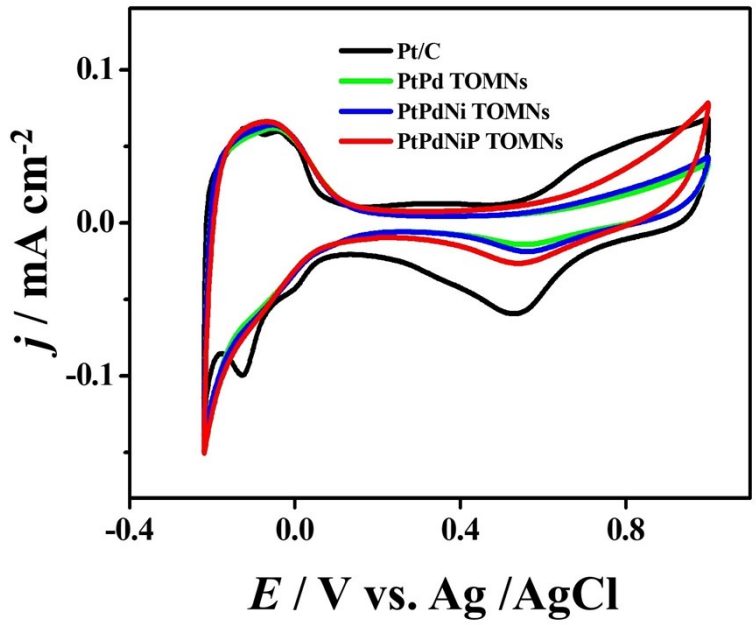

Fig. S7 CVs of the catalysts recorded in N_2-saturated 0.5 M H_2SO_4 solution with a scan rate of 50 mV s^{-1}.

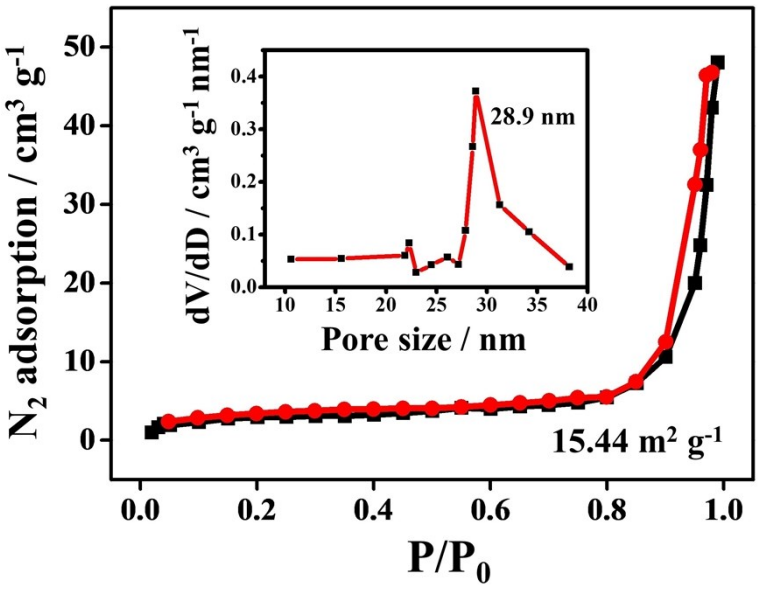

Fig. S8 N_2 adsorption-desorption isotherms for PtPdNiP TOMNs. The inset is the BJH pore-size distribution curves.

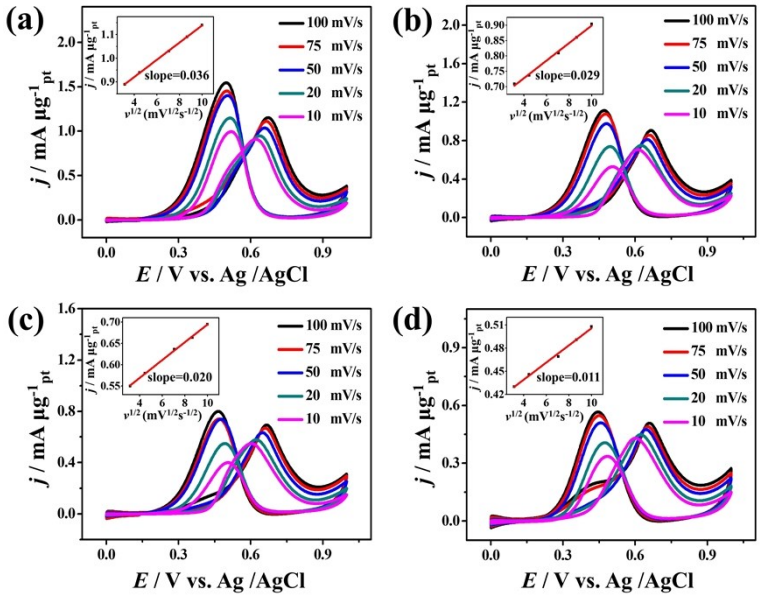

Fig. S9 CVs at different scan rates and their corresponding fitted plot of the j_m *vs*. the $v^{1/2}$ for the (a) PtPdNiP TOMNs, (b) PtPdNi TOMNs, (c) PtPd TOMNs and (d) Pt/C.

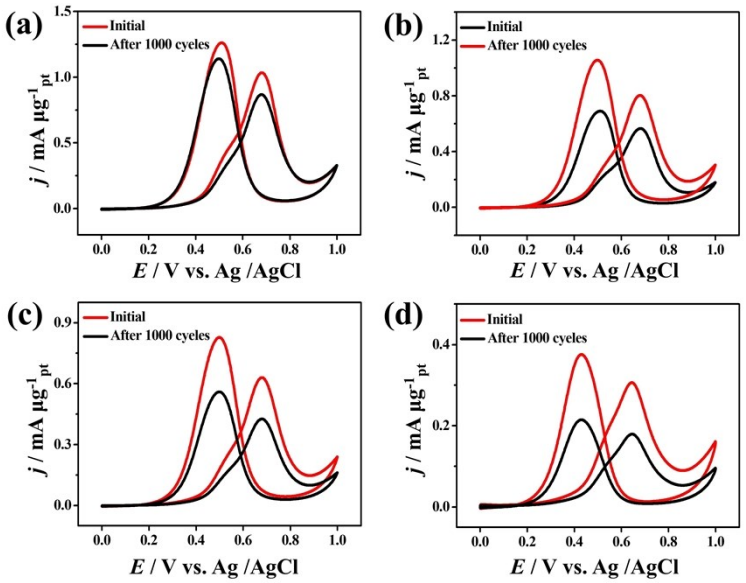

Fig. S10 CVs of MOR recorded in 0.5 M H_2SO_4 solution with 1.0 M CH_3OH at scan rate of 50 mV s^{-1} before and after durability test for (a) PtPdNiP TOMNs, (b) PtPdNi TOMNs, (c) PtPd TOMNs and (d) Pt/C.

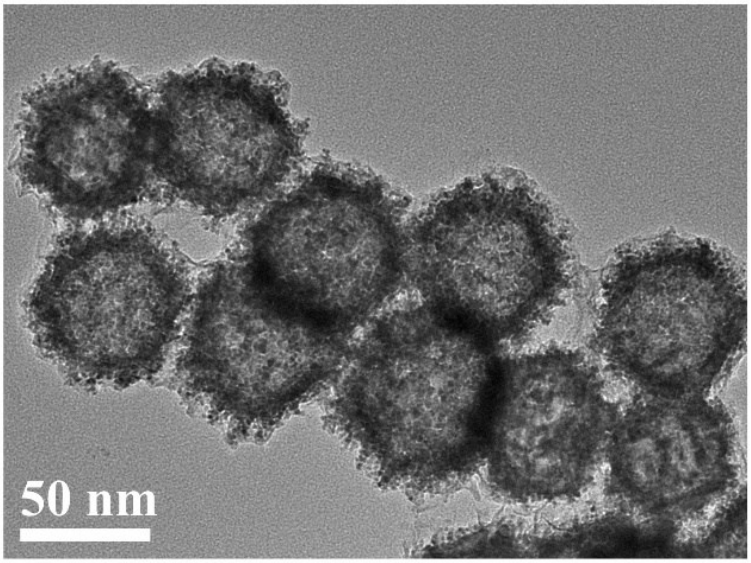

Fig. S11 TEM image of the PtPdNiP TOMNs after the durability test.

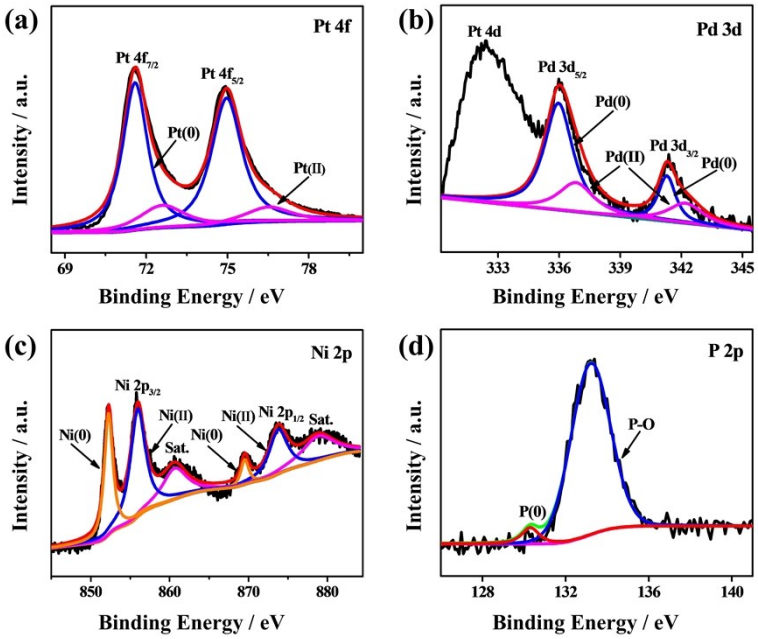

Fig. S12 XPS spectra of PtPdNiP TOMNs in (a) Pt 4f (b) Pd 3d (c) Ni 2p and (d) P 2p regions after the durability test.

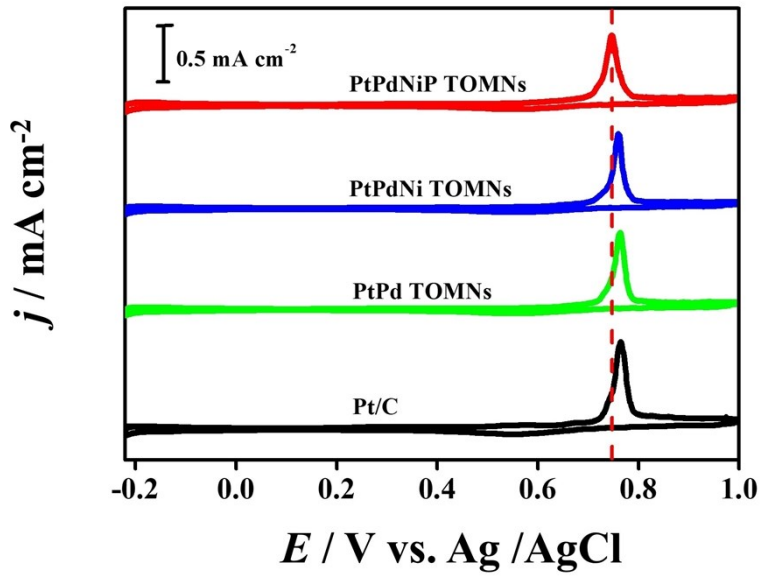

Fig. S13 CO-stripping curves of different catalysts tested in a CO-saturated 0.5 M H_2SO_4 solution at a scan rate of 50 mV s^{-1}.

Table S1 Comparisons of the MOR performance of PtPdNiP TOMNs with other reported Pt-based electrocatalysts.

Catalysts	Condition	Scan rate ($mV\ s^{-1}$)	Mass activity ($A\ mg^{-1}_{Pt}$)	Ref.
PtPdNiP TOMNs	**0.5 M H_2SO_4 containing 1.0M CH_3OH**	**50**	**1.04**	**This work**
PtPdCo MHNPs	0.5 M H_2SO_4 containing 1.0M CH_3OH	50	0.91	1
Pt Nanoparticles	0.5 M H_2SO_4 containing 1.0M CH_3OH	50	0.87	2
Pt-Pd-Cu Nanodendrites	0.5 M H_2SO_4 containing 1.0M CH_3OH	50	0.69	3
PtPdTe Nanowire	0.5 M H_2SO_4 containing 1.0M CH_3OH	50	0.59	4
Hollow Pt−Pd Nanocages	0.5 M H_2SO_4 containing 1.0M CH_3OH	50	0.58	5
Pt Nanowires	0.5 M H_2SO_4 containing 1.0M CH_3OH	50	0.46	6
Au@Pd@Pt Core-Shell Nanoparticles	0.5 M H_2SO_4 containing 1.0M CH_3OH	50	0.43	7
PtAg Octahedral Nanocrystals	0.5 M H_2SO_4 containing 1.0M CH_3OH	50	0.37	8

References

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