Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Supporting information

Effect of electrode material and electrolysis process on the preparation of electrolyzed oxidizing water

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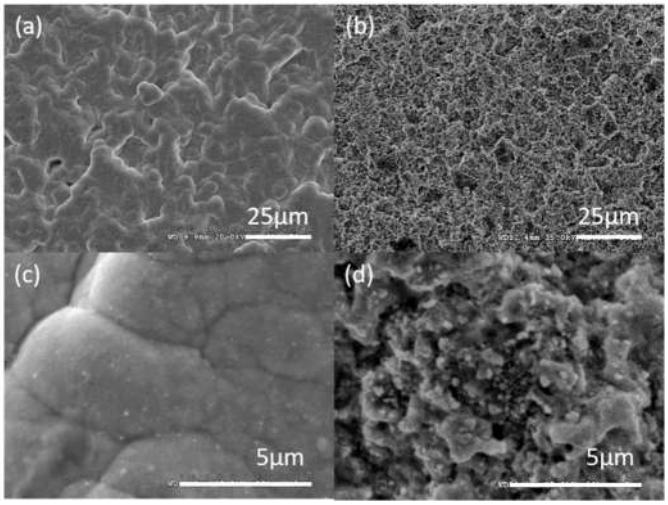

Fig. S1† SEM diagrams of Pt-EP (a, c) and Pt-TD (b, d) electrodes.

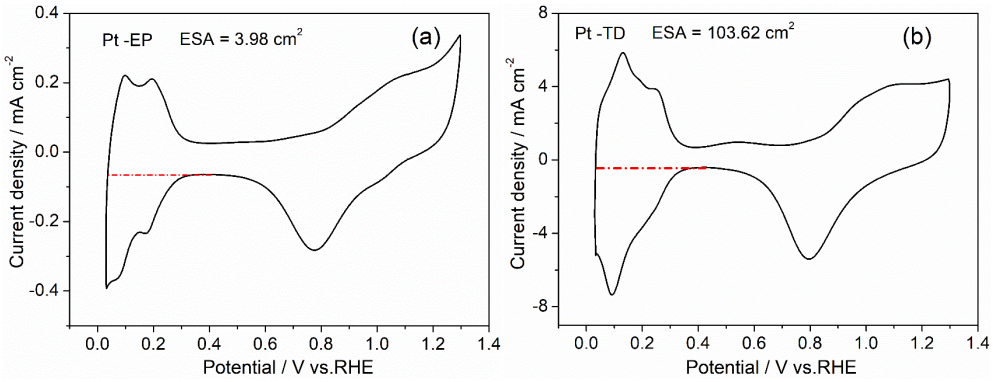

Fig. S2† Electrochemical active surface areas (ESAs) of Pt-EP(a) and Pt-TD(b) electrodes in 0.5 mol L^{-1} H_2SO_4. (ESA = Q_H /0.21. Q_H is the quantity of electric charge of the H_{ad} underpotential deposition. 0.21 mC cm^{-2} is the charge constant of H_{ad} underpotential deposition on the polycrystalline platinum.)

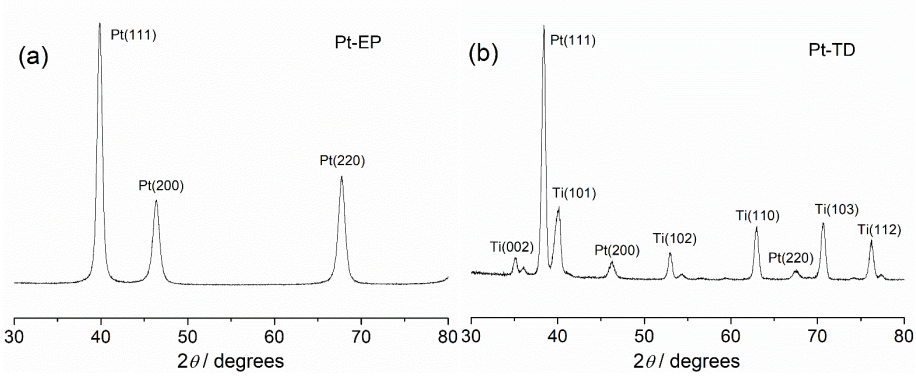

Fig. S3† XRD diagrams of Pt-EP (a) and Pt-TD (b) electrodes.

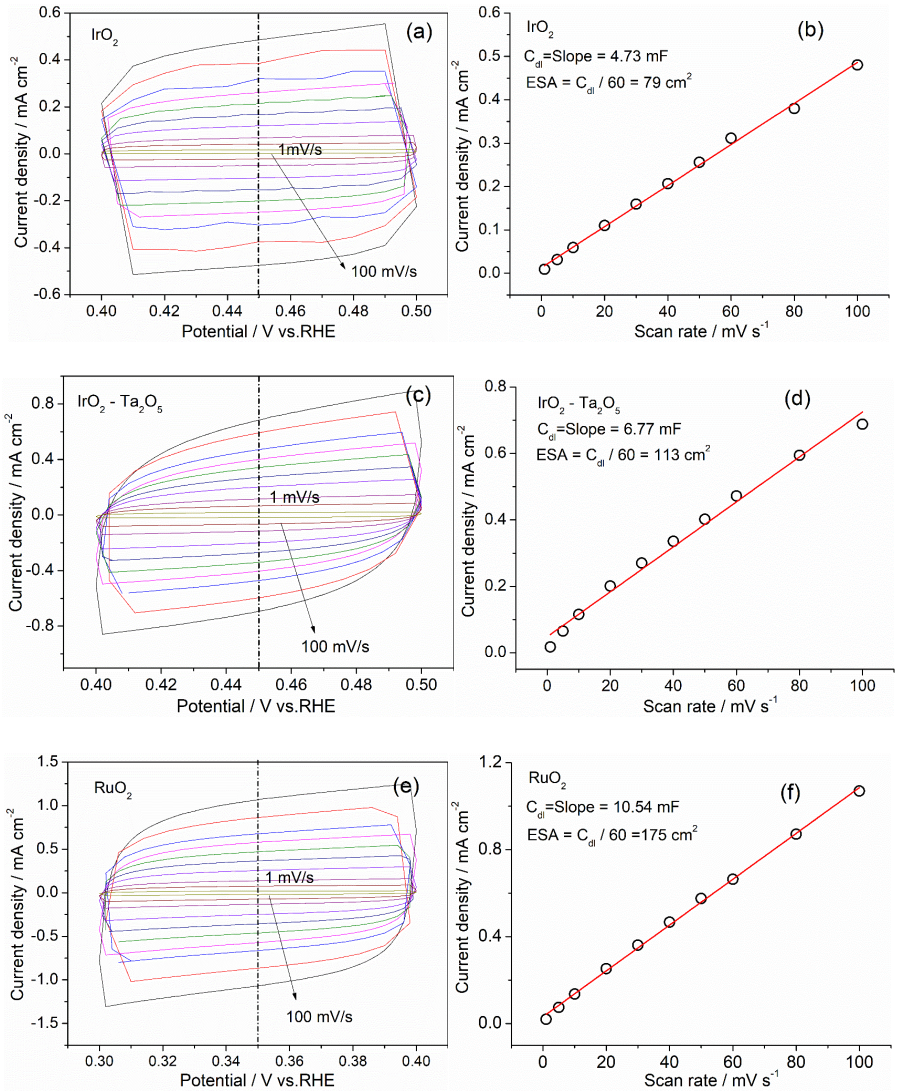

Fig. S4† Electrochemical active surface areas (ESAs) of IrO_2(a, b), IrO_2-Ta_2O_5(c, d) and RuO_2(e, f) electrodes in 0.5 mol L^{-1} H_2SO_4. (ESA = C_{dl}/60. C_{dl} is the capacitance of oxide electrode and 60 μF cm^{-2} is the capacitance constant of smooth oxide electrode. $C_{dl} = i_c/v$, which corresponds to the slope in Fig. S4† (b, d, f). i_c is the current density and v is scan rate (1, 5, 10, 20, 30, 40, 50, 60, 80, 100 mV/s))

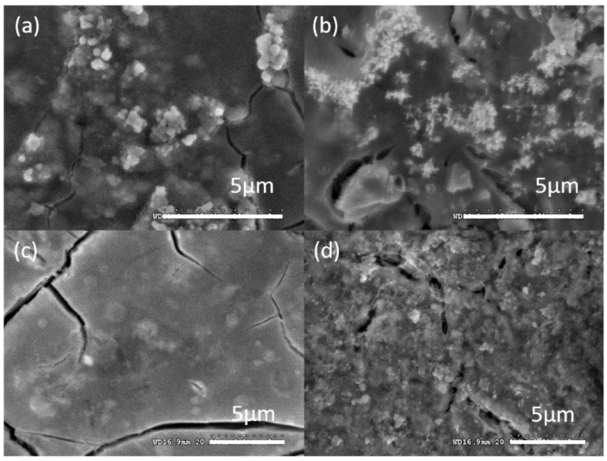

Fig. S5† SEM diagrams of RuO_2 (a), IrO_2-Ta_2O_5 (b), IrO_2 (thermal decomposition temperatures 400℃, c) and IrO_2 (thermal decomposition temperatures 600℃, d) electrodes.

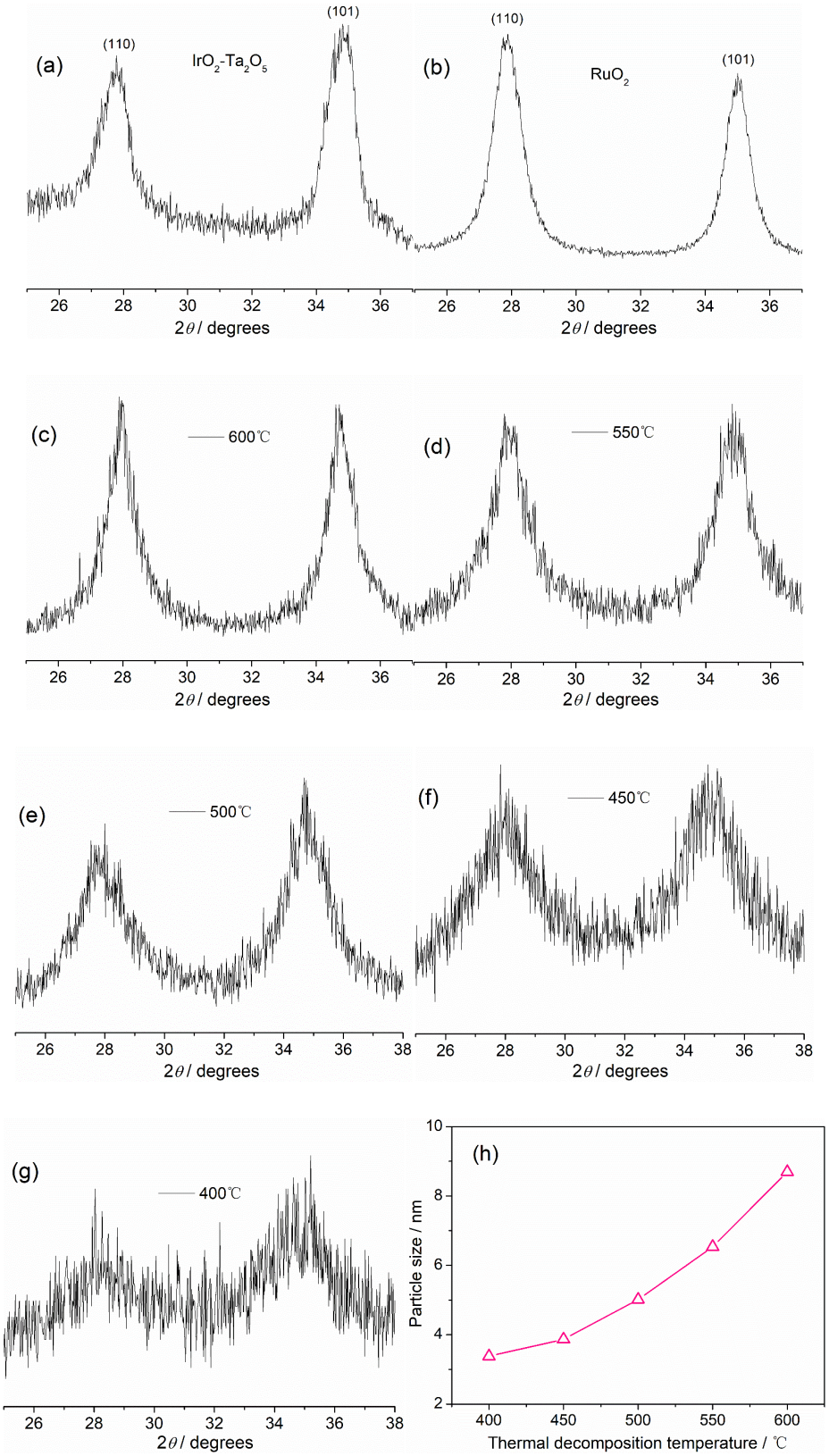

Fig. S6† XRD diagrams of IrO_2-Ta_2O_5 (a) and RuO_2 (b) electrodes. XRD diagrams of IrO_2 electrodes at different thermal decomposition temperatures. ((c) 600℃, (d) 550℃, (e)500℃, (f)450℃, (g) 400℃). The particle size of IrO_2 electrodes of different thermal decomposition temperatures (h).

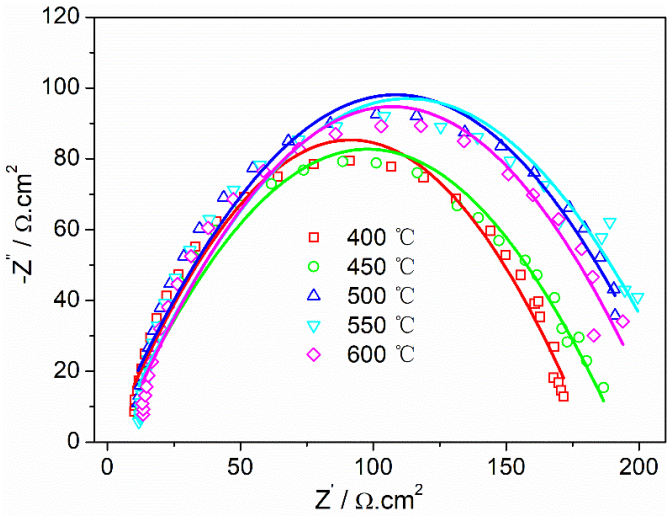

Fig. S7† Electrochemical impedance spectroscopy of IrO_2 electrodes at different thermal decomposition temperatures.

Table S1† The compositions of IrO_2-Ta_2O_5, RuO_2-SnO_2 and RuO_2-TiO_2 by XRF

Electrode	Element	Atom%	Std. dev. proc.-calc.	Line	Int. (cps μA^{-1})
IrO_2-Ta_2O_5	IrO_2	75.305	[0.370] Quan-FP	IrLα	71.1850
	Ta_2O_5	24.695	[0.169] Quan-FP	TaLα	42.3708
RuO_2-SnO_2	RuO_2	72.629	[28.234] Quan-FP	RuKα	3.8226
	SnO_2	27.371	[71.766] Quan-FP	SnKα	0.2605
RuO_2-TiO_2	RuO_2	75.381	[0.207] Quan-FP	RuKα	33.4685
	TiO_2	24.619	[0.089] Quan-FP	TiKa	24.4534

Table S2† The values of pH and ORP of EO water prepared by different electrode materials

Electrode material	The physicochemical property of EOW	
	pH	ORP / mV
Pt-EP	1.76	1144
Pt-TD-500	1.91	1164
RuO_2-500	2.03	1160
IrO_2-500	1.88	1161
IrO_2-Ta_2O_5-500	1.89	1144

Table S3† The values of pH and ORP of EO water prepared by IrO_2-Ta_2O_5 electrodes after continuous electrode polarity changes.

Number	pH	ORP/mV	Note
1	2.65	1107	①
2	2.63	1106	②
3	2.65	1107	①
4	2.65	1105	②
5	2.65	1101	①
6	2.63	1109	②
7	2.66	1102	①
8	2.65	1093	②
9	2.66	1103	①
10	2.68	1115	②

① IrO_2-Ta_2O_5-1 as anode, IrO_2-Ta_2O_5-2 as cathode

② IrO_2-Ta_2O_5-2 as anode, IrO_2-Ta_2O_5-1 as cathode

Table S4† The preparation process parameters and physicochemical properties of EO water at different current density

The preparation process parameters			The physicochemical properties of EO water		
Current density / mA cm^{-2}	Time /min	Voltage / V	pH	ORP / mV	ACC / mg L^{-1}
20	38	15	2.47	1163	59.31
30	27	18	2.47	1166	60.00
40	20	20	2.53	1163	56.37
50	17	21	2.53	1163	57.70
60	16	25	2.48	1165	70.21
70	13	28	2.49	1161	60.85

Table S5† The preparation process parameters and physicochemical properties of EO water at different electrolyte concentration

The preparation process parameters			The physicochemical properties of EO water		
Electrolyte concentration / g L^{-1}	Time / min	Voltage / V	pH	ORP / mV	ACC / mg L^{-1}
0.3	35	26	2.73	1144	67.40
0.4	25	22	2.6	1158	63.14
0.5	20	20	2.58	1147	58.04
0.6	18	19	2.52	1164	61.53
0.7	15	18	2.54	1165	55.74
0.8	12	18	2.53	1164	50.63

Table S6† The values of pH at different rotational speeds

Time / min	pH			
	0rpm	450 rpm	900 rpm	1350 rpm
0	2.21	2.30	2.05	2.05
10	1.92	2.17	2.21	1.99
20	2.14	1.96	1.99	2.01
30	2.17	2.15	2.02	2.13
40	2.09	2.09	2.17	2.29
50	2.08	2.18	2.24	2.00
60	1.86	2.11	2.00	1.98

Table S7† The values of ORP at different rotational speeds

Time / min	ORP / mV			
	0rpm	450 rpm	900 rpm	1350 rpm
0	1163	1149	1158	1158
10	1147	1142	1153	1133
20	1144	1139	1155	1128
30	1150	1137	1148	1123
40	1151	1134	1139	1123
50	1154	1134	1129	1101
60	1152	1124	1106	1057

Table S8† The values of pH at different temperature

Time / min	pH			
	30℃	50℃	60℃	70℃
0	1.89	1.98	1.98	1.86
10	2.04	1.92	1.85	1.95
20	1.89	1.84	1.92	1.89
30	1.95	1.90	1.82	1.99
40	1.92	1.90	1.90	1.92
50	2.05	1.89	1.94	1.84
60	1.98	1.93	1.93	1.86

Table S9† The values of ORP at different rotational speeds

Time / min	ORP / mV			
	30℃	50℃	60℃	70℃
0	1159	1155	1157	1153
10	1156	1151	1155	1154
20	1155	1157	1152	1153
30	1152	1156	1151	1150
40	1150	1153	1151	1142
50	1150	1150	1141	1129
60	1145	1145	1135	1105