OXYGEN EVOLUTION REACTION

Describing perovskite catalysts

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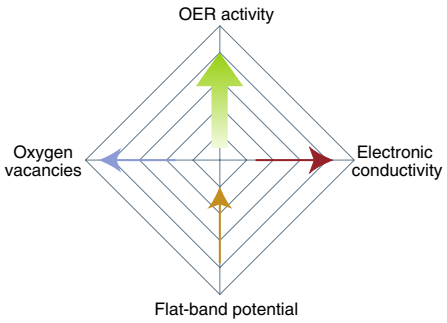

The design of efficient water electrolysers has received a great deal of attention in the past few decades, including significant efforts to develop hydrogen- and oxygen-evolving catalysts. These should exhibit as little thermodynamic penalty as possible to drive the reaction and display high long-term stability, while containing the minimum amounts of precious metals. While the state-of-the-art cathode catalysts have already achieved outstanding performances, more research is required for the oxygen-evolving counterparts. Among these, perovskite oxides are a very interesting class of anode catalysts for use in alkaline electrolytes. One design strategy consists of finding a physicochemical property that correlates with the activity that can then be tuned to find the optimum catalyst. However, this often leads to an over-simplification of a complex scenario where different reaction pathways can occur, meaning that the proposed property lacks generability and cannot be directly transferred between structurally different catalysts.

Now, Emiliana Fabbri and co-workers show that for perovskite oxides, one single descriptor cannot predict the activity towards the oxygen evolution reaction (OER) but rather a combination of descriptors is required. The researchers have investigated a wide range of oxygen-deficient perovskite materials with multiple compositions, including $La_{1-x}Sr_xCoO_{3-\delta}$ (with various x fractions), $LaMO_{3-\delta}$ (where M = Cr, Mn, Fe, Co, Ni), $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ and $PrBaCo_2O_{6-\delta}$. The descriptors considered are the electronic conductivity, the flat-band potential, and the amount of oxygen vacancies, which were obtained by ex situ and in situ impedance spectroscopy and neutron diffraction, respectively. The single descriptors provide a qualitative estimation of the catalytic activity, although clear outliers are found in all three. On the other hand, the researchers conclude that for a perovskite oxide to be highly active for water oxidation it has to exhibit high electronic conductivity, a high amount of oxygen vacancies and a low flat-band potential.

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