

Tracking Changes in Surface Chemistry and Structure of Supported IrO_x Nanoparticles in Acidic Oxygen Evolution Reaction Conditions

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Advanced materials are needed to meet the requirements of water electrolyzers designed for harvesting renewable electricity, and converting this electricity into molecular hydrogen (H₂) and molecular oxygen (O₂). In particular, polymer electrolyte membrane water electrolyser devices would benefit from a reduction in the size of iridium oxide particles used to electrocatalyze the oxygen evolution reaction (OER) at the anode. Nevertheless, this strategy requires developing electron conducting, high surface area and stable supports. Herein, we synthesized IrO_x nanoparticles, supported them onto doped SnO₂ aerogels, and assessed their electrocatalytic activity towards the OER and their resistance to corrosion in acidic media ex situ and in situ (by means of a flow cell connected to an inductively-coupled mass spectrometer, FC-ICP-MS). The FC-ICP-MS results show that the long-term OER activity of IrO_x/doped SnO₂ aerogels is controlled by the resistance to corrosion of the doping element, and by its concentration in the host SnO₂ matrix. In particular, we provide evidence that Sb-doped SnO₂ supports continuously dissolve while Ta-doped or Nb-doped SnO₂ supports are stable under acidic OER conditions. These results shed fundamental light on the complex and dynamic equilibrium existing between SnO₂ and the doping element oxide in OER conditions.

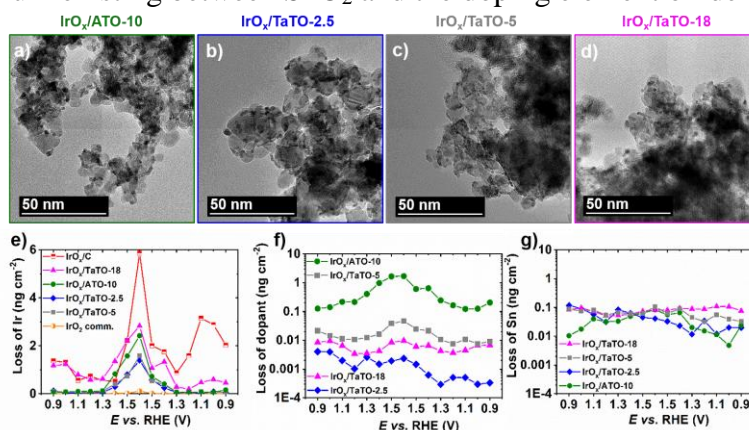


Figure 1. Transmission electron microscopy of IrO_x nanoparticles supported on: a) ATO-10, b) TaTO-2.5, c) TaTO-5 and d) TaTO-18. e), f) and g) correspond to time- and element-resolved materials dissolution during oxygen evolution reaction.

References

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