Electronic Supplementary Information

Table S1. The fit results of TLM ($R_{s,el}$, $R_{p,el}$, $C_{p,el}$ and $Q_{w,el}$) in Fig. 7 and Fig. 8 according to the equivalent circuit model in Fig. 2a.

- **$R_{s,cat.}$**

Fig. 7a,b		pO_2 / atm															
		0.02		0.04		0.06		0.08		0.1		0.2		0.5		1	
		$R_{s,cat}$ / Ωcm²	Err %	$R_{s,cat}$ / Ωcm²	Err %	$R_{s,cat}$ / Ωcm²	Err %	$R_{s,cat}$ / Ωcm²	Err %	$R_{s,cat}$ / Ωcm²	Err %	$R_{s,cat}$ / Ωcm²	Err %	$R_{s,cat}$ / Ωcm²	Err %	$R_{s,cat}$ / Ωcm²	Err %
T/℃	800	3.98E-02	0.03	5.63E-02	0.03	6.90E-02	0.07	7.97E-02	0.06	8.91E-02	0.00	1.26E-01	0.05	1.99E-01	0.08	2.82E-01	0.01
	750	7.91E-02	0.09	1.12E-01	0.06	1.37E-01	0.08	1.58E-01	0.00	1.77E-01	0.00	2.50E-01	0.01	3.95E-01	0.03	5.59E-01	0.00
	700	1.68E-01	0.10	2.38E-01	0.10	2.92E-01	0.02	3.37E-01	0.08	3.77E-01	0.00	5.33E-01	0.02	8.42E-01	0.02	1.19E+00	0.03
	650	3.89E-01	0.03	5.51E-01	0.04	6.75E-01	0.06	7.79E-01	0.06	8.71E-01	0.00	1.23E+00	0.06	1.95E+00	0.06	2.75E+00	0.06
	600	9.91E-01	0.07	1.40E+00	0.07	1.72E+00	0.01	1.98E+00	0.09	2.22E+00	0.01	3.13E+00	0.02	4.96E+00	0.08	7.01E+00	0.04

- **$R_{p,cat.}$**

Fig. 7a,b		pO_2 / atm															
		0.02		0.04		0.06		0.08		0.1		0.2		0.5		1	
		$R_{p,cat}$ / Ωcm²	Err %	$R_{p,cat}$ / Ωcm²	Err %	$R_{p,cat}$ / Ωcm²	Err %	$R_{p,cat}$ / Ωcm²	Err %	$R_{p,cat}$ / Ωcm²	Err %	$R_{p,cat}$ / Ωcm²	Err %	$R_{p,cat}$ / Ωcm²	Err %	$R_{p,cat}$ / Ωcm²	Err %
T/℃	800	3.07E-02	2.28	3.33E-02	2.94	3.31E-02	2.95	3.21E-02	3.06	2.88E-02	4.55	2.47E-02	4.45	1.30E-02	7.20	8.50E-03	8.95
	750	1.50E-01	2.01	1.45E-01	1.36	1.41E-01	1.14	1.36E-01	1.08	1.32E-01	1.07	1.11E-01	1.56	6.63E-02	3.45	3.81E-02	5.14
	700	4.50E-01	1.56	4.23E-01	1.13	4.09E-01	0.98	3.99E-01	0.92	3.90E-01	0.89	3.46E-01	1.05	2.38E-01	2.55	1.39E-01	4.65
	650	1.35E+00	1.19	1.24E+00	1.15	1.21E+00	1.05	1.18E+00	0.99	1.16E+00	0.96	1.07E+00	0.95	8.64E-01	1.53	5.73E-01	3.73
	600	3.97E+00	1.21	3.72E+00	1.08	3.61E+00	1.06	3.53E+00	1.06	3.48E+00	1.06	3.27E+00	1.16	2.86E+00	1.47	2.15E+00	3.11

- **$C_{p,cat.}$**

Fig. 7c		pO_2 / atm															
		0.02		0.04		0.06		0.08		0.1		0.2		0.5		1	
		$C_{p,cat}$ / Fcm^{-2}	Err %	$C_{p,cat}$ / Fcm^{-2}	Err %	$C_{p,cat}$ / Fcm^{-2}	Err %	$C_{p,cat}$ / Fcm^{-2}	Err %	$C_{p,cat}$ / Fcm^{-2}	Err %	$C_{p,cat}$ / Fcm^{-2}	Err %	$C_{p,cat}$ / Fcm^{-2}	Err %	$C_{p,cat}$ / Fcm^{-2}	Err %
T/℃	800	3.07E-02	5.25	3.33E-02	6.94	3.31E-02	6.73	3.21E-02	6.67	2.88E-02	8.42	2.47E-02	7.48	1.30E-02	9.13	8.50E-03	10.00
	750	1.50E-01	4.37	1.45E-01	3.25	1.41E-01	2.77	1.36E-01	2.63	1.32E-01	2.63	1.11E-01	3.48	6.63E-02	5.36	3.81E-02	6.30
	700	4.50E-01	3.15	4.23E-01	2.52	4.09E-01	2.25	3.99E-01	2.14	3.90E-01	2.10	3.46E-01	2.47	2.38E-01	4.60	1.39E-01	5.95
	650	1.35E+00	2.67	1.24E+00	2.37	1.21E+00	2.23	1.18E+00	2.16	1.16E+00	2.12	1.07E+00	2.16	8.64E-01	3.25	5.73E-01	5.68
	600	3.97E+00	2.56	3.72E+00	2.30	3.61E+00	2.23	3.53E+00	2.23	3.48E+00	2.22	3.27E+00	2.40	2.86E+00	3.12	2.15E+00	5.41

- **$R_{s,ano.}$, $R_{p,ano.}$**

Fig. 8a, 800℃		$R_{s,ano}$ / Ωcm^2	Err %	$R_{p,ano}$ / Ωcm^2	Err %	Fig. 8b, pH_2=0.4atm		$R_{s,ano}$ / Ωcm^2	Err %	$R_{p,ano}$ / Ωcm^2	Err %
pH_2 / atm	0.4	3.89E-02	18.81	5.17E-02	5.59	T/℃	800	4.14E-02	19.35	7.89E-02	23.40
	0.5	4.13E-02	17.61	5.43E-02	5.34		750	7.17E-02	18.13	1.16E-01	21.29
	0.6	4.26E-02	16.12	5.60E-02	4.64		700	1.28E-01	16.39	2.07E-01	19.12
	0.7	4.30E-02	15.43	5.73E-02	4.12		650	2.39E-01	17.83	4.41E-01	23.80
	0.8	3.76E-02	22.53	5.98E-02	4.85		600	4.67E-01	18.20	1.18E+00	19.43

- **Q_w, $C_{p,ano.}$**

Fig. 8c, 800℃		Q_w / $Fs^{1/2}cm^{-2}$	Err %	$C_{p,ano}$ / Fcm^{-2}	Err %	Fig. 8d, pH_2=0.4atm		Q_w / $Fs^{1/2}cm^{-2}$	Err %	$C_{p,ano}$ / Fcm^{-2}	Err %
pH_2 / atm	0.4	1.18E-01	11.77	9.11E-04	22.22	T/℃	800	1.44E-01	3.14	1.00E-03	20.23
	0.5	1.18E-01	10.75	9.94E-04	20.57		750	9.95E-02	3.22	7.86E-04	26.00
	0.6	1.18E-01	9.71	1.07E-03	18.33		700	7.11E-02	3.83	7.78E-04	25.20
	0.7	1.20E-01	9.08	1.13E-03	17.18		650	5.45E-02	4.11	7.37E-04	26.34
	0.8	1.33E-01	11.43	1.09E-03	24.34		600	4.47E-02	3.98	6.90E-04	38.45

Table S2. The fit results of TLM ($R_{s,el}$, $R_{p,el}$, $C_{p,el}$ and $Q_{w,el}$) in Fig. 12 according to the equivalent circuit model in Fig. 2a.

- **Anode**

Fig. 12a		Original				Infiltrated			
		$R_{s,ano}$ / Ωcm^2	Err %	$R_{p,ano}$ / Ωcm^2	Err %	$R_{s,ano}$ / Ωcm^2	Err %	$R_{p,ano}$ / Ωcm^2	Err %
T/℃	700	1.28E-01	16.39	2.07E-01	19.12	4.54E-02	4.47	2.98E-01	1.03
	650	2.39E-01	17.83	4.41E-01	23.80	8.33E-02	5.34	6.07E-01	1.28
	600	4.67E-01	18.20	1.18E+00	19.43	1.81E-01	8.03	1.38E+00	1.68

Fig. 12b		Original				Infiltrated			
		Q_w / Fs$^{1/2}$cm^{-2}	Err %	$C_{p,ano}$ / Fcm^{-2}	Err %	Q_w / Fs$^{1/2}$cm^{-2}	Err %	$C_{p,ano}$ / Fcm^{-2}	Err %
T/℃	700	7.11E-02	3.83	7.78E-04	0.09	5.41E-02	1.26	5.08E-04	13.00
	650	5.45E-02	4.11	7.37E-04	0.05	3.76E-02	1.24	4.78E-04	18.60
	600	4.47E-02	3.98	6.90E-04	0.03	2.57E-02	1.18	4.28E-04	13.00

- **Cathode**

Fig. 12c		Original				Infiltrated			
		$R_{s,cat.}$ / Ωcm^2	Err %	$R_{p,cat.}$ / Ωcm^2	Err %	$R_{s,cat.}$ / Ωcm^2	Err %	$R_{p,cat.}$ / Ωcm^2	Err %
T/℃	700	5.33E-01	0.07	3.46E-01	1.05	9.52E-03	5.06	2.15E-01	1.24
	650	1.23E+00	0.04	1.07E+00	0.95	1.68E-02	5.93	5.58E-01	1.21
	600	3.13E+00	0.01	3.27E+00	1.16	2.69E-02	10.87	1.45E+00	1.31

Fig. 12d		Original		Infiltrated	
		$C_{p,cat}$ / Fcm^{-2}	Err %	$C_{p,cat}$ / Fcm^{-2}	Err %
T/℃	700	8.33E-02	2.47	5.48E-03	1.32
	650	4.37E-02	2.16	4.78E-03	1.36
	600	2.89E-02	2.40	4.43E-03	1.55

Table S3. The fit results of half-cell in Fig. S3c compared to full-cell data in Fig. 12c.

Half									
T/℃	$1000T^{-1}/K^{-1}$	$\log(R_{s,ori}$ / Ωcm$^2)$	err	$\log(R_{s,inf}$ / Ωcm$^2)$	err	$\log(R_{p,ori}$ / Ωcm$^2)$	err	$\log(R_{p,inf}$ / Ωcm$^2)$	err
600	1.02759	-0.13	0.03	-0.81	0.01	-0.40	0.02	-1.11	0.00
650	1.08325	0.35	0.02	-0.61	0.06	-0.01	0.02	-0.76	0.03
700	1.14528	0.61	0.03	-0.31	0.02	0.69	0.09	-0.28	0.01
Activation energy / eV		1.40	0.20	1.40	0.20	1.10	0.30	1.20	0.10

Full									
T/℃	$1000T^{-1}/K^{-1}$	$\log(R_{s,ori}$ / Ωcm$^2)$	err	$\log(R_{s,inf}$ / Ωcm$^2)$	err	$\log(R_{p,ori}$ / Ωcm$^2)$	err	$\log(R_{p,inf}$ / Ωcm$^2)$	err
600	1.02759	-0.27	0.00	-2.02	0.02	-0.46	0.00	-0.67	0.01
650	1.08325	0.09	0.00	-1.77	0.03	0.03	0.00	-0.25	0.01
700	1.14528	0.50	0.00	-1.57	0.05	0.51	0.01	0.16	0.01
Activation energy / eV		1.30	0.00	0.80	0.10	1.65	0.06	1.40	0.05

Table S4. The fit results of half-cell in Fig. S3d compared to full-cell data in Fig. 12d.

Half					
T/℃	$1000T^{-1}/K^{-1}$	$\log(C_{p,ori} / Fcm^{-2})$	err	$\log(C_{p,inf} / Fcm^{-2})$	err
600	1.02759	-1.39	0.02	-1.69	0.04
650	1.08325	-1.61	0.07	-1.85	0.03
700	1.14528	-1.92	0.03	-2.19	0.02
Activation energy		0.80	0.10	0.70	0.10

Full					
T/℃	$1000T^{-1}/K^{-1}$	$\log(C_{p,ori} / Fcm^{-2})$	err	$\log(C_{p,inf} / Fcm^{-2})$	err
600	1.02759	-1.08	0.01	-2.26	0.01
650	1.08325	-1.36	0.01	-2.32	0.01
700	1.14528	-1.54	0.01	-2.35	0.01
Activation energy		0.80	0.10	0.16	0.03