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Oxygen Evolution Reaction Investigation on Pt(111) and Ir(111) Using Dynamic Electrochemical Impedance Spectroscopy in Acidic Medium

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Abstract Text:

Polymer electrolyte membrane water electrolyzers (PEMWE) are promising devices for energy conversion from electricity to chemistry. They are able to deal with important and fast changes in energy production. At the cathode compartment, the hydrogen evolution reaction occurs without kinetic limitation and practically reversibly. Nonetheless, the oxygen evolution reaction (OER) which is the anodic reaction remains a scientific challenge due to kinetic limitations and stability issues. Iridium is currently the best compromise between activity and stability [1]. However, it still undergoes degradation in the harsh oxidative and acidic operating conditions of a PEMWE [2].

The development of optimized OER catalysts is an essential step to practically implement PEMWE. A better understanding of structural effects on the catalysts activity and stability is needed. This study focuses on well-defined electrocatalysts at an atomic scale. Ir(111) single-crystal was characterized before and after electrooxidation and OER thanks to different electrochemical methods. Pt(111) single-crystal, widely studied in the literature [3-4], was characterized in the same way and used as a reference. Above 1.4 vs. RHE and 1.3V vs. RHE, respectively for Pt(111) and Ir(111), the initial clean surface undergoes irreversible structural changes, related to the formation of defects and leading to an improvement of the oxygen evolution activity. Although classical electrochemical impedance spectroscopy (EIS) is a valuable technique when applied to stable and reversible systems, it fails with irreversible ones. Therefore, we used dynamic electrochemical impedance spectroscopy (DEIS). One can see (fig. 1) that the two methods give the same result in the reversible hydrogen adsorption area (fig.1a) while they differ for oxide formation (fig.1b) and OER (fig.1c). By analyzing the whole set of DEIS spectra, we are able to provide details on mechanism parameters for oxide formation and OER.

References

- [1] Aricò, A. S., et al. (2012). "Polymer electrolyte membrane water electrolysis: status of technologies and potential applications in combination with renewable power sources." Journal of Applied Electrochemistry **43**(2): 107-118.
- [2] Cherevko, S., et al. (2014). "Dissolution of Noble Metals during Oxygen Evolution in Acidic Media." ChemCatChem **6**(8): 2219-2223.
- [3] CONWAY, B. E. (1995). "ELECTROCHEMICAL OXIDE FILM FORMATION AT NOBLE METALS AS A SURFACE-CHEMICAL PROCESS." Progress in Surface Science **49**(4): 331-452.
- [4] Drnec, J., et al. (2017). "Initial stages of Pt(111) electrooxidation: dynamic and structural studies by

surface X-ray diffraction." *Electrochimica Acta* **224**: 220-227.

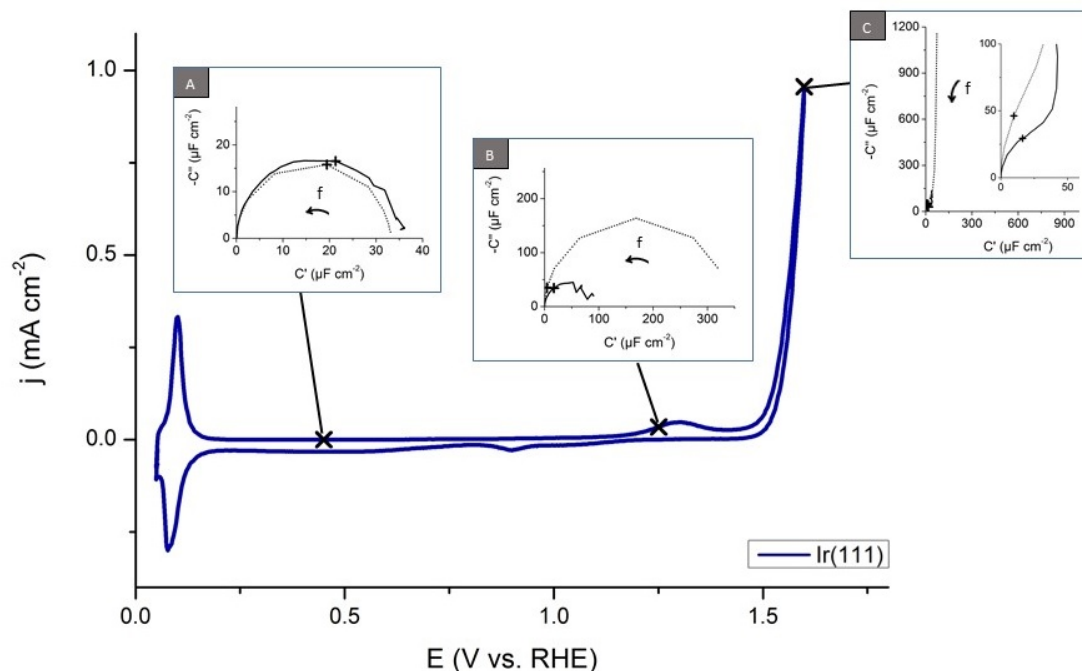


Figure 1. Cyclic voltammogram of Ir(111) in 0.05M H₂SO₄ at 50 mV s⁻¹. Complex capacitance plots of Ir(111) using EIS (dotted lines) and DEIS (continuous lines) between 5 Hz to 45 kHz (crosses at 220 Hz) at 0.45V (A), 1.25V (B) and 1.6V (C).

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