EIS and theoretical investigation of the formation of oxygen on the surfaces of different materials. The effect of the electrolyte on the formation of the oxygen bubbles

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Solid surfaces can gather gas bubbles via processes such as direct immersion in water, temperature or pressure fluctuations, solvent exchange, microwaves, ultrasounds, cosmic rays, and (photo) (electro)chemical gas evolution reaction [1-3].
In this study, a pathway for ion transport between oxygen bubbles and (semi)conducting catalysts was found. To comprehend how bubbles affixed to catalysts affect crucial gas-evolving events in nature and technology, it is critically necessary to identify this portal. This urgency is heightened by the harmful effects that trapped gas bubbles play in catalysis, such as reaction inefficiency and overpotential. As a result, the dissemination of these discoveries to the broad audience of Nature Chemistry will aid continuing study in this fast advancing field of catalysis.
Here, we demonstrate that metal alkali ions restricted to the EDL area of the surfaces of oxygen bubbles may be transferred to and from the EDL of hematite surfaces. Controlling the amount and polarity of an externally applied electric potential traveling through hematite permits direct control of this gateway. Specifically, a negative electric potential enhances ion transport through hematite, whereas a positive electric potential inhibits it. In addition, we demonstrate that ion transport is inhibited when bubbles formed on a catalyst are transferred to an insulator, such as polytetrafluoroethylene.

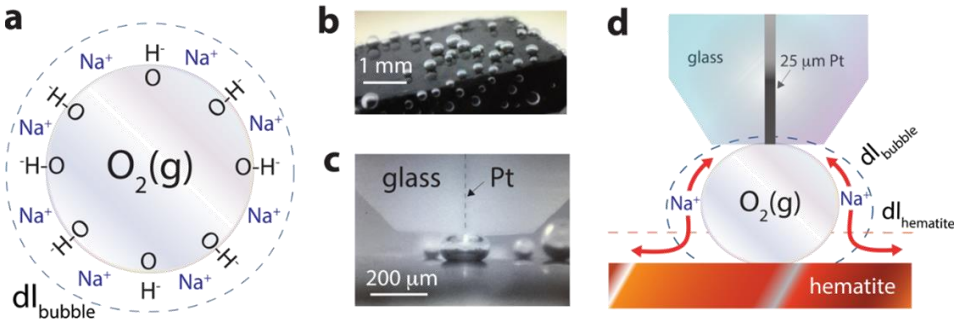

Figure 1. O_2 microbubbles produced and measured electrochemically.

In this investigation, the findings of theoretical MC and MD calculations for the experiments conducted in the study are reported. This is done to evaluate the effect of the electrolyte on the early stage of bubble formation, the adsorption of oxygen on the surface.

References

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