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Unveiling the electrolyte effects of CO₂ electroreduction to CO and H₂ evolution from the interfacial pH perspective

Liu, X.

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Propositions

Accompanying the thesis

Unveiling the electrolyte effects of CO₂ electroreduction to CO and H₂ Evolution from the interfacial pH perspective

1. It's crucial to deconvolute CO₂ electroreduction from the parasitic H₂ evolution.
2. Interfacial pH is a decisional parameter that influences the reactivity and selectivity of the proton (hydroxyl anion)-involved reactions.
3. A reliable measurement of the interfacial pH visualizes the evolution of the interfacial environment during the reactions.
4. Electrolyte effects vary with interfacial conditions. Electrolyte effects strategies should be tailored to the interfacial environment.
5. Electrolyte effects implicitly influence interfacial pH and tune the interfacial reaction environment. (Chapter 1)
6. The interfacial pH is strongly dependent on the heterogeneous electrode reactions and the homogeneous chemical reactions. (Chapter 2)
7. CO₂RR is hardly limited by the mass transport conditions. By electrolyte effect strategies the increase in interfacial pH during CO₂RR and HER under strong polarization conditions can be relieved but not eliminated. (Chapter 3)
8. In mildly acidic media, CO₂RR surpasses proton reduction under appropriate circumstances, while it is not comparable with water reduction. (Chapter 4)
9. A weak proton donor, such as a alkali cation and a protic anion, greatly influences the HER, even when the pH is well beyond the pK_a of the donor. (Chapter 5)
10. Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less.

Xuan Liu
Leiden, 6th Feb 2025