Supporting Information

A Comparative Study of Edge-Selective and Face-Specific Growth of PdAg Alloys on Au Nanoplates and Their Applications for Ethanol Oxidation Reaction

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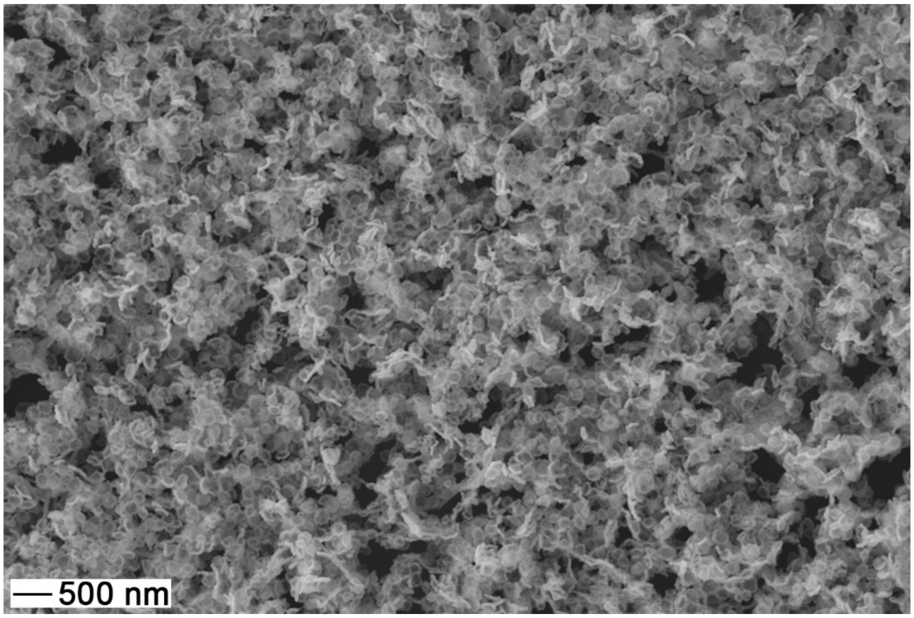

Figure S1. Low-magnified SEM image of Au@PdAg in-plane core-shell nanoplates obtained *via* edge-specific growth (Au@PdAg NPs-E).

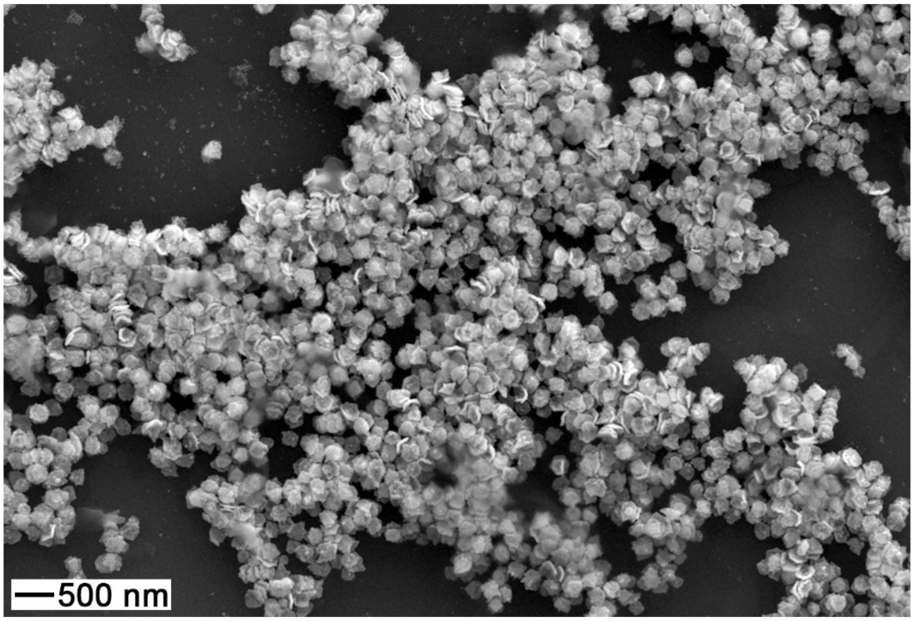

Figure S2. Low-magnified SEM image of Au@PdAg core-shell nanoplates obtained *via* face-specific growth (Au@PdAg NPs-F).

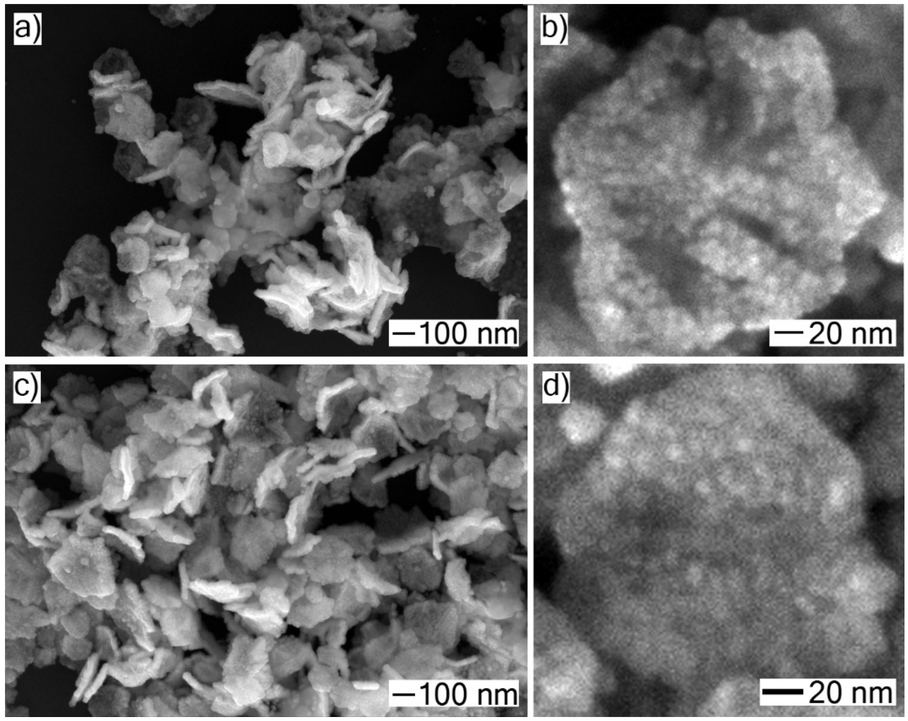

Figure S3. SEM images of AuPdAg nanoplates, except that the capping agent was replaced by: a, b) CTAC (200 mM, 1.5 mL)+CTAB (200 mM, 0.5 mL); c, d) CTAC (200 mM, 0.5 mL)+CTAB (200 mM, 1.5 mL), respectively.

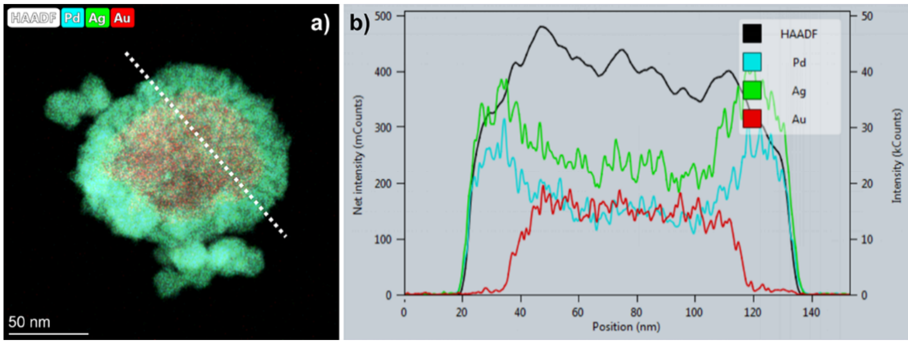

Figure S4. a) HAADF-STEM+EDX-STEM image and b) corresponding line-scan profile of a Au@PdAg NP-E.

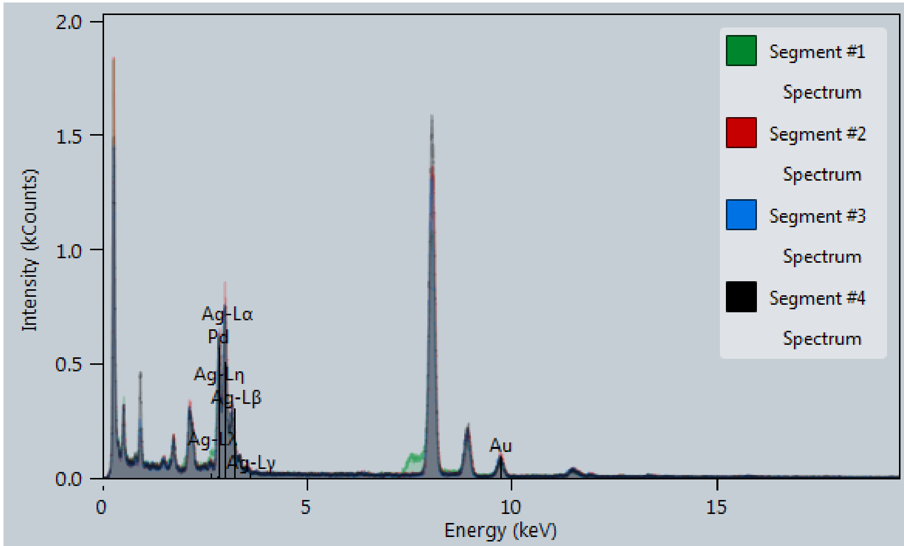

Figure S5. EDS spectrum of AuPdAg-E NPs. The molar ratio of Au:Pd:Ag was measured to be 10.7:45.0:44.3.

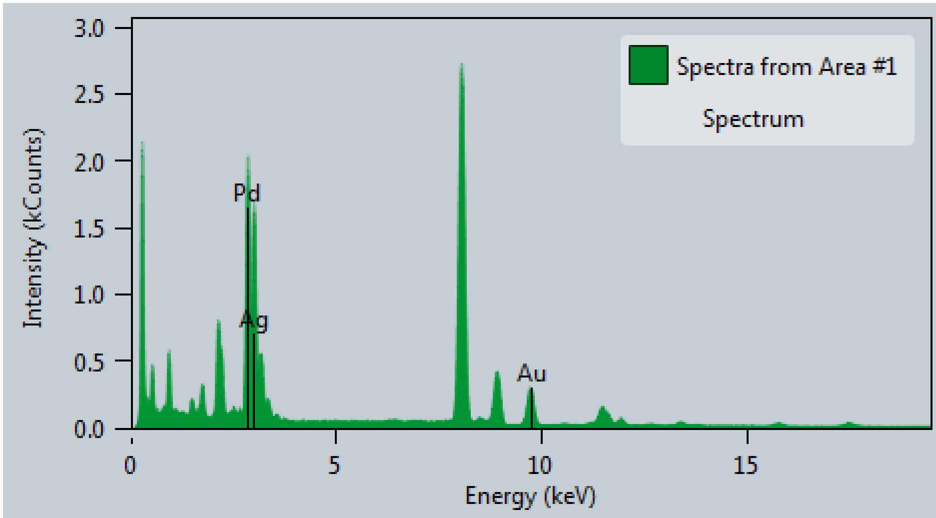

Figure S6. EDS spectrum of AuPdAg-F NPs. The molar ratio of Au:Pd:Ag was measured to be 14.1:60.0:25.9.

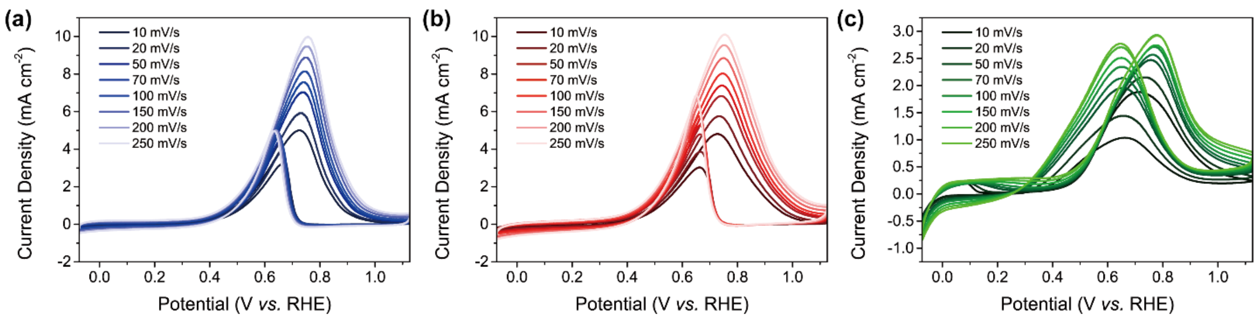

Figure S7. CV curves collected in 1 M KOH+1 M ethanol under different scan rates: a) AuPdAg-E NPs/C; b) AuPdAg-F NPs/C; c) Pt/C.

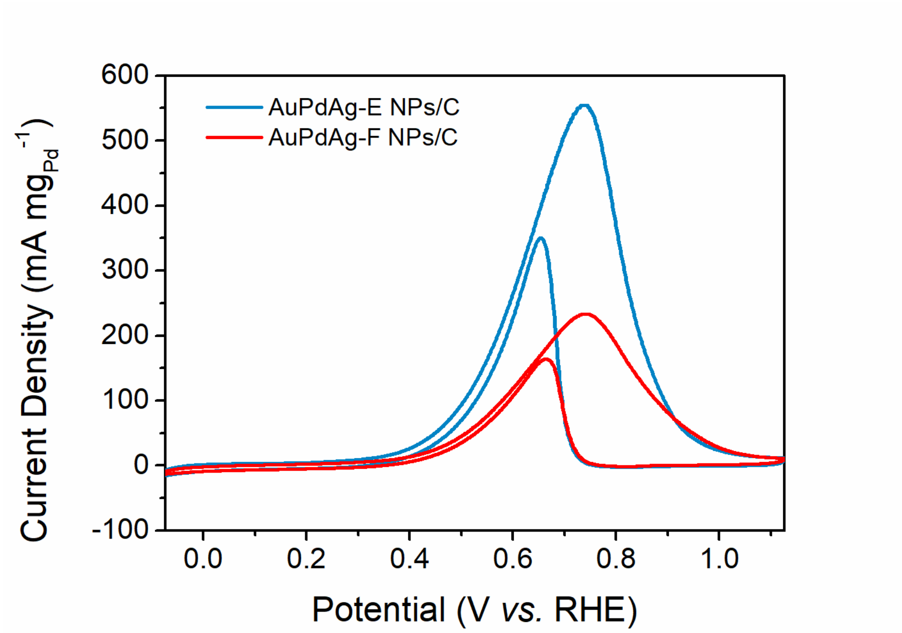

Figure S8. The CV curves of AuPdAg-E NPs/C and AuPdAg-F NPs/C with current density based on the mass of palladium in 1 M KOH with 1 M ethanol solution.

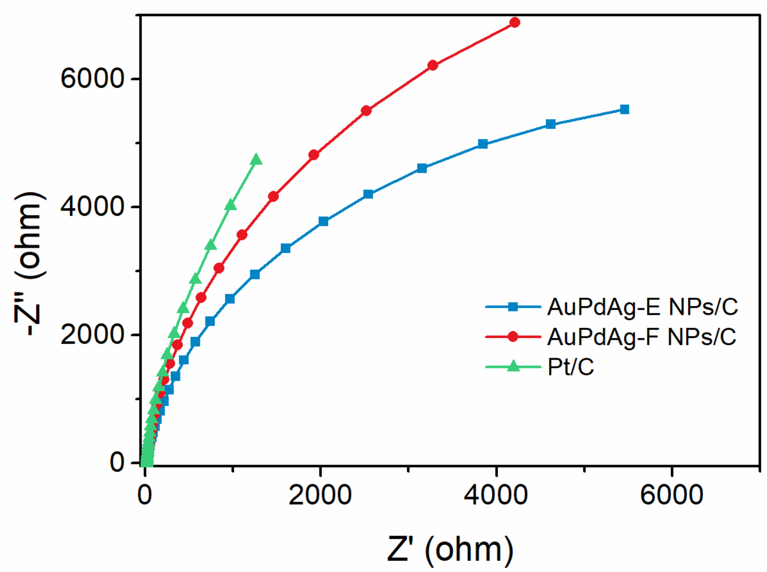

Figure S9. Electrochemical impedance spectra of AuPdAg-E NPs/C, AuPdAg-F NPs/C and Pt/C.

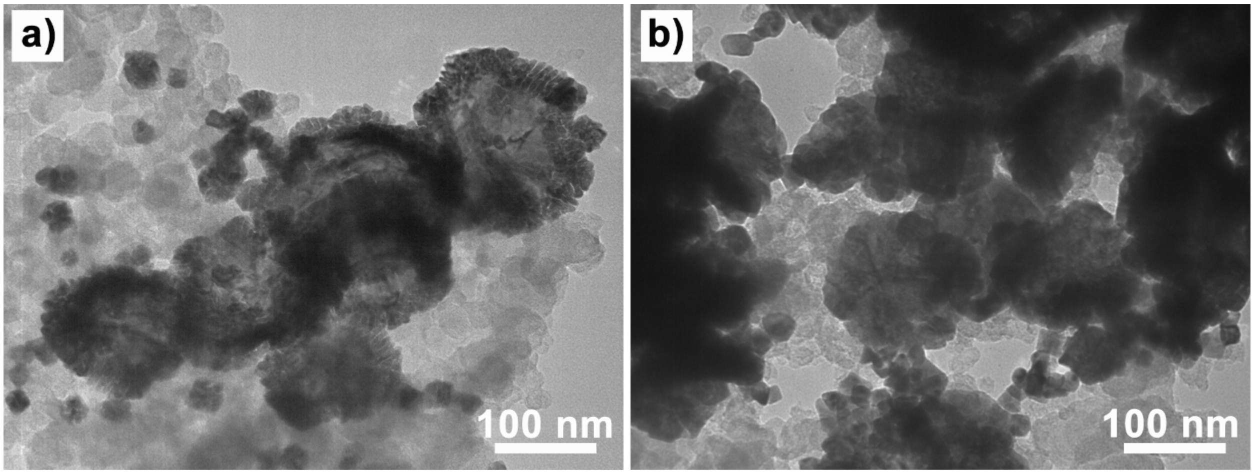

Figure S10. TEM images of a) AuPdAg-E NPs/C and b) AuPdAg-F NPs/C after 250 cycles of CV testing.

Table S1. XRD results and theoretical diffraction peak positions of as-prepared AuPdAg NPs.

Sample/Element	Value Type	Diffraction Peak Position (º)				
		111	200	220	311	222
AuPdAg-E NPs	XRD	38.9	45.3	66.4	79.8	84.0
	Theoretical*	39.0	45.4	66.1	79.6	83.8
AuPdAg-F NPs	XRD	39.2	45.6	66.8	80.5	85.3
	Theoretical*	39.3	45.8	66.6	80.3	84.6
Au	JCPDS No. 04-0784	38.2	44.4	64.6	77.5	81.7
Pd	JCPDS No. 46-1043	40.1	46.7	68.1	82.1	86.6
Ag	JCPDS No. 04-0836	38.1	44.3	64.4	77.5	81.5

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

Table S2. XPS data of Au@PdAg NPs-E and Au@PdAg NPs-F.

Sample	**Orbital**	**B. E. Peak (eV)**	**FWHM (eV)**	**relative peak area**	**element/oxidation state**
AuPdAg-E NPs	Ag $3d_{3/2}$	373.3	0.8	37.0%	Ag(0)
		374.2	1.5	4.8%	Ag(I)
	Ag $3d_{5/2}$	367.3	0.8	45.6%	Ag(0)
		368.3	2.3	12.6%	Ag(I)
	Pd $3d_{3/2}$	339.8	0.82	16.1%	Pd(0)
		340.5	3.9	42.4%	Pd(II)
	Pd $3d_{5/2}$	334.5	0.78	23.8%	Pd(0)
		335.3	2.0	17.7%	Pd(II)
	Au $4f_{5/2}$	87.3	0.78	44.0%	Au(0)
		88.0	1.1	2.3%	Au(I)
	Au $4f_{7/2}$	83.6	0.7	44.5%	Au(0)
		85.3	2.2	9.2%	Au(I)
AuPdAg-F NPs	Ag $3d_{3/2}$	373.3	0.86	33.6	Ag(0)
		374.2	1.5	6.9	Ag(I)
	Ag $3d_{5/2}$	367.3	0.89	44.4	Ag(0)
		368.3	1.9	15.1	Ag(I)
	Pd $3d_{3/2}$	339.8	0.80	17.6	Pd(0)
		340.6	3.4	37.8	Pd(II)
	Pd $3d_{5/2}$	334.5	0.75	26.7	Pd(0)
		335.3	1.6	17.9	Pd(II)
	Au $4f_{5/2}$	87.2	0.75	22.5	Au(0)
		88.2	0.96	7.4	Au(I)
	Au $4f_{7/2}$	83.6	0.70	21.4	Au(0)
		85.6	3.5	48.8	Au(I)

Table S3. Summary of EOR performances of electrocatalysts in the present study.

Electrocatalyst	$E_{Pd\text{-}O}$ (V *vs.* RHE)	E_s [a] (V *vs.* RHE)	E_p [b] (V *vs.* RHE)	ECSA ($cm^2\ mg^{-1}$)	j_r/j_f [b]	Specific Activity ($mA\ cm^{-2}$) [b]	*j*(t=3000s) ($mA\ cm^{-2}$)
AuPdAg-E NPs	0.66	0.34	0.74	78.81	0.63	7.04	0.50
AuPdAg-F NPs	0.66	0.32	0.74	34.16	0.70	6.85	0.33
Pt/C	-	0.41	0.76	309.8	0.79	2.48	0.06

[a] derived from LSV curve at the scan rate of 10 mV/s;

[b] derived from CV curve at the scan rate of 50 mV/s.