Improvement of the Power Density in Redox-Flow Batteries and The effect of using a Pt-CE on the ORR activity of metal-free electrocatalysts

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Abstract: The biggest challenge in Vanadium-based Redox-Flow-Batteries (RFB) is the low power density, which hinders this technology to find a wider field of application.
One of the approaches to increase the power density can be achieved by improving the stability of the standard V(V) electrolyte (1.6 M vanadium; 2 M H_2SO_4; 0.05 M H_3PO_4) against agglomeration at elevated temperatures ($\geq$ 40°C) with the usage of additives. A promising additive-group is tertiary amines, which has good dispersal and long-term chemical stability properties at 40°C compared with the standard electrolyte solution.
Another approach is by using flow fields structures in bipolar plates to increase the distribution of electrolyte in the cell and to avoid dead zones. The effect of parallel flow-field structures on the charge-discharge processes can be seen through an 9 % power density increase compared to a conventional redox-flow-cell setting.

High overpotential is one the main issues in Polymer electrolyte fuel cells (PEMFC), which lower their efficiency. Although Pt is among the best catalysts, which reduce the overpotential, it's prohibitively high price does not allow actual scaling of the PEMFC technology. An alternative affordable are urgently needed.
However, the choice of the counter electrode (CE) can be crucial, as a Pt-counter electrode can potentially dissolve into water-based electrolytes and affect the performance of Pt-free catalysts in carbon-durability tests. Regarding this debate LSV-, CV-measurements combined with start-stop/load cycle durability tests and complementary ICP-measurements in acidic and alkaline matrixes were conducted to examine the validity of this hypothesis, if Pt-CE dissolve into the electrolyte and deposit on the carbon foam-based catalyst.