Supplementary Information

Surface plasmon-enhanced ethanol electrocatalysis and enhancement mechanism of nanoporous AuPd with wide spectrum response characteristics under visible light irradiation

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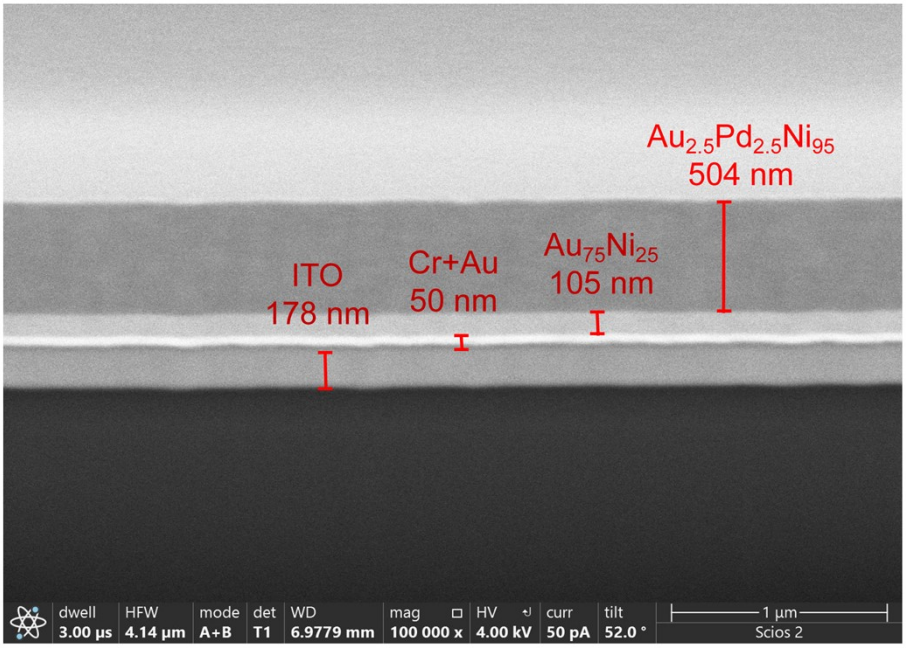

Figure S1. SEM of cross-sectional structure of Au2.5Pd2.5Ni95 precursor.

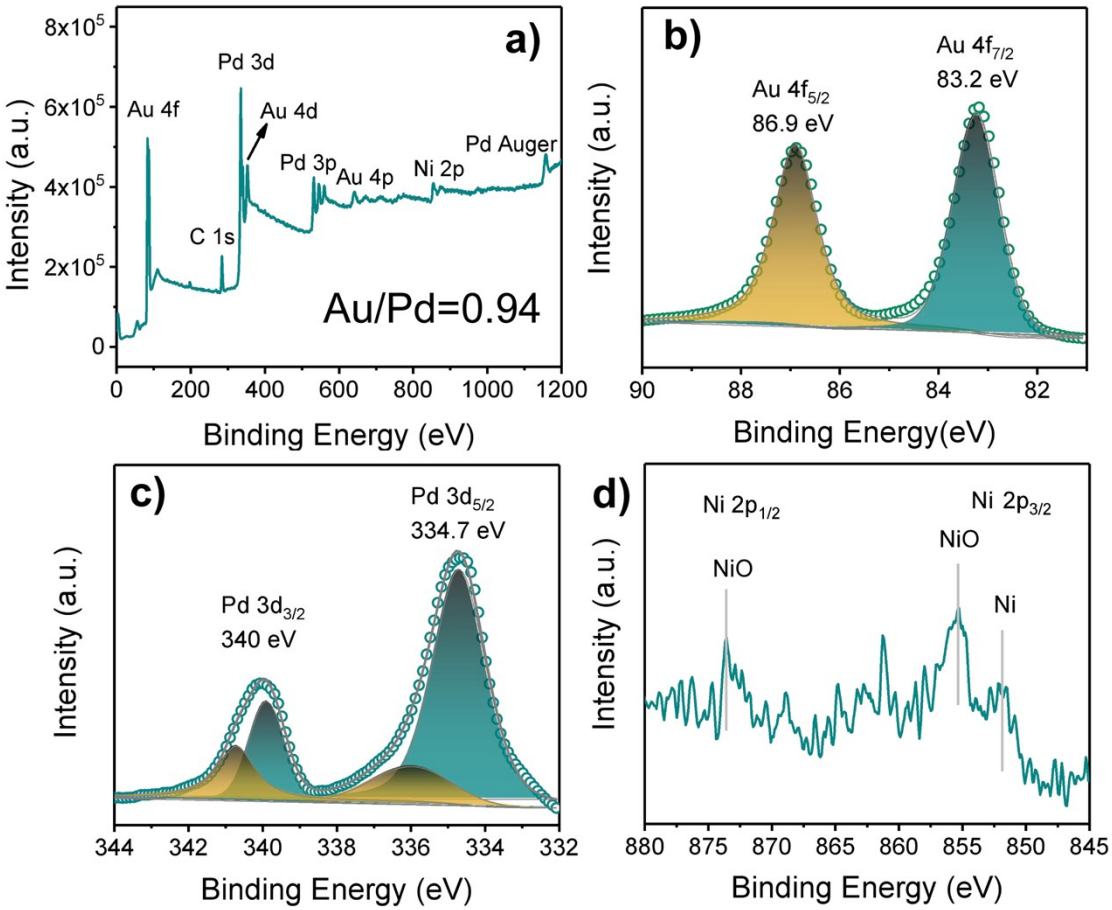

Figure S2. XPS spectra of NP AuPd. (a) XPS survey spectra. Narrow scan spectra of (b) Au 4f, (c) Pd 3d, (d) Ni 2p.

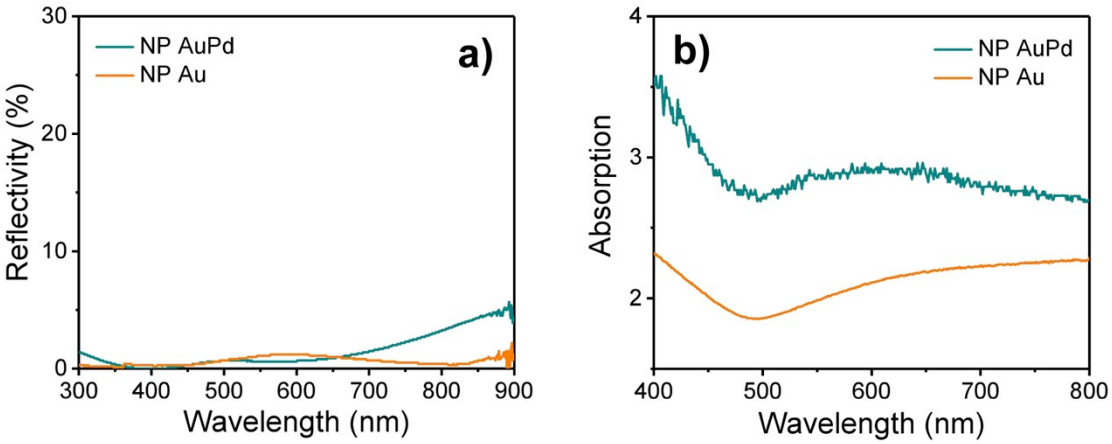

Figure S3. (a) Reflection spectra of the NP AuPd prepared by 100 nm $Au_{25}Ni_{75}$ transition layer and 500 nm $Au_{2.5}Pd_{2.5}Ni_{95}$ precursor. (b) Absorption spectra of the NP AuPd prepared by 25 nm $Au_{25}Ni_{75}$ and 300 nm $Au_{2.5}Pd_{2.5}Ni_{95}$ precursor.

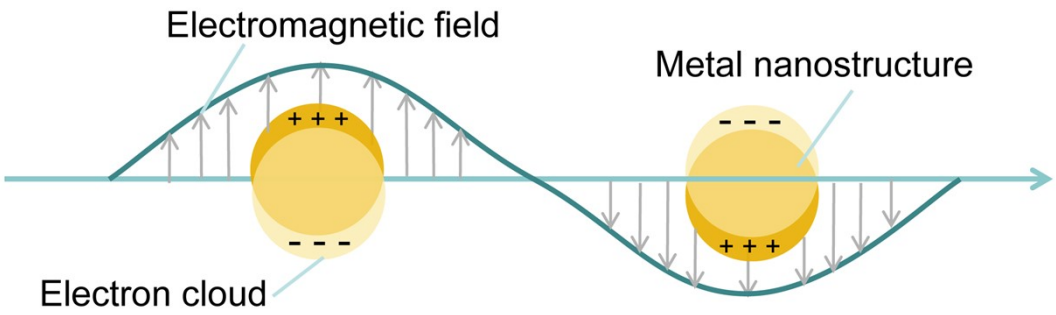

Figure S4. Schematic diagram of LSPR effect of metal nanostructure.

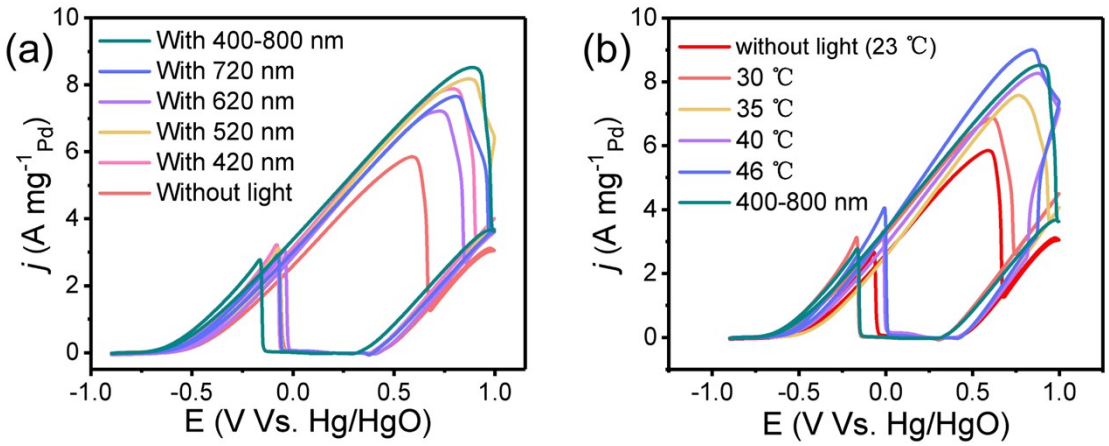

Figure S5. Original CV curves without iR compensation of NP AuPd towards EOR (a) under different light wavelength and (b) at different solution temperatures without visible light illumination.

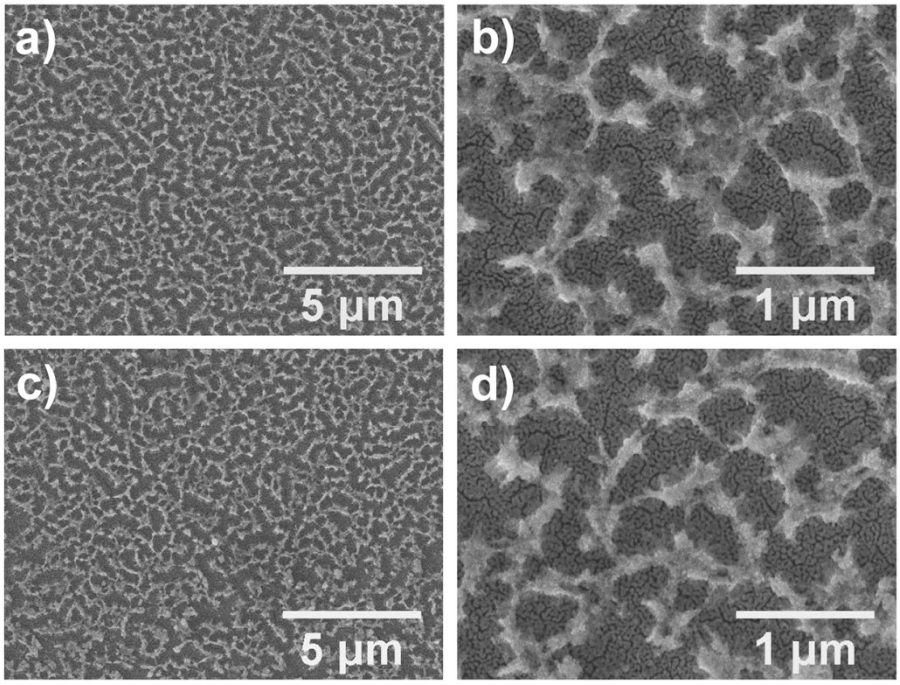

Figure S6. Surface SEM images (a-b) befor and (c-d) after long-term 6000 s CA test of NP AuPd.

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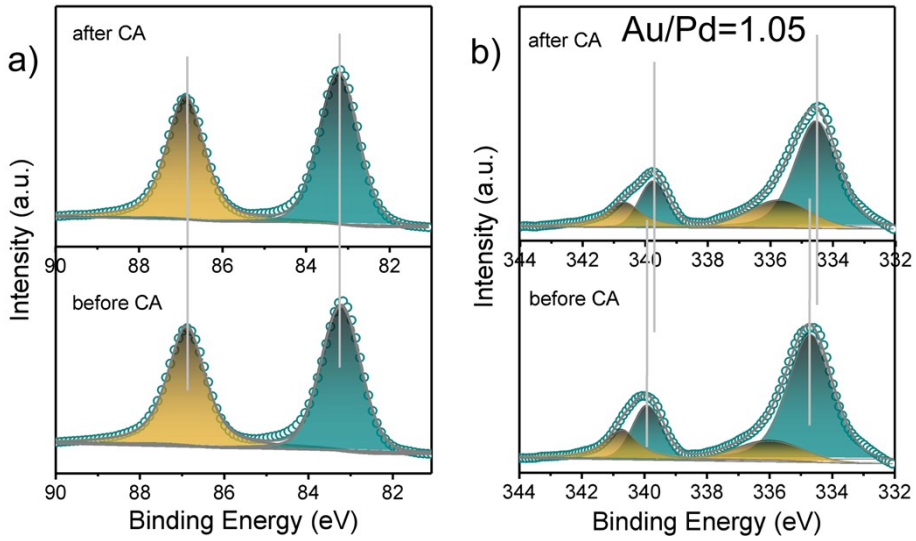

Figure S7. XPS spectra of (e) Au 4f and (f) Pd 3d of NP AuPd after long-term CA.

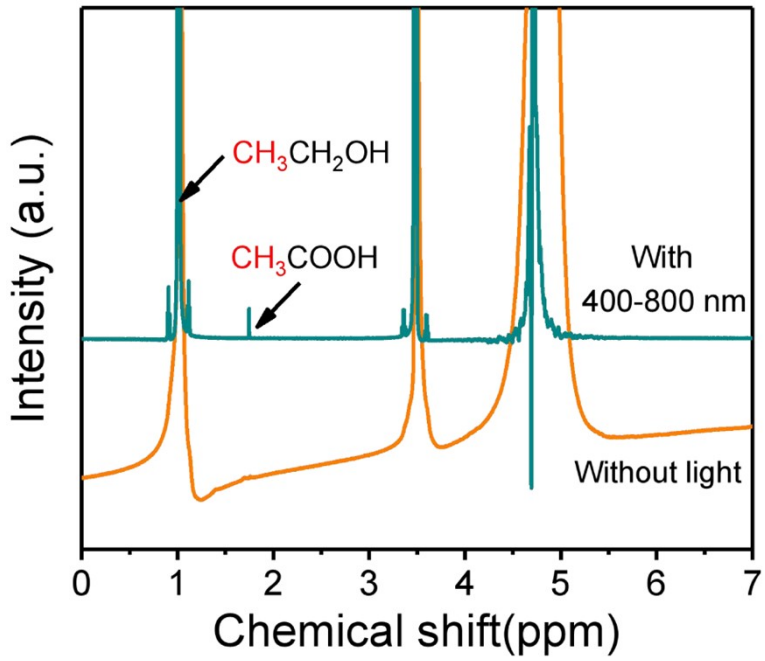

Figure S8. 1H NMR analysis of the electrolytes after CA test for NP AuPd with and without visible light illumination. The total charge during CA test is 9 C.

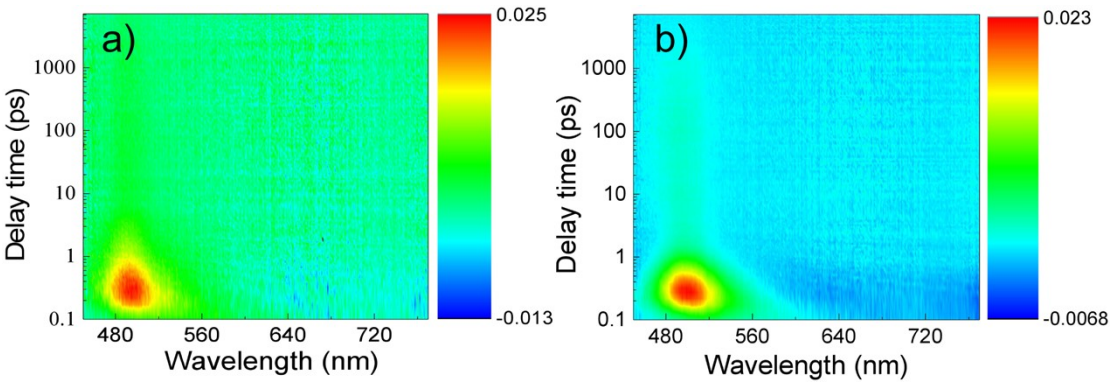

Figure S9. 2D pseudocolor TA spectra of (a) NP Au and (b) NP AuPd after the excitation with a 400 nm laser pulse.

Table S1. Deposition parameters of the Au−Ag−Ni alloys film

Sample layer	element	target power (W)	deposition rate (nm/s) [a]	deposition time (s)	thickness (nm) [b]	mass of Pd (mg cm^{-2}) [c]
$Au_{2.5}Pd_{2.5}Ni_{95}$	Au	6	0.021	880	500	0.019
	Pd	9	0.020			
	Ni	240	0.528			
$Au_{25}Ni_{75}$	Au	38	0.135	249	100	-
	Ni	120	0.264			
Au	Au	120	0.427	70	30	
Cr	Cr	150	0.301	50	15	

[a] The deposition rates were determined by measuring the thickness of calibration samples by a stylus profiler.

[b] The thickness data were calculated using data of deposition rate and deposition time.

[c] The mass were calculated by equation S1 and S2:

$$m = V \times \rho \quad \text{(S1)}$$

Where, m, V, and ρ are the mass, volume, and density of Pd atom.

$$V = S \times d = 1 \times v \times t \quad \text{(S2)}$$

Where, S, d, v, and t are the effective geometric area (1 cm^2), thickness, deposition rate and deposition time.