**Impact of Ir-Valence Control and Surface Nanostructure on Oxygen Evolution Reaction over a Highly Efficient Ir-TiO2 Nanorod Catalyst**

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 Water electrolysis is a potentially effective method to address the issues of environmental emissions and energy sustainability, but it has the challenge of a sluggish oxygen evolution reaction (OER). IrOx-based materials are regarded as the most promising candidates in acidic media, but they are still limited because of the high cost of the Ir metal [1-3].

 In this study, we report a composite catalyst, IrOx−TiO2−Ti (ITOT), with a high concentration of active OH species and mixed valence IrOx on its surface. We have discovered that the obtained ITOT catalyst shows an outstanding OER activity (1.43 V vs RHE at 10 mA cm−2) in acidic media. Moreover, no apparent potential increase was observed even after a chronopotentiometry test at 10 mA cm−2 for 100h and cyclic voltammetry for 700 cycles. We proposed a detailed OER mechanism on the basis of the analysis of the in situ electrochemical X-ray absorption near-edge structure (XANES) and extended X-ray absorption fine structure (EXAFS) measurements as well as density functional theory (DFT) calculations. All together, we have concluded that controllable Ir-valence and the high OH concentration in the catalyst is crucial for the obtained high OER activity.

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