Characterising Pt-based Catalysts for Oxygen Reduction Reaction: Technique Comparison

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Using catalysts in polymer exchange membrane (PEM) fuel and electrolysis cells minimises overpotential and energy loss. To design better catalysts, it is pertinent to understand the activity trends behind current platinum-based catalysts.

The main electrochemical methods right now are the ultramicroelectrode (UME), rotating disk electrode (RDE), rotating ring disk electrode (RRDE), floating electrode (FE)[1], gas diffusion electrode (GDE)[2], and membrane electrode assembly (MEA) techniques. Each of the mentioned methods has benefits and challenges related to their setup, mass transport conditions, iR drop, operating conditions, and cleanliness. This means using the method best suited to one's research question is essential.

For example, RDE is the fastest method to screen many catalysts and discard the lowest-performing ones. However, separating good catalysts from the best is difficult when the mass transport of gases for oxygen reduction reaction (ORR) limits the reliable potential window. Using the FE with oxygen transported to the catalyst in the gas phase, the intrinsic activity of catalysts for ORR can be investigated[3]. GDEs are essentially miniature MEA half-cells. They can be used as simplified MEAs where optimisation of layers can be done more quickly and precisely[2]. Methods such as FE and GDE will lead to a better understanding of the ORR mechanisms using more reliable high-mass transport experimental data.

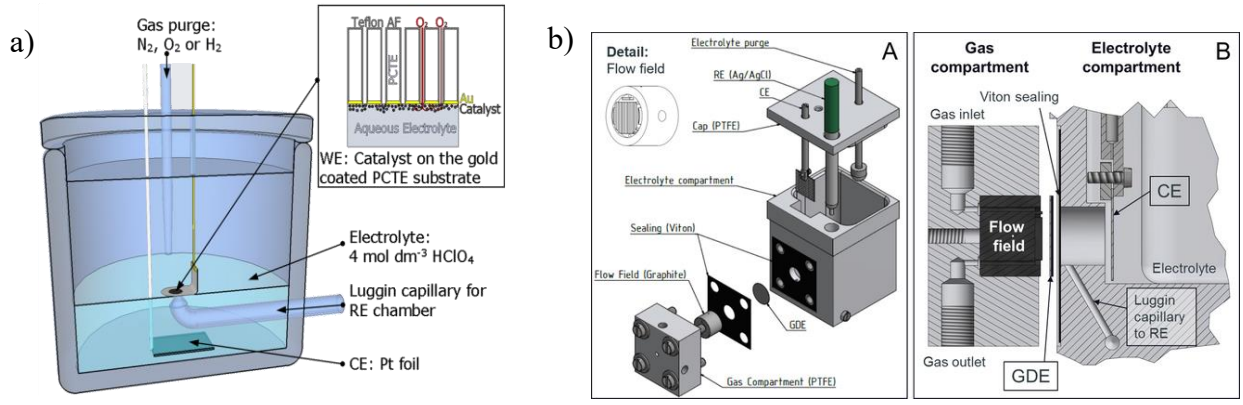

Figure 1: A schematics of FE (a) developed by Zalitis *et al.*[1] and GDE (b) by Ehelebe *et al.*[4].

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