Supplementary Information (SI) for Faraday Discussions.
This journal is © The Royal Society of Chemistry 2026

Glucose electrooxidation reaction on Ni-based nanocatalysts for replacing OER in alkaline electrolyser

Axel Rigoulet[1], Têko Napporn[1,2,1], Christophe Coutanceau[1,2]
[1]IC2MP CNRS, Université de Poitiers, 4 rue Michel Brunet, 86073 Poitiers cedex 9, France.
[2]French Research Network on Hydrogen, FR H2, France

SI figures captions.	**Page**
Figure SI 1. HPLC chromatograms of standard solutions of sodium formate at concentrations between 0.01 and 0.1 M (left). Corresponding calibration curve (right).	2
Table SI 2. Name of all the compounds that were potentially expected to be produced during electrolysis with their structure and experimentally determined retention times.	3
Figure SI 3. Plots of the charge transferred during electrolysis against electrolysis time (red dashed traces correspond to the ideal case, calculated by linear regression of the beginning of each curve).	4
Figure SI 4. Nyquist (left) and Bode (right) plots for each {material, aldose} set. Legend: s.e. = supporting electrolyte; ald = aldose; b.e. = before electrolysis; a.e. = after electrolysis.	5

[1] Corresponding author, teko.napporn@univ-poitiers.fr

SI 1. Chromatograms of formic acid standards and calibration curve

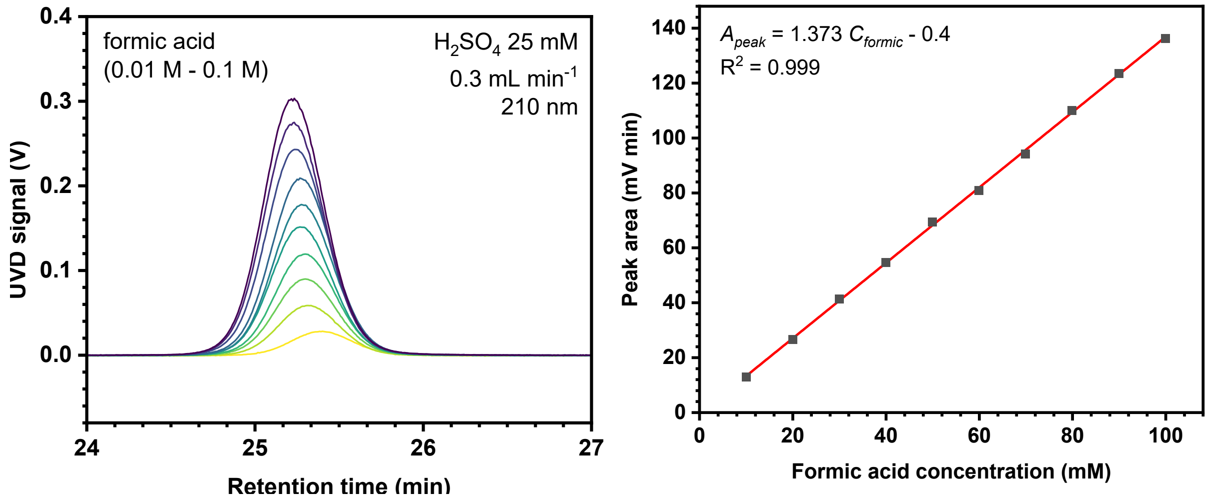


Figure SI 1. HPLC chromatograms of standard solutions of sodium formate at concentrations between 0.01 and 0.1 M (left). Corresponding calibration curve (right).

SI 2. Retention times of all the envisaged reaction products.

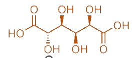
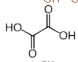
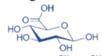
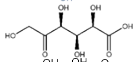
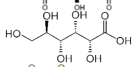
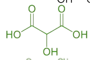
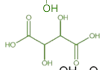
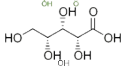
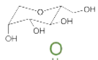
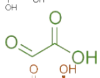
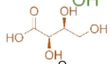
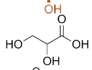
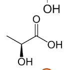
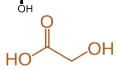
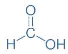
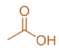
Compound	Structure	t_R (min)
Glucaric acid		14.7
Oxalic acid		14.7
Glucuronic acid		14.8
5-ketogluconic acid		15.5
Gluconic acid		16.0
Tartronic acid		16.1
Tartaric acid		16.5
Xylonic acid		16.9
Fructose		17.2
Glyoxylic acid		17.4
Threonic acid		17.7
Glyceric acid		19.5
Lactic acid		20.7
Glycolic acid		22.2
Formic acid		25.3
Acetic acid		27.2

Table SI 2. Name of all the compounds that were potentially expected to be produced during electrolysis with their structure and experimentally determined retention times.

SI 3. Deviation from linearity in Q-t plots for all tested conditions.

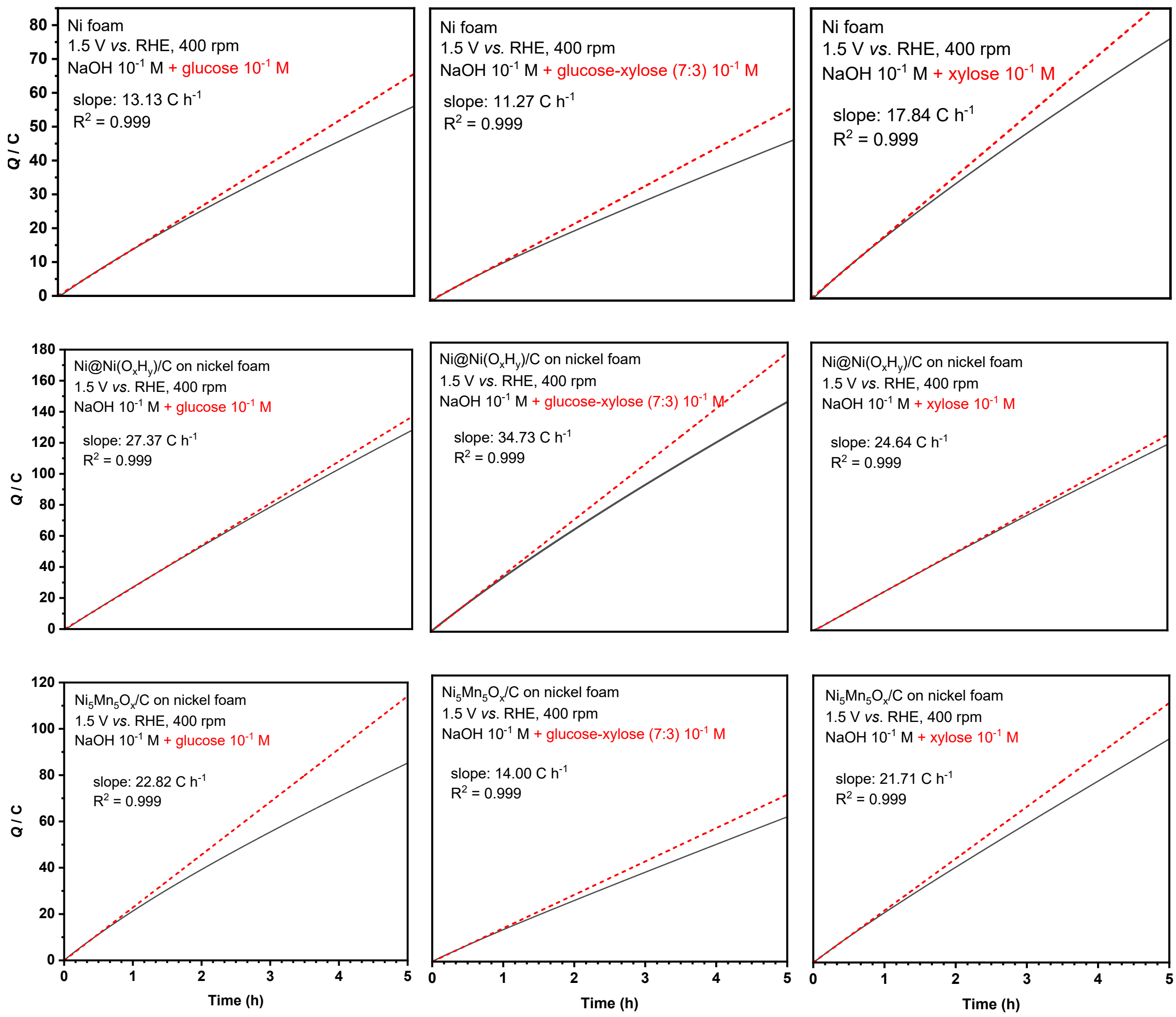
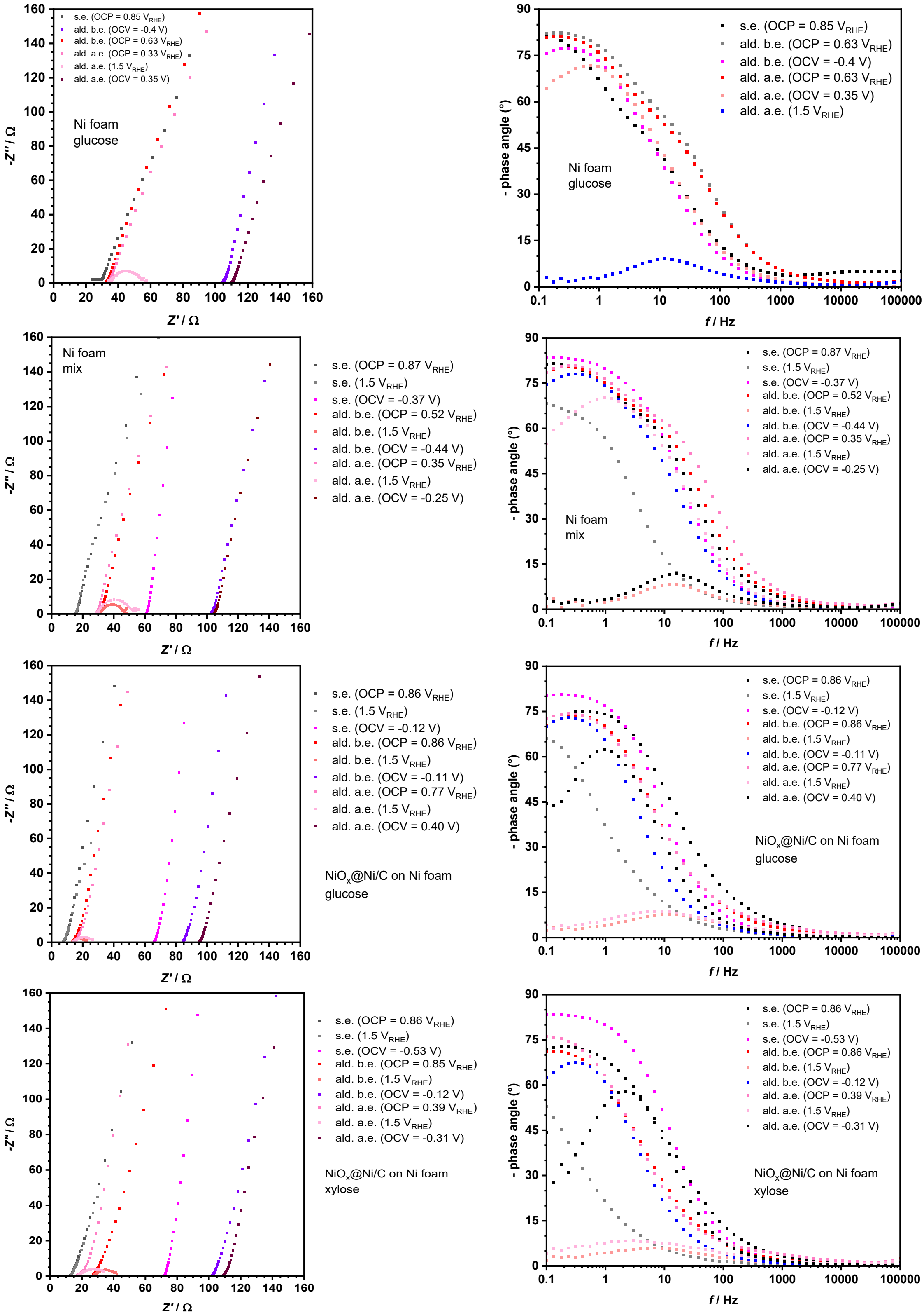


Figure SI 3. Plots of the charge transferred during electrolysis against electrolysis time (red dashed traces correspond to the ideal case, calculated by linear regression of the beginning of each curve).

SI 4. Nyquist and Bode diagrams for the different electrolysis conditions.



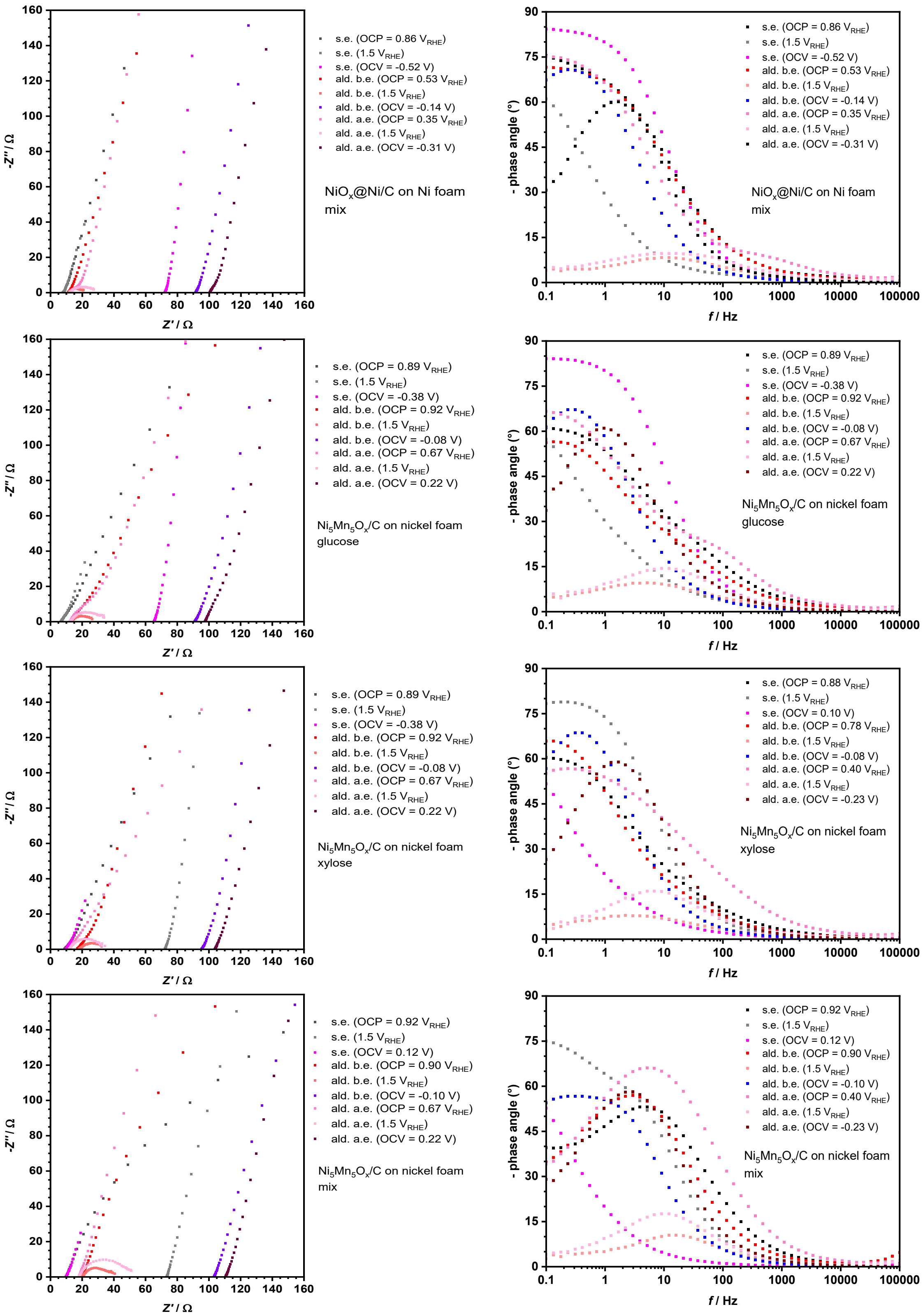


Figure SI 4. Nyquist (left) and Bode (right) plots for each {material, aldose} set. Legend: s.e. = supporting electrolyte; ald = aldose; b.e. = before electrolysis; a.e. = after electrolysis.

SI 5. Methodology of uncertainty calculation for the faradaic efficiency toward formate

The following relationship between parameters was used:

from $$FE_{f,app.} = 100\frac{2FC_{f.a.}V_{cell}}{Q_{exp}}$$

The following error sources were considered:

- Volume of solution in the cell: δV_{cell} = 6 10^{-5} L
- Time increments in chromatography: $\delta t_{\text{chromato}}$ = 0.5 s (converted to minutes)
- UV detector signal: $\delta U_{\text{chromato}}$ = 10^{-6} mV
- Time increments in chronoamperometry: δt_{CA} = 1 s
- Current intensity in chronoamperometry: δi_{CA} = 10^{-5} A
- Slope of the formate calibration curve by linear regression: δk_{CC} = 9.73 mV min L mol^{-1}
- Intercept of the formate calibration curve by linear regression: $\delta C_{0,\text{CC}}$ = 6 10^{-1} mV min

From which the resulting uncertainties were calculated using the GUM formuila[2]:

$$\delta X = \sqrt{\sum_i (\frac{\partial X}{\partial i}\delta i)^2}$$

Where δX is the error on quantity X which depends on quantities i with respective errors δi.

Error on the formic acid chromatography peak areas δA_{peak}

$$\delta A_{peak} = \sqrt{(t_{chromato}\delta U_{chromato})^2 + (U_{chromato}\delta t_{chromato})^2}$$

from $A_{peak} = U_{chromato}t_{chromato}$

Error on the formic acid concentration $\delta C_{f.a.}$

$$\delta C_{f.a.} = \sqrt{(\frac{\delta A_{peak}}{k_{CC}})^2 + (\frac{C_{0,CC} - A_{peak}}{k_{CC}^2}\delta k_{CC})^2 + (-\frac{\delta C_{0,CC}}{k_{CC}})^2}$$

from $$C_{f.a.} = \frac{A_{peak} - C_{0,CC}}{k_{CC}}$$

Error on the experimental electrolysis charge δQ_{exp}

$$\delta Q_{exp} = \sqrt{(i_{CA}\delta t_{CA})^2 + (t_{CA}\delta i_{CA})^2}$$

[2] General uncertainty method – Guide to the expression of uncertainty in measurement, ISO/CEI Guide 98-3:2008.

from $Q_{exp} = i_{CA} t_{CA}$

Error on the faradaic efficiency toward formic acid $\delta FE_{f.a.}$

$$\delta FE_{f.a.} = 100 \sqrt{(\frac{2FV_{cell}}{Q_{exp}} \delta C_{f.a.})^2 + (\frac{2FC_{f.a.}}{Q_{exp}} \delta V_{cell})^2 + (-\frac{2FC_{f.a.} V_{cell}}{Q_{exp}^2} \delta Q_{exp})^2}$$