Supplementary Material

Table S1. Summary of RuO_2 based pH electrode characteristics reported previously and in this work

Deposition method	Electrode sensitive material	Substrate	Precursor	Slope, mV/pH	E^0, mV	R^2	pH range	Response time, s	T, ^0C	Hysteresis, mV	Drift, mV/h	Reference electrode	Ref.
ED [1]	RuO_2	Au wire	K_2RuO_4	59.3	521	N/A	2.0 - 12.0	N/A	N/A	N/A	N/A	NHE [2]	[1]
		Au disk	$RuCl_3 \cdot xH_2O$	60.5	N/A	0.999	2.0 – 11.0	7	N/A	N/A	N/A	Ag|AgCl|KCl	[2]
		Pt	RuO_2	56.2	596	0.999	4.0 - 10.0	N/A	37.5	N/A	N/A		[3]
		Pt-Ti	RuO_2	59.3	609	0.999	4.0 - 10.0	N/A	37.5	N/A	N/A		[3]
Screen-printing	RuO_2	Polyester foil	RuO_2-graphite	51.2	606	N/A	2.0 – 10.0	N/A	N/A	N/A	N/A	SCE [3]	[4]
		Al_2O_3	RuO_2	58.4	578	0.995	2.0 – 12.0	14	22	N/A	0.5	Ag|AgCl|KCl	[5]
		Al_2O_3	$RuO_2 \cdot xH_2O$	52.1	651	N/A	2.0 – 10.0	15	21 – 24	N/A	N/A		[6]
		Al_2O_3	**RuO_2**	**61.8**	**682**	**0.996**	**1.0 – 13.0**	**14**	**22**	**4.6 – 24.9**	**0.15**		**This study**
		Al_2O_3	RuO_2-glass [4]	56.0	N/A	N/A	2.0 – 12.0	120	N/A	N/A	N/A	Screen printed Ag/AgCl	[7]
	RuO_2-Ta_2O_5	Al_2O_3	RuO_2, Ta_2O_5, glass powder	68.2	N/A	0.987	2.0 – 12.0	15	N/A	10	N/A	Screen printed Ag/AgCl	[7]
	RuO_2-Ta_2O_5	Al_2O_3	RuO_2, Ta_2O_5	56	N/A	N/A	2.0 – 12.0	15	N/A	N/A	N/A	Ag|AgCl|KCl	[8]
	RuO_2-SnO_2	Al_2O_3	RuO_2, SnO_2	56.5	631	0.998	2.0 – 12.0	9	N/A	7	N/A		[9]
	RuO_2-Cu_2O	Al_2O_3	RuO_2, Cu_2O	47.4	N/A	N/A	2.0 – 13.0	N/A	21	N/A	N/A		[10]
	RuO_2-La_2O	Al_2O_3	RuO_2, La_2O_3	49.3	N/A	N/A	2.0 – 12.0	N/A	19	N/A	N/A		[11]
	RuO_2-TiO_2	Al_2O_3	RuO_2, TiO_2	56.6	630	0.999	2.0 – 11.0	15	N/A	5	N/A		[12]
	RuO_2-Pt	Al_2O_3-Pt	RuO_2	58.0	640	N/A	2.0 – 13.0	1-2	23	~ 0	1.5		[13]
	RuO_2-Nafion	Al_2O_3	RuO_2	58.3	656	0.999	2.0 – 12.0	42	22	N/A	0.4		[5]
	RuO_2-Nafion	Al_2O_3	RuO_2-glass [4]	58.6	684	0.995	3.0 – 11.0	N/A	N/A	11.5 – 26	N/A		[14]

Deposition method	Electrode sensitive material	Substrate	Precursor	Slope, mV/pH	E^0, mV	R^2	pH range	Response time, s	T, ^{0}C	Hysteresis, mV	Drift, mV/h	Reference electrode	Ref.
Sol-gel	RuO_2-CN	Au, Co, steel	RuO_2, CNT	63.1	647	1.000	2.0 – 12.0	50	N/A	N/A	N/A	SCE	[15]
Pechini	RuO_2-TiO_2	Ti	$RuCl_3$, Ti	56.0	N/A	0.998	2.0 – 12.0	N/A	25	N/A	N/A		[16]
RFMS [5]	RuO_2	Pt wire	RuO_2-glass [6]	60	913	N/A	2.0 – 12.0	90	25	30	3	NHE	[17]
		OMC [7]	RuO_2	57.8	598	0.999	2.0 – 12.0	180	22	3.14	19.0	Ag|AgCl|KCl	[18]
		OMC	RuO_2	58.4	670	0.999	4.0 – 10.0	30	22	1.13	5.0		[19]
		Carbon	RuO_2	59.2	800	1.000	4.0 – 10.0	25	22	5.44	20.5		[19]
		Pt	RuO_2	58.6	925	0.999	4.0 – 10.0	20	22	6.45	23.4		[19]
		Si	Ru	55.6	N/A	N/A	1.0 – 13.0	<1	N/A	4.36	0.38		[20]
		Si	Ru	51.7	N/A	0.978	2.0 – 10.0	N/A	N/A	N/A	N/A	SCE	[21]
		Si	RuO_2	55.8	N/A	0.998	2.0 – 10.0	N/A	N/A	N/A	N/A		[21]
		Si	Ru	56.0	N/A	N/A	1.0 - 12.0	N/A	N/A	N/A	N/A	Ag|AgCl|KCl	[22]
		Al_2O_3	RuO_2	73.8	N/A	0.998	4.0 - 10.0	3	22	~ 5	N/A		[23]
		Al_2O_3	RuO_2	58.8	N/A	0.999	2.0 – 12.0	30	22	1.3	2.9	RuO_2 [8]	[24]
	RuO_2-Ta_2O_5-Nafion	Al_2O_3	RuO_2	55.3	288	1.000	2.0 – 12.0	136 (pH 6)	22	0.7	7.2	RuO_2 [8]	[24]
	RuO_2-CNT [9]	Ta	Ru, CNT	55.5	643	1.000	2.0 – 12.0	40	25	10.2	~ 3	Ag|AgCl|KCl	[25]

[1] ED – Electrodeposition
[2] NHE – Normal Hydrogen Electrode
[3] SCE – Saturated calomel electrode
[4] RuO_2-glass paste with the resistivity of 10 kΩ/sq (3914, Electro-Science Laboratories, USA)
[5] RFMS – Radio-Frequency Magnetron Sputtering
[6] Submicron particles of RuO_2 and high lead silicate, or borosilicate, glass (typically containing 63-90% PbO, 10-25% SiO_2 and 0-25% $B_2 0_3$, by weight) dispersed in a viscous organic liquid This study
[7] OMC - Ordered Mesoporous Carbon
[8] RuO_2, acrylic well filled with PVB-SiO_2 junction material
[9] CNT – Carbon Nanotubes

Table S2. Change of the sensitivity of the fabricated electrodes with time

Time, days	Temperature, °C	Theoretical sensitivity, mV/pH	Measured sensitivity, mV/pH		
			RuO_2-800	RuO_2-850	RuO_2-900
1	21	58.3	61.8 ± 1.0	60.5 ± 1.4	56.1 ± 2.1
3	21	58.3	60.0 ± 1.5	58.1 ± 0.4	59.4 ± 0.7
6	22	58.5	58.3 ± 0.0	59.5 ± 0.6	59.3 ± 0.0
7	22	58.5	62.0 ± 0.1	62.1 ± 0.6	59.8 ± 0.1
11	22	58.5	60.6 ± 0.3	58.5 ± 1.8	59.3 ± 1.8
14	24	58.9	58.7 ± 0.3	58.9 ± 0.3	62.2 ± 0.5

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