Novel Iridium-Based Electrocatalyst on Titanium Substrates for the Oxygen Evolution Reaction

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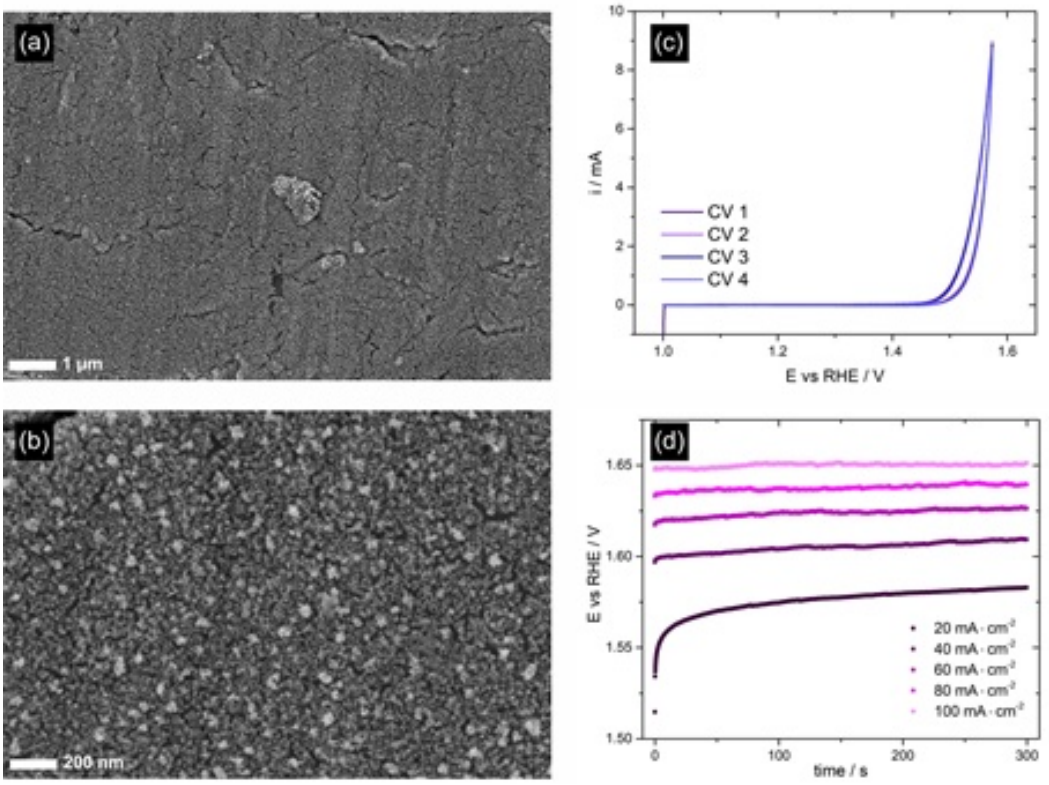
The oxygen evolution reaction (OER) is the critical half-cell reaction in proton exchange membrane water electrolysis (PEMWE) that still needs improvement for the practical development of sustainable hydrogen production[1-2]. The most developed OER electrocatalyst materials used for acidic water electrolysis are based on Iridium or Iridium oxides[1-2]. Due to the scarcity and high material cost of Ir[1], there is a demand for catalyst materials with both a high electrochemical active area and an exceptionally high robustness towards mechanical and chemical degradation.



(a), (b) Top-down SEM images of as deposited Ir on Ti foil. (c) Cyclic voltammograms acquired prior to (CV 1-2) and after (CV 3-4) electrochemical stressing through stepped galvanostatic OER (d).

In this project, a novel and facile synthesis concept for Ir-based catalysts deposited on Ti substrates is developed. Different experimental parameters of electrodeposition are screened and correlated to the morphologies of the resulting catalyst layers through scanning electron microscopy (SEM). The catalysts are characterized electrochemically to determine their activity in the OER as well as their stability under the applied harsh anodic and acidic reaction conditions. The deposition parameters are optimized to obtain a minimal Ir loading on Ti supports without losses in activity or stability of the catalyst.

[1] Paige Shirvanian, Frans van Berkel, *Ele. Comm.*, **2020**, *114*, 106704.
[2] Katherine Ayers, Nemanja Danilovic, Ryan Ouimet, Marcelo Carmo, Bryan Pivovar, Marius Bornstein, *Annu. Rev. Chem. Biomol. Eng.*, **2019**, 10 (1), 219-239