Towards Reliable Stability Measurements of OER Catalysts

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Currently, significant efforts are taken to find the most active and stable electrochemical oxygen evolution reaction (OER) catalyst diverting from critical raw material. However, one also needs to consider new catalyst screening methods, especially with respect to stability investigations where rotating disk electrode (RDE) studies are not suitable [1]. Recently, we introduced a gas diffusion electrode (GDE) setup as a new testing platform for OER catalysts [2]. This methodology stems from fuel cell studies where carbon gas diffusion layer (GDL) is used as a transport layer to bring the reactant to the catalyst. Since carbon is not stable under the harsh OER conditions, water electrolyser uses titanium-based porous transport layers (PTLs). In the current work, we utilized the GDE setup to test the influence of the transport layer on the stability of a highly active $Ir_{0.7}Ru_{0.3}O_x$ nanoparticle catalyst immobilized on homemade antimony-doped tin oxide (ATO) support. The test was conducted potentiostatically (@ 1.6 V vs RHE) for 2 h at 60 °C. The stability of the catalyst was then compared when deposited on GDL vs PTL. Rapid decline of the GDL-deposited catalyst activity was observed, while the PTL-deposited catalyst demonstrates a rather stable behavior (Fig. 1). We attribute this fast activity drop to the carbon oxidation of the GDL. Moreover, the activity at 30 °C of the PTL-deposited catalyst was compared to literature data on RDE setup [1]. In the RDE setup, a breakdown is observed after only 30 min when applying a constant current density. In contrast, PTL-deposited catalyst exhibits no activity loss during 2 h under similar conditions.

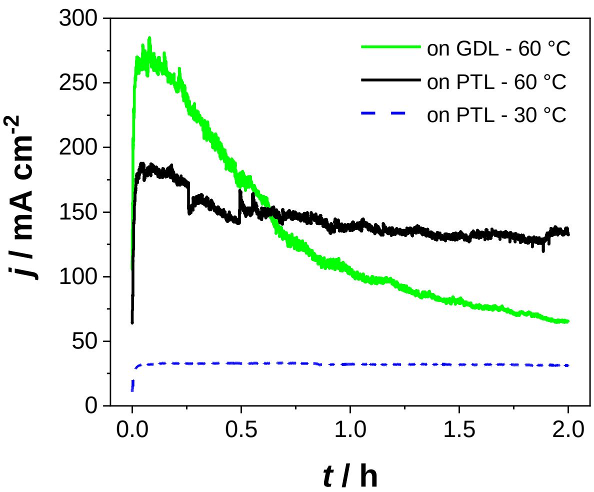

Figure 1. Potentiostatic stability transients at 1.6 V vs RHE of $Ir_{0.7}Ru_{0.3}O_x$/ATO deposited on C-based GDL (green full) and on Ti-based PTL at 60 °C (black full) and 30 °C (blue dashed).

[1] H. A. El-Sayed. *Journal of The Electrochemical Society*, **166** (8), F458-F464 (2019)
[2] J. Schröder. *JACS Au*, **1**, 247-251 (2021)