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The Wolfson Department of Chemical Engineering

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Platinum-group-metal free anion exchange membrane fuel cells

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Anion-exchange membrane fuel cells (AEMFCs) have made significant advancements over the past decade. Various low-cost anion exchange membranes and electrocatalysts have been synthesized, leading to improved performance. Several studies have demonstrated relatively good cell performance when employing a PGM-free cathode electrocatalysts including CoFe, CoMn, and FeNC. However, studies focusing on AEMFCs utilizing both PGM-free anode and cathode electrocatalysts are scarce. In this study, we employed a PGM-free electrocatalyst for both the anode and cathode in an AEMFC and examined its performance under different operating conditions and design parameters. Among the very few HOR electrocatalysts that have been developed, Ni-based electrocatalysts have demonstrated remarkable ex-situ activity for the hydrogen oxidation reaction. However, their in-situ activity in a fuel cell is significantly lower due to their instability in ambient conditions. We are developing a unique activation method to increase the HOR activity of the cell. By employing this activation method, we have shown significant improvement in the catalytic activity of these electrocatalysts within an AEMFC environment. The overall results indicate an enhancement in cell performance compared to the non-activated electrocatalysts. In addition, our results with PGM-free AEMFCs have shown significant improvement in cell performance compared to the state-of-the-art literature. We firmly believe that with proper optimization at the cell and operational level, we can substantially enhance the performance of these PGM-free AEMFCs.