

Combining Identical-Location Transmission Electron Microscopy and X-Ray Photoelectron Spectroscopy to Unravel Unravelling Structure – Chemical Composition – Oxygen Evolution Reaction Activity

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Keywords: Proton-exchange membrane water electrolyzers, oxygen evolution reaction, iridium oxidenanoparticles; identical-location transmission electron microscopy.

Determining the relationships between structure, oxidation state and oxygen evolution reaction (OER) activity is fundamental to design improved anode catalysts for polymer electrolyte membrane water electrolyser (PEMWE) devices. In this study, four IrO_x nanocatalysts differing from each other by the chemical composition were synthesized and characterized before after ageing in conditions simulating proton-exchange membrane water electrolyser anode operating conditions. By combining identical location transmission electron microscopy, X-ray photoelectron spectroscopy and electrochemistry, we highlight and decode complex relationships between chemical composition of the different nanocatalysts, nature of the support material, and OER electrocatalytic activity at the beginning-of-life and at the end-of-life of the electrode. Independently on the chemical nature of the fresh nanocatalyst, Ir(III), Ir(IV) and Ir(V) species were monitored after electrochemical ageing. Our analysis suggests that Ir(V) species account for the major part of the OER activity, while Ir(III) species are responsible for its decay.

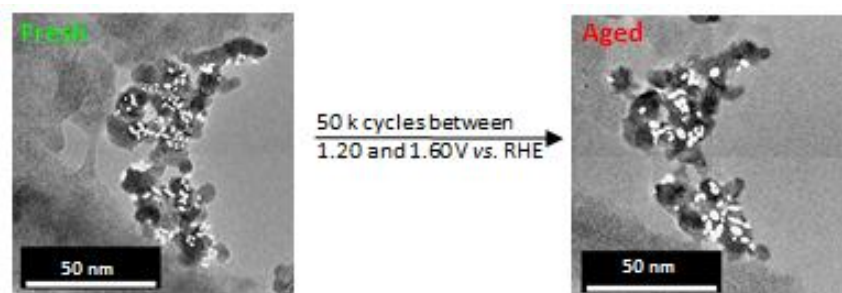


Figure 1 : Identical-Location Transmission Electron Microscopy (IL-TEM) images of Ir/Ox nanoparticles supported on antimony-doped tin oxide before/after 50 k potential cycles between $1.20 < E < 1.60$ V vs. RHE.

Acknowledgements

The French National Research Agency (MOISE project, grant number ANR-17-CE05-0033) financially supported this research.

REFERENCES

1. F. Claudel, L. Dubau, G. Berthomé, L. Sola-Hernandez, C. Beauger, L. Piccolo, F. Maillard, submitted.