

Carbon-supported Ta-based Electrocatalysts for the Oxygen Reduction and Evolution Reactions

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Electrocatalytic materials with high efficiency for the main reactions on the reversible oxygen electrodes, the oxygen reduction reaction (ORR) and oxygen evolution reaction (OER), are necessary for the development of new electrochemical conversion devices. Although some noble metals such as Pt and metal oxides (RuO₂, IrO₂) possess excellent activity as bifunctional electrocatalysts, their high cost and instability hinder large-scale applications.

Tantalum-based materials have demonstrated to be active and robust electrocatalysts for the ORR in acidic environment [1]. They have an excellent electrochemical stability and become active for the oxygen reactions when the surface stoichiometry is tuned [2]. Carbon materials can act both as support and electron conductor phase. Nanocomposites based on tantalum sub-oxides on carbon black have been investigated for the ORR and OER in alkaline medium.

The synthesis is based on a microemulsion path and temperature treatment. The electrochemical activity was studied by linear sweep voltammograms in O₂-saturated (ORR) and deaerated (OER) 0.1 M NaOH electrolyte. The results exhibit a good behavior of Ta-based catalysts for the OER and ORR, which gets better with higher temperature treatment.

References

- [1] K. Ota, et al., J. Power Sources. 196 (2011) 5256–5263.
- [2] D. Sebastián, et al., ChemCatChem. 7 (2015) 911–915.