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Rigorous diagnosis for zero-gap membrane electrode assemblies

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ABSTRACT

Decarbonisation of hard-to-abate sectors, such as iron making, urgently needs to replace carbon-intensive fuels with low-carbon alternatives, such as hydrogen, and low-cost solutions for carbon management. Electrolysis technology provides a promising route to produce clean hydrogen and convert waste CO₂ into fuels or feedstocks, such as carbon monoxide. The state-of-the-art electrolysis cells are based on membrane-electrode assemblies (MEA), where electrodes are in immediate contact with ion-exchange membranes to minimise ohmic losses. However, this compact cell design makes it extremely challenging to diagnose the contributions of each component to the overall cell performance. This technical limitation results in a significant knowledge gap in understanding how materials behave under industrially relevant conditions. This gap has been presently hindering the translation of fundamental discoveries to real-world utility. This talk will report our recent findings in circumventing these challenges through the development of novel embedded reference electrodes and their embedding configuration in MEA cells.

KEY WORDS

Electrolysis; Membrane Electrode Assembly; Voltage diagnosis

BIOGRAPHY

I am a Senior Lecturer in Chemical Engineering. I completed my PhD at the University of Queensland in 2016 and subsequently worked on carbon dioxide electrolysis at UQ and Delft University of Technology (EU Horizon SELECTCO₂). I joined the University of Melbourne in 2023 and was awarded an ARC DECRA on integrating carbon capture and electrolysis, and promoted to Senior Lecturer in 2025. My research focuses on scaling electrochemical systems for low-carbon energy and industry. I lead the Li Energy Lab and have supervised numerous students to successful academic and industry careers, with several receiving national recognition.

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