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Novel CeO₂-based Screen-Printed Potentiometric Electrodes for pH monitoring

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Table 1: Preparation of 1L of $\text{NH}_4\text{Cl}/\text{NH}_3$ and $\text{NaHCO}_3/\text{Na}_2\text{CO}_3$ buffer solutions.

Table 2: SPEs capacitive current obtained in NaCl 0.1 mol L^{-1} . Experimental conditions: CV between 0.1V/NHE and 1V/NHE . Scan rate: 0.05 V s^{-1} , 5 electrodes.

Table 3: $|\Delta E|$ (mV) as well as anodic and cathodic i_p (nA) measured by CV in NaCl 0.1 mol L^{-1} containing FcTMA^+ $2 \cdot 10^{-3} \text{ mol L}^{-1}$. Experimental conditions: CV between 0.1V/NHE and 1V/NHE . Scan rate: 0.05 V s^{-1} , 5 electrodes.

Table 4: Results of the simulation of EIS measurements

Table 1

NH₄Cl/NH₃ buffer solutions					
		Volume (mL) of		Total equivalent activity of	
	pH	HCl (1 mol L ⁻¹)	NH ₃ (1 mol L ⁻¹)	NH ₄ ⁺ (mol L ⁻¹)	NH ₃ (mol L ⁻¹)
	7.2	50.0	50.7	3.4 10 ⁻²	3.0 10 ⁻⁴
	7.5	50.0	51.1	3.4 10 ⁻²	6.3 10 ⁻⁴
	7.6	50.0	50.3	3.4 10 ⁻²	8.0 10 ⁻⁴
	8.6	50.0	60.0	3.4 10 ⁻²	8.0 10 ⁻³
	9.3	50.0	97.0	3.3 10 ⁻²	3.8 10 ⁻²
	9.5	50.0	125.0	3.3 10 ⁻²	5.9 10 ⁻²
	9.7	50.0	170.0	3.2 10 ⁻²	9.2 10 ⁻²
	10.6	50.0	950.0	2.2 10 ⁻²	4.5 10 ⁻¹
	10.8	30.0	970.0	1.4 10 ⁻²	4.7 10 ⁻¹
NaHCO₃/Na₂CO₃ buffer solutions					
		Volume (mL) of		Total equivalent activity of	
IS*	pH	NaHCO ₃ (1 mol L ⁻¹)	Na ₂ CO ₃ (1 mol L ⁻¹)	HCO ₃ ⁻ (mol L ⁻¹)	CO ₃ ²⁻ (mol L ⁻¹)
0.05	8.6	53.0	22.0	3.8 10 ⁻²	1.2 10 ⁻³
	8.9	43.0	3.6	3.1 10 ⁻²	1.8 10 ⁻³
	9.7	21.8	9.4	1.6 10 ⁻²	4.7 10 ⁻³
0.10	9.6	45.3	18.2	3.1 10 ⁻²	8.3 10 ⁻³
	10.1	24.9	22.3	1.8 10 ⁻²	1.0 10 ⁻²
	10.6	7.1	30.8	5.3 10 ⁻³	1.4 10 ⁻²
0.20	9.3	115.7	28.2		
	10.1	36.1	54.6		
	10.4	19.3	60.1		
	10.6	12.3	62.4		
	11.8	3.9	64.9		

*IS: Ionic strength

Table 2

SPEs	I_c (nA)
C	36 ± 1
CeO ₂	40 ± 2
Ce _{0.8} Sm _{0.2} O ₂	260 ± 10
Ce _{0.8} Zr _{0.2} O ₂	470 ± 20

Table 3

SPEs	ΔE (mV)	i_{pa} (nA)	i_{pc} (nA)
C	62 ± 2	195 ± 10	195 ± 10
CeO ₂	63 ± 3	205 ± 10	205 ± 10
Ce _{0.8} Sm _{0.2} O ₂	60 ± 3	205 ± 10	205 ± 10
Ce _{0.8} Zr _{0.2} O ₂	60 ± 3	205 ± 10	205 ± 10

Table 4

SPEs	EE Circuit	Component of the equivalent electrical circuit (EEC)					χ^2
		R_e (ohm)	C_d ($\mu\text{F}/\text{cm}^2$)	R_f (ohm)	Q-Yo ($\times 10^6$)	Q-n	
CeO ₂	R(C(RQ))	0.0	1.89	1587.0	0.556	0.927	0.0188
CeO ₂	R(CR)Q	0.0	1.89	1583.0	0.556	0.927	0.0187
Ce _{0.8} Sm _{0.2} O ₂	R(C(RQ))	0.0	0.63	5395.0	6.397	0.923	0.0073
Ce _{0.8} Sm _{0.2} O ₂	R(CR)Q	0.0	0.63	5395.0	6.397	0.923	0.0073
Ce _{0.8} Zr _{0.2} O ₂	R(C(RQ))	0.0	0.31	19140.0	3.169	0.944	0.0088
Ce _{0.8} Zr _{0.2} O ₂	R(CR)Q	0.0	0.31	19140.0	3.169	0.944	0.0088
C	R(C(RQ))	0.0	1.20	2316.0	0.487	0.920	0.0101
C	R(CR)Q	0.0	1.20	2313.0	0.488	0.920	0.0101