Tailored electrochemical interfaces for renewable energy conversion

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ABSTRACT

The design and development of active, stable and selective electrocatalysts for energy conversion reactions is key for the transition towards a sustainable future. Investigating the electrochemical interface at the atomic and molecular levels is essential to understand the structure-reactivity relations and tune the active site for electrocatalytic reactions.
This talk will first focus on tailored electrocatalysts for renewable energy conversion reactions such as oxygen reduction and evolution (ORR and OER, respectively). The slow kinetics of the ORR and OER limits the performance of proton exchange membrane fuel cells and electrolysers for the use and production of green hydrogen. I will present our work on oxygen electrocatalysis, from model studies on well-defined surfaces [1,2] to the development of self-supported high-surface area nanostructured catalysts for ORR and OER [3,4] (Figure 1, left).
In the second part, I will discuss about the role of pH, electrolyte anions and structure sensitivity on well-defined Cu electrodes for CO and CO_2 reduction [5] (Figure 1, right). We have studied the effect of pH, anion adsorption, and potential dependence of interfacial processes for CO reduction [6,7]. We show how model studies are essential to understand the structure-property relationships and design efficient electrocatalysts for sustainable energy conversion.

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FIGURES

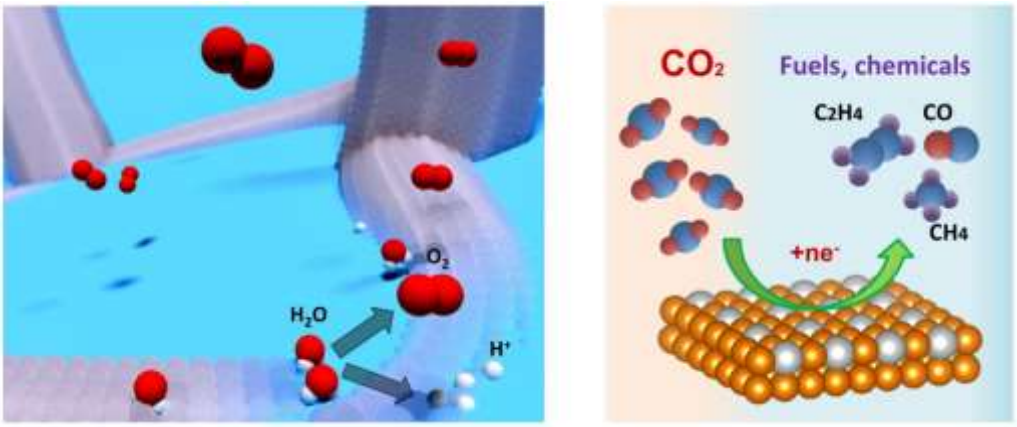

Figure 1: Schematic illustration of Ir nanostructured networks for electrochemical water splitting (left) and Cu-based electrocatalysts for CO_2 reduction to green fuels and chemicals (right).