Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary information

Strain in a Platinum Plate Induced by an Ultrahigh Energy Laser Boosts the Hydrogen Evolution Reaction

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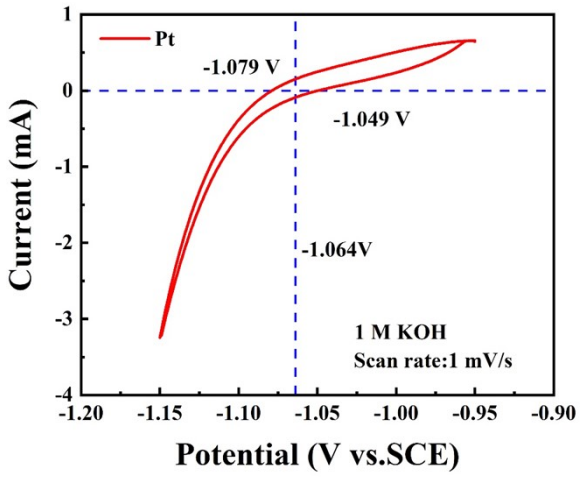

Figure S1 RHE voltage calibration: The saturated calomel electrode (SEC) is standardized using the CV method under the traditional three-electrode system. The electrolyte (KOH) had to be charged for 30 minutes with high-purity hydrogen to saturation. During the standardization process, the standard platinum electrode was used as the auxiliary electrode and the working electrode, and the scanning speed was 1 mV s^{-1}. When the current density reaches zero, the average of the two potentials are considered to be the thermodynamic potential of the HER. The pH value is 13.95 for a 1 M KOH solution; the results show a zero-current point of -1.064 V in a 1 M KOH solution, which is nearly consistent with the value of -1.070 V estimated from the Nernst equation.

$$E\ (\mathrm{RHE}) = E\ (\mathrm{SCE}) + 0.241 + 0.059\ \mathrm{pH} = E\ (\mathrm{SCE}) + 1.064$$

According to the principle of 1 M KOH, E (RHE) = *E* (SCE) +0.241 + 0.059 pH = *E* (SCE) + 0.2587 can be obtained in a 0.5 M H_2SO_4 solution.

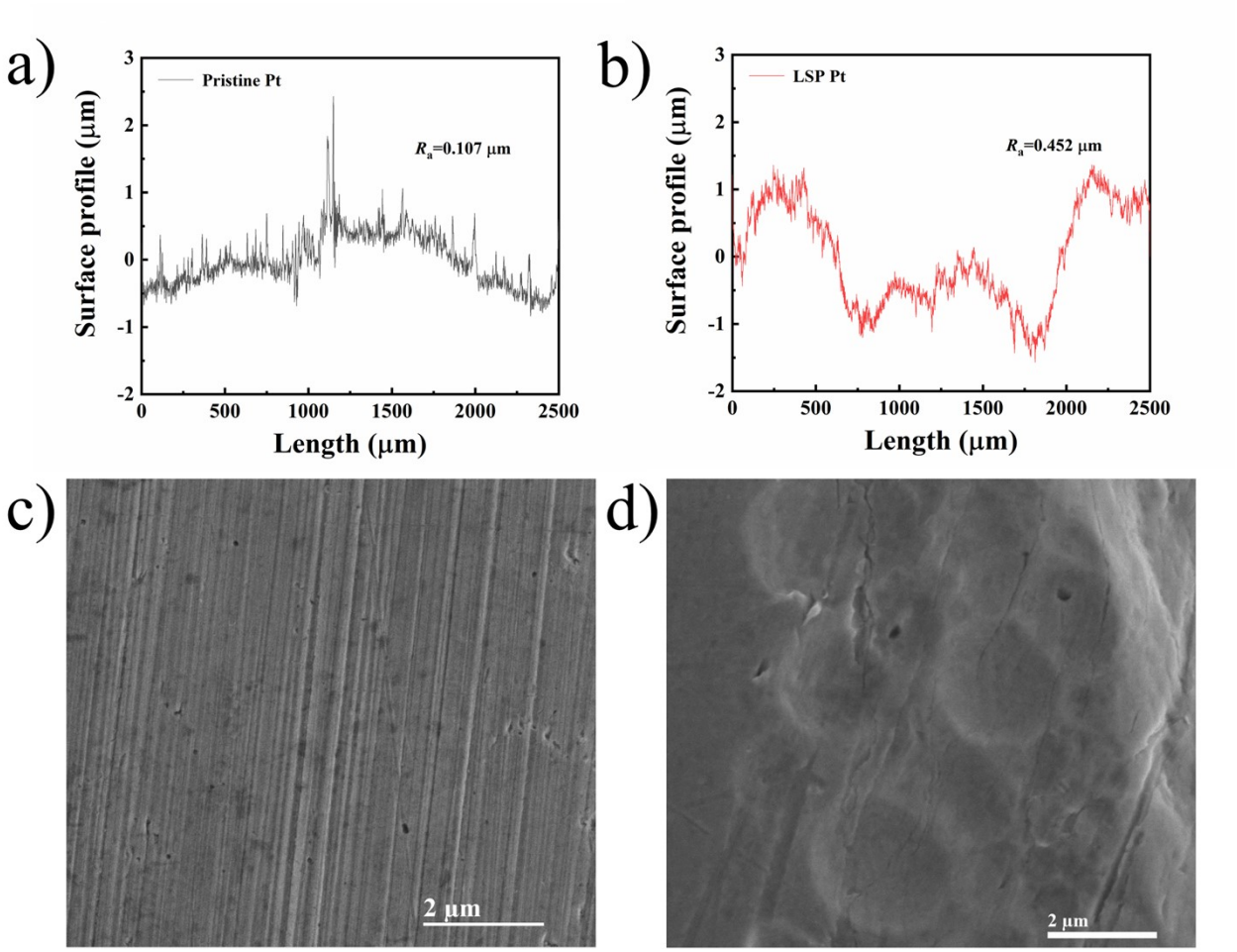

Figure S2 The R_a values of (a) pristine Pt and (b) LSP Pt plates. Surface morphologies of (c) pristine Pt and (d) LSP Pt plates.

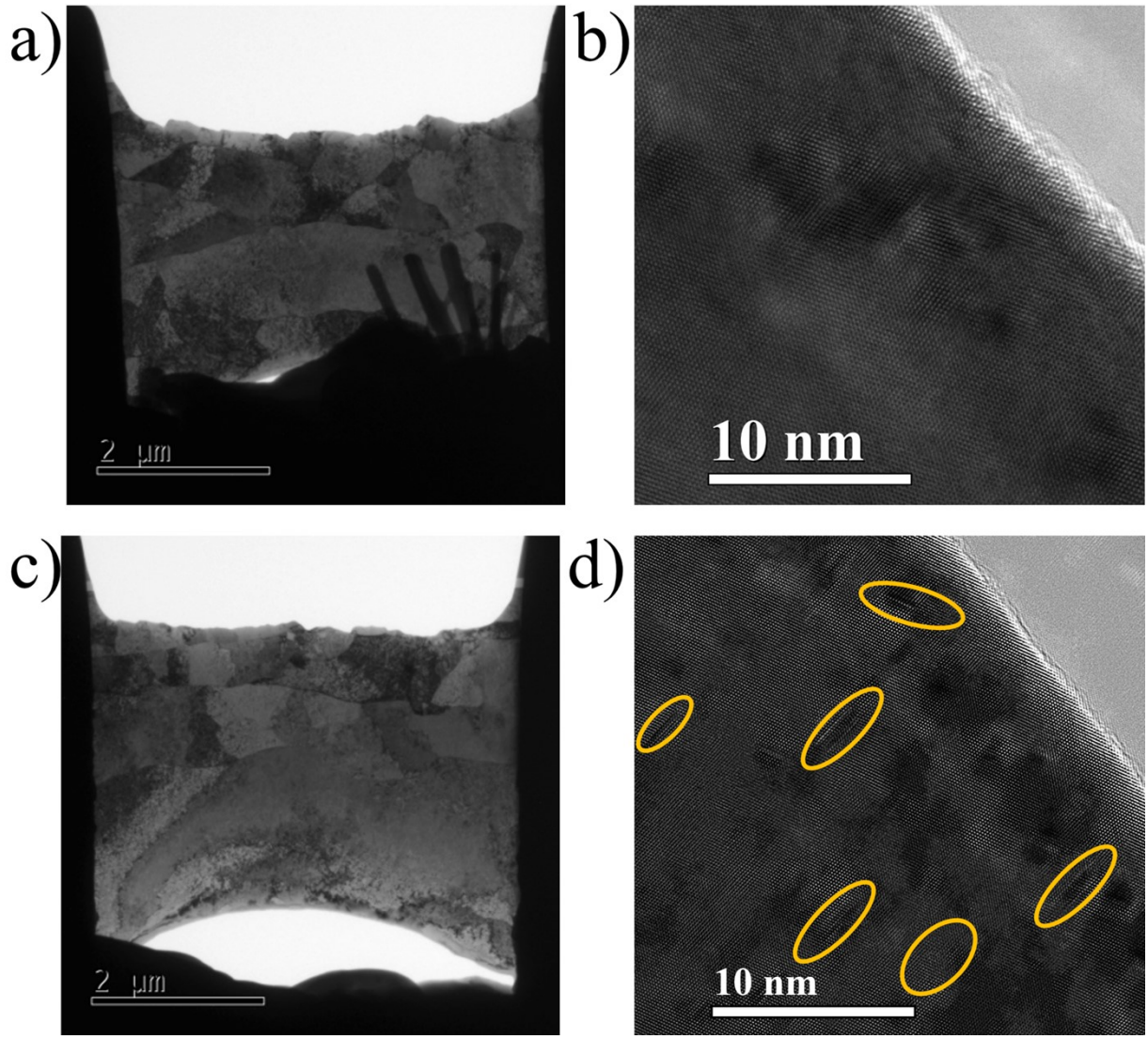

Figure S3 (a, b) TEM and HRTEM images of pristine Pt plates. (c, d) TEM and HRTEM images of LSP Pt plates.

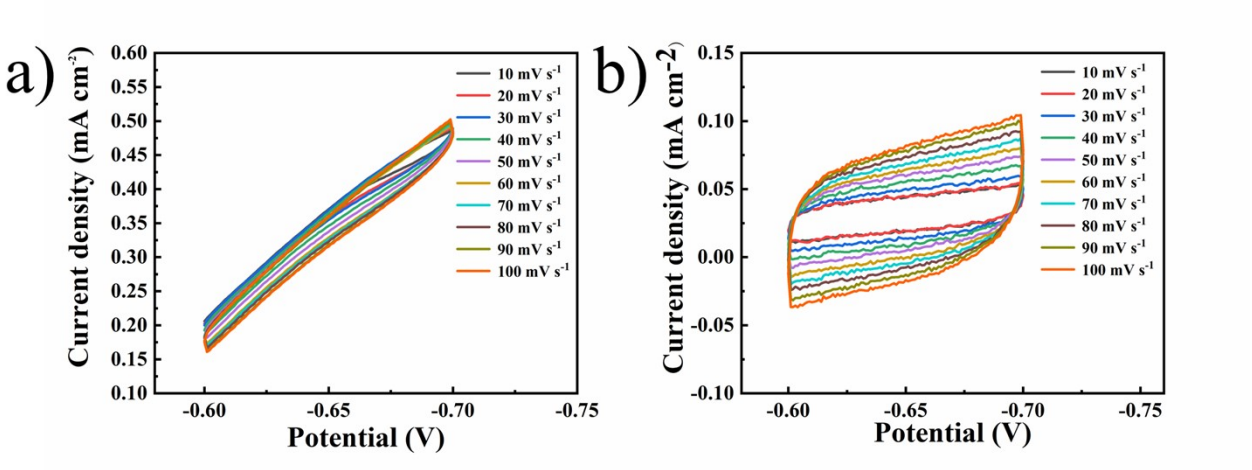

Figure S4 CV curves of (a) pristine Pt and (b) LSP Pt electrodes in a 1 M KOH solution.

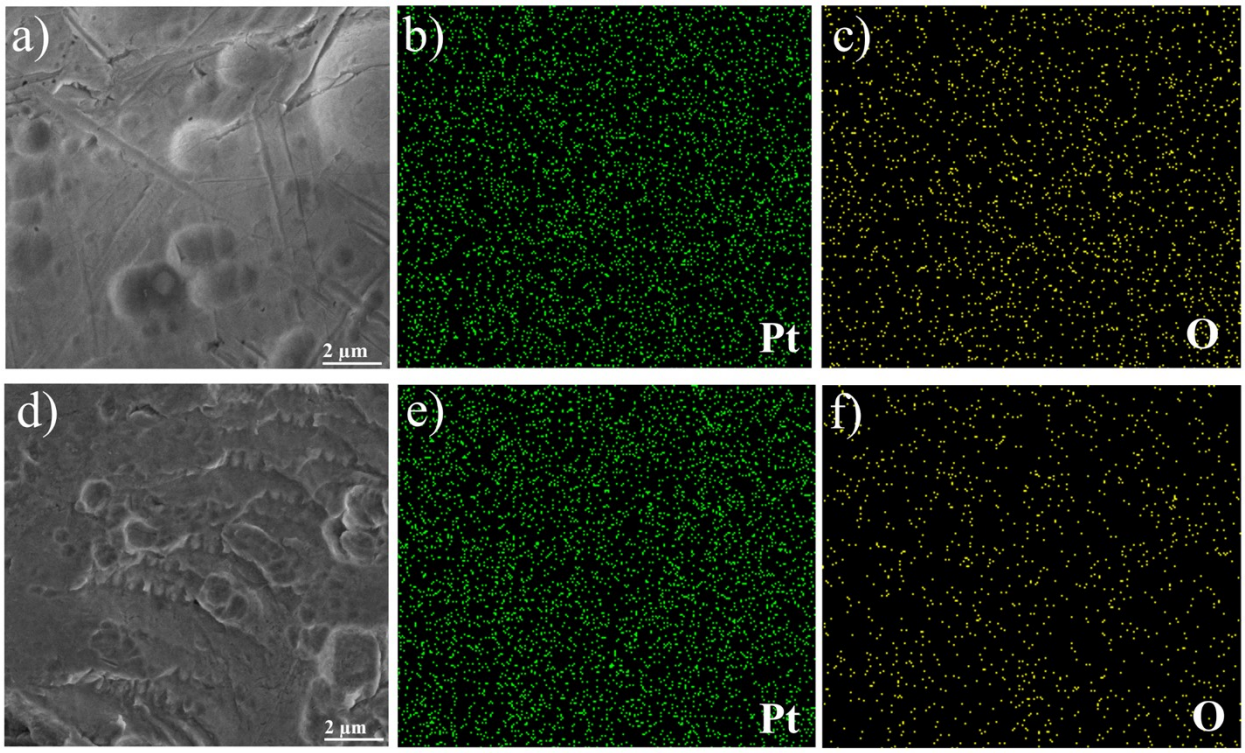

Figure S5 (a) FESEM images and (b, c) EDS elemental mapping of the LSP Pt electrode after aging for 24 hours at a fixed current density of 10 mA cm^{-2} in a 0.5 M H_2SO_4 solution. (d) FESEM images and (e, f) EDS elemental mapping of the LSP Pt electrode after aging for 24 hours at a fixed current density of 10 mA cm^{-2} in a 1 M KOH solution.

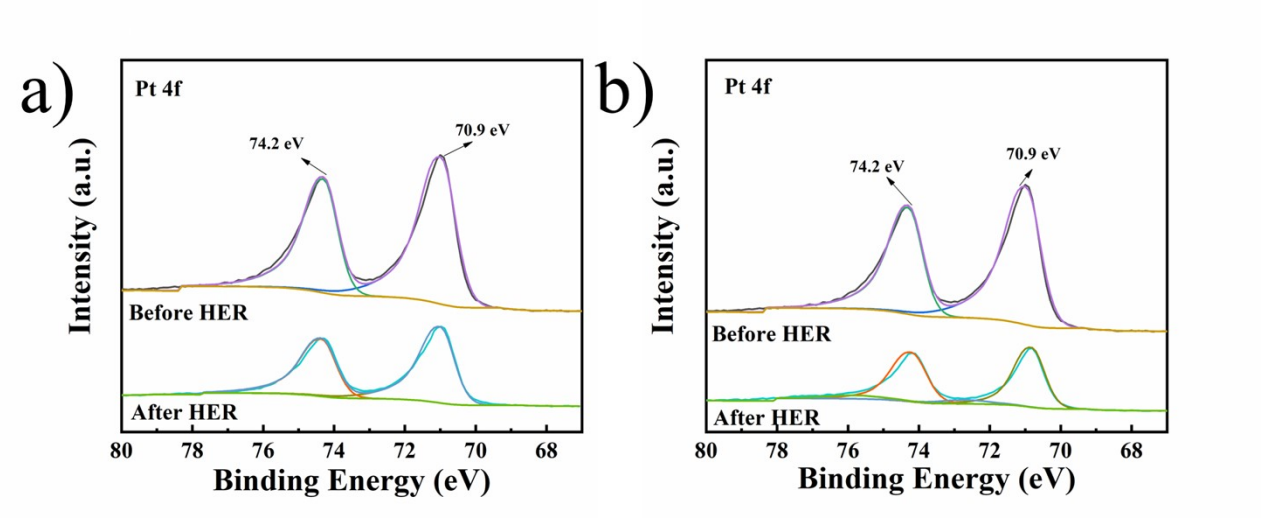

Figure S6 Pt 4f XPS spectra of the LSP Pt before and after aging for 24 hours in a (a) 0.5 M H_2SO_4 and (b) 1 M KOH solution, respectively.

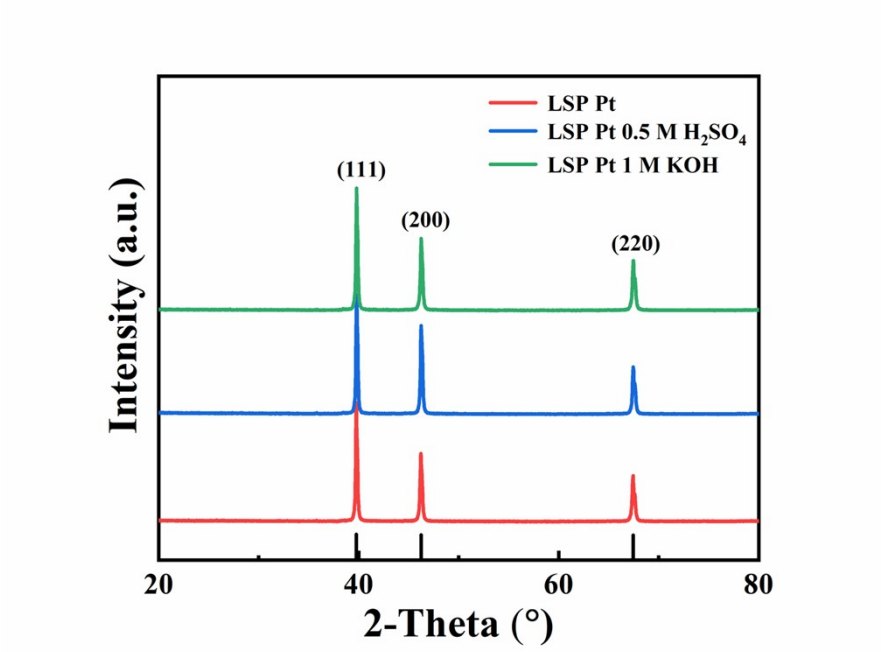

Figure S7 XRD pattern of the LSP Pt electrode before and after aging for 24 hours in a 0.5 M H_2SO_4 and 1 M KOH solution.

Table S1 Summary of fitted EIS data for the pristine and LSP Pt electrodes in a 0.5 M H_2SO_4 solution.

Samples	R_s (Ω cm^{-2})	Q_{dl}	R_{ct} (Ω cm^{-2})
Pristine Pt	0.85	1.96×10^{-5}	9.2
LSP Pt	0.79	6.74×10^{-5}	3.5

Table S2 Summary of fitted EIS data for the pristine and LSP Pt electrodes in a 1 M KOH solution.

Samples	R_s (Ω cm^{-2})	Q_{dl}	R_{ct} (Ω cm^{-2})
Pristine Pt	0.89	1.07×10^{-4}	8.3
LSP Pt	0.78	2.34×10^{-4}	4.4

Table S3 Electrocatalytic performance Comparison of the electrodes for the HER.

Electrocatalyst	Tafel slope (mV dec^{-1})	η_{10} (mV)	Current density for HER stability (mA cm^{-2})	HER Stability (h)	Electrolyte	Reference
LSP Pt	22.7	48	10	>24	0.5 M H_2SO_4	This work
Pristine Pt	30.2	79	10	> 24	0.5 M H_2SO_4	This work
LSP Pt	65.7	139	10	> 24	1 M KOH	This work
Pristine Pt	91.2	264	10	> 24	1 M KOH	This work
SnS_2-Pt-3	126	210	10	> 20	0.5 M H_2SO_4	[1]
$Ti_3C_2Tx@_1$ Pt	80	37	10	> 10	0.5 M H_2SO_4	[2]
Pt-Ag/SiNW	70	50	N/A	N/A	0.5 M H_2SO_4	[3]
Pt-CQDs/Gr-C400	40	27	N/A	N/A	0.5 M H_2SO_4	[4]
Pt-MoS_2 /MWCNTs	28	42	10	10	0.5 M H_2SO_4	[5]
Pt-MoS_2 /MWCNTs	41	75	10	10	1 M KOH	[5]
Pt_1-Mo_2C-C	64	155	170	> 20	1 M KOH	[6]
0.6 Ni-Fe-Pt nanocubes (NCs)	64	326	25	> 20	1 M KOH	[7]
PtPd@NLS	23	29	N/A	N/A	0.5 M H_2SO_4	[8]
PtPd@NLS	97	46	10	>12	0.1 M KOH	[8]

References

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