Supporting Information

One-Pot Synthesis of PdAuAg Nanocrystals for Efficient Electrocatalytic Oxidation of Ethanol: Achieving Morphology Control by Independently Adjusting Metal-Atom Concentrations

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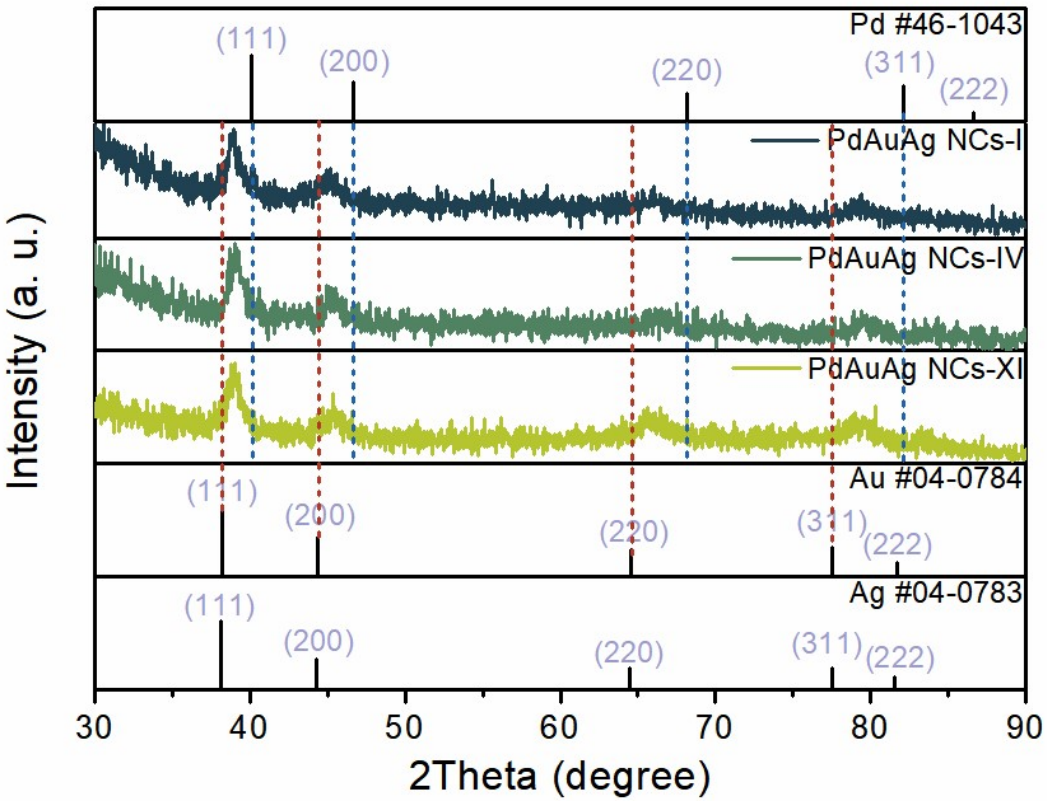

Figure S1. XRD patterns of PdAuAg NCs-I, PdAuAg NCs-IV, and PdAuAg NCs-XI, referring to the information of standard cards of Pd, Au and Ag.

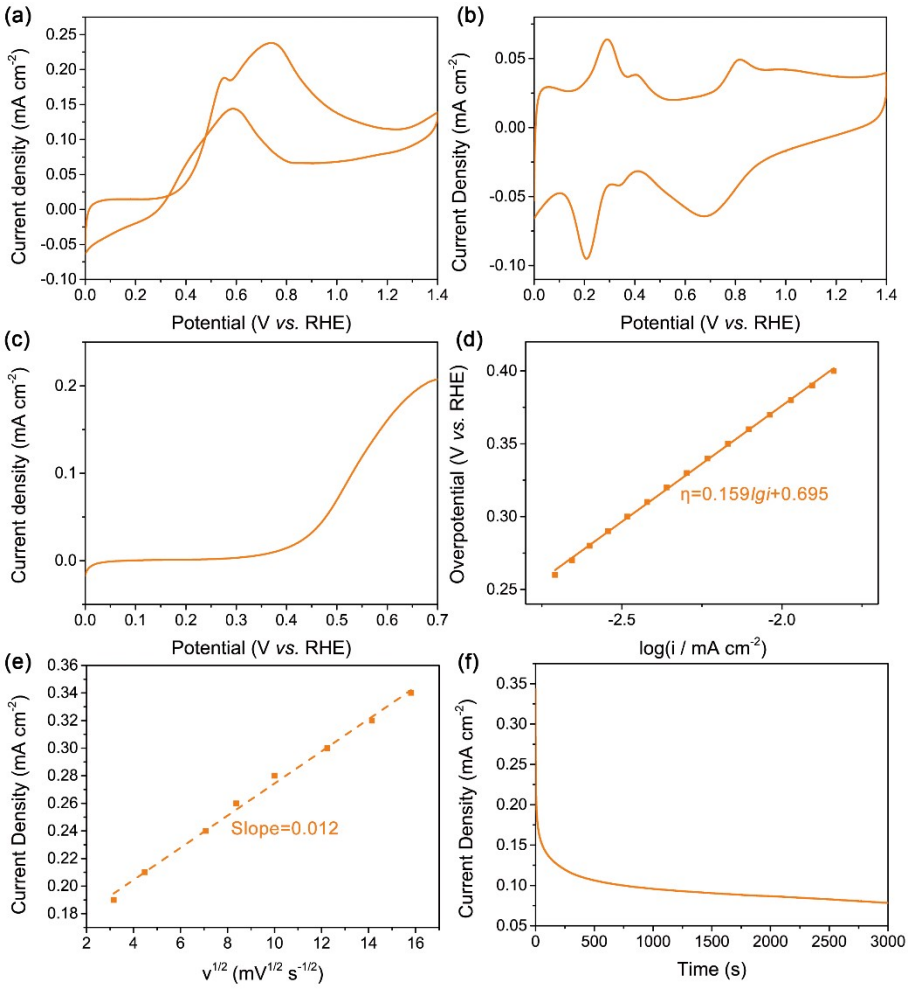

Figure S2. EOR measurements of Pt/C: a, b) CV curves in a) 1 M KOH and b) 1 M ethanol+1 M KOH; c) LSV curve; d) Tafel plot; e) EOR kinetics based on specific activity and scan rate; f) *i-t* curve measured at 0.75 V *versus* RHE.

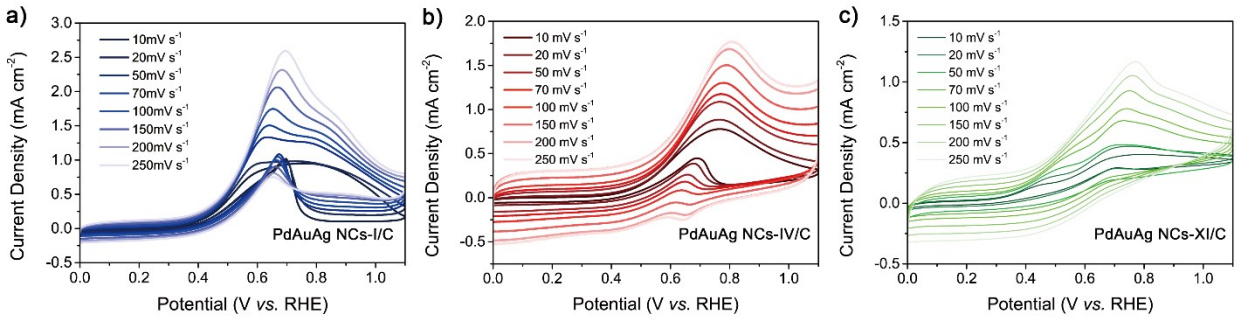

Figure S3 CV curves of PdAuAg NCs/C collected in 1 M ethanol+1 M KOH at different scan rates.

Table S1. Summary of particle size of PdAuAg NCs shown in Figure 1.

Sample	Particle Size (nm)	
	Average value	Standard deviation
PdAuAg NCs-I	16.5	1
PdAuAg NCs-II	23.8	2
PdAuAg NCs-III	25.1	1
PdAuAg NCs-IV	21.5	1
PdAuAg NCs-V	22.7	3
PdAuAg NCs-VI	17.5	1
PdAuAg NCs-VII	28.8	2
PdAuAg NCs-VIII	27.3	2
PdAuAg NCs-IX	25.8	3
PdAuAg NCs-X	22.8	2
PdAuAg NCs-XI	20.3	1
PdAuAg NCs-XII	17.2	2

Table S2. XRD results and theoretical diffraction peak positions of PdAuAg NCs.

		Diffraction Peak Position (°)			
		(111)	(200)	(220)	(311)
PdAuAg NCs-I	XRD	39.0	45.2	66.2	79.4
	Theoretical*	38.8	45.1	65.7	79.0
PdAuAg NCs-IV	XRD	38.9	45.3	66.4	79.6
	Theoretical*	39.1	45.5	66.2	79.7
PdAuAg NCs-XI	XRD	39.1	45.5	66.0	79.4
	Theoretical*	39.0	45.3	66.0	79.4
Pd	JCPDS No. 46-1043	40.1	46.7	68.1	82.1
Au	JCPDS No. 04-0784	38.2	44.4	64.6	77.5
Ag	JCPDS No. 04-0783	38.1	44.3	64.4	77.5

*The theoretical value was calculated using Vegard's Law.

Table S3. Summary of XRD results, crystalline size, and particle size of PdAuAg NCs.

Sample No.	Two Theta (°)	Full width at half maxima (FWHM, °)	Crystalline Size* (nm)	Particle Size* (nm)
PdAuAg NCs-I	39.0	0.965	8.7	16.5
PdAuAg NCs-IV	38.9	0.879	9.5	21.5
PdAuAg NCs-XI	39.1	1.085	7.7	20.3

*The crystalline size was calculated using Debye-Scherrer equation and the particle size was statistically measured by counting 100 particles in corresponding typical electro-microscope images. The difference between them should be attributed to the anisotropic morphology of current products and the presence of internal defective structure.

Table S4. Summary of the relative peak areas (%) for each split B.E. peak and the parameters used to fit the Pd 3d, Ag 3d, and Au 4f high-resolution XPS spectra.

Sample	Orbital	B. E. Peak (eV)	FWHM (eV)	peak area (a. u.)	element/oxidation state
PdAuAg NCs-I	Pd 3d	335.1	1.1	30.5	Pd(0)
		340.4	1.1	17.9	Pd(II)
		335.9	2.5	31.8	Pd(0)
		341.0	2.8	19.8	Pd(II)
	Ag 3d	368.0	1.2	40.7	Ag(0)
		373.9	1.1	26.6	Ag(I)
		368.6	3.5	20.1	Ag(0)
		374.4	2.8	12.7	Ag(I)
	Au 4f	84.1	0.9	50.0	Au(0)
		87.7	1.0	38.1	Au(I)
		84.5	2.5	8.9	Au(0)
		88.4	2.3	3.0	Au(I)
PdAuAg NCs-IV	Pd 3d	334.7	0.8	26.0	Pd(0)
		340.0	0.8	16.9	Pd(II)
		334.9	3.5	26.3	Pd(0)
		339.7	3.5	30.8	Pd(II)
	Ag 3d	367.7	0.8	42.3	Ag(0)
		373.7	0.9	30.4	Ag(I)
		367.9	2.4	17.8	Ag(0)
		374.1	2.4	9.5	Ag(I)
	Au 4f	87.4	0.9	42.0	Au(0)
		83.8	0.9	32.3	Au(I)
		87.7	2.7	14.2	Au(0)
		84.1	2.8	11.5	Au(I)
PdAuAg NCs-XI	Pd 3d	334.8	3.4	48.0	Pd(0)
		339.9	0.8	18.9	Pd(II)

		335.6	2.4	21.7	Pd(0)
		340.1	2.7	11.4	Pd(II)
	Ag 3d	367.3	0.8	43.0	Ag(0)
		373.4	0.8	29.4	Ag(I)
		367.8	2.4	17.0	Ag(0)
		373.7	2.4	10.6	Ag(I)
	Au 4f	83.4	0.8	38.8	Au(0)
		87.1	0.8	29.6	Au(I)
		83.7	2.4	17.1	Au(0)
		87.3	2.4	14.5	Au(I)