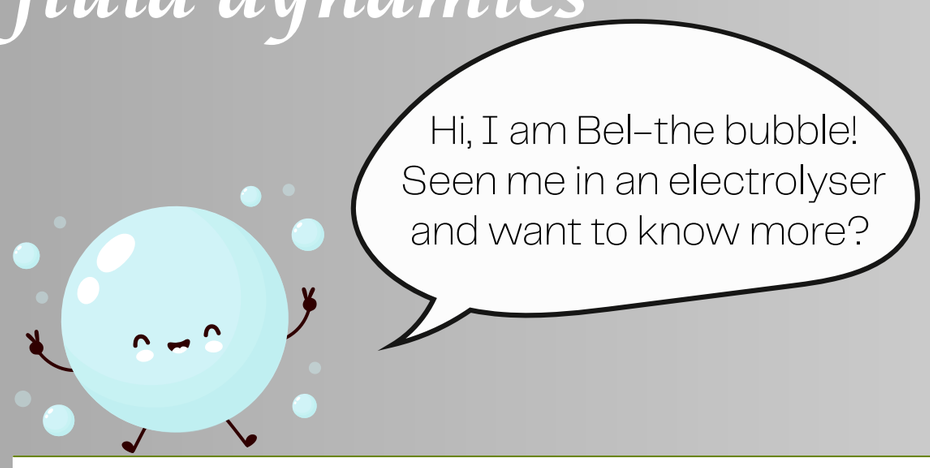
Bubble-Ω-lysis

Where ohmic resistance meets fluid dynamics

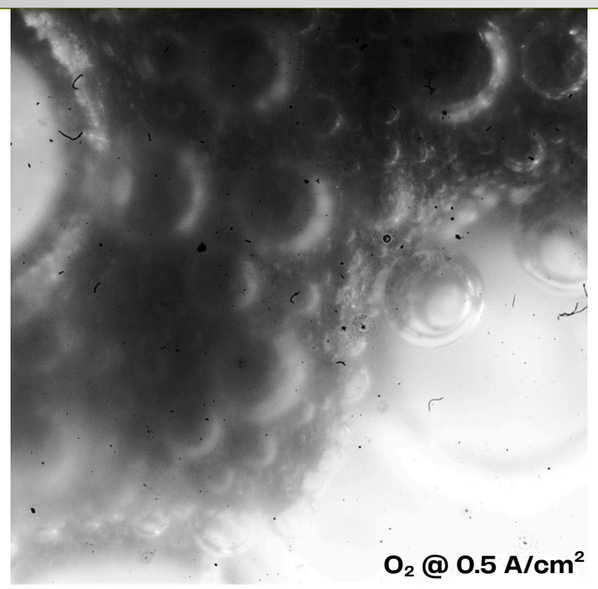


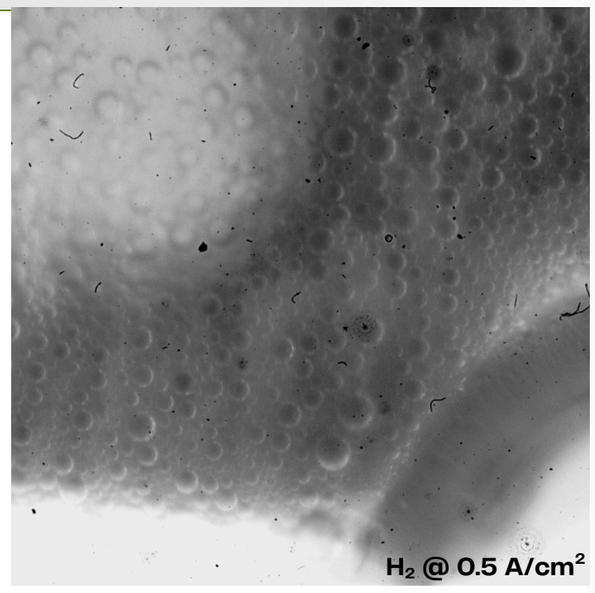
Authors

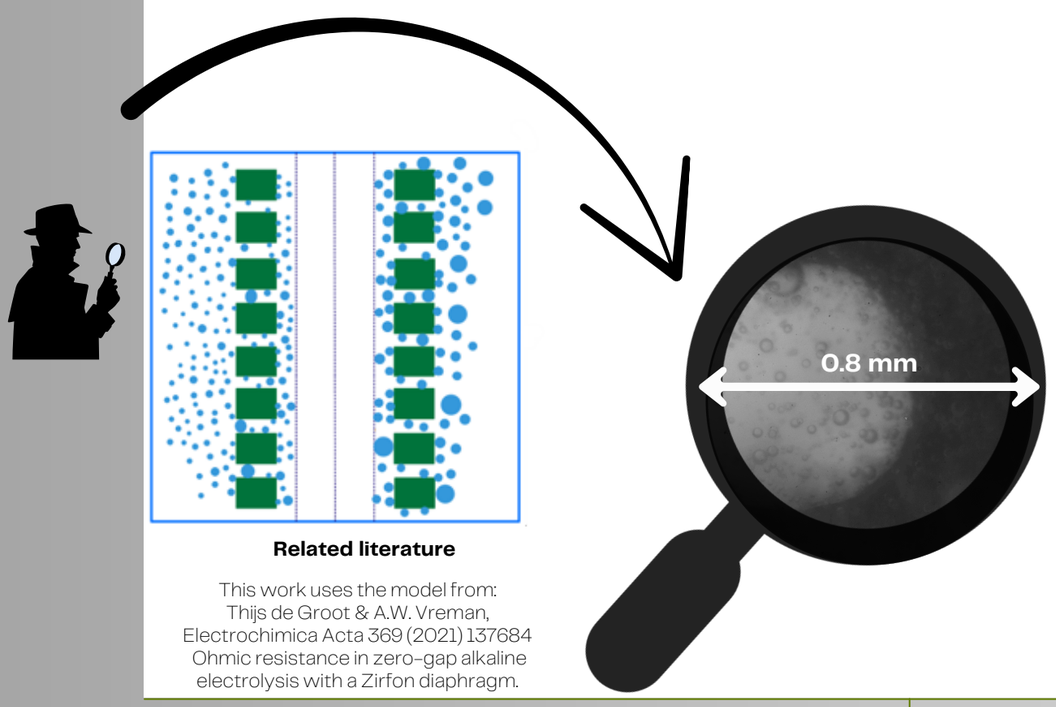
Saksham Pandey[a], Kubilay Özdemir[a], Albertus W. Vreman[a], Matheus T. de Groot[a]

Affiliations

[a]Sustainable Process Engineering Group, TU/e, P.O.Box 513, Eindhoven, 5600MB







Related literature

This work uses the model from:
Thijs de Groot & A.W. Vreman,
Electrochimica Acta 369 (2021) 137684
Ohmic resistance in zero-gap alkaline electrolysis with a Zirfon diaphragm.

Introduction

Alkaline water electrolysis efficiency @high current density ---> ohmic resistance

Ohmic resistance in zero gap cell design ---> Bubbles + Diaphragm + Electrode Geometry

OBJECTIVE

To understand bubble dynamics and correlate them with ohmic resistance in alkaline electrolysis under industrial conditions

METHODOLOGY

Combining high-speed camera imaging and electrochemical impedance spectroscopy (EIS) to correlate ohmic resistance with bubble dynamics.

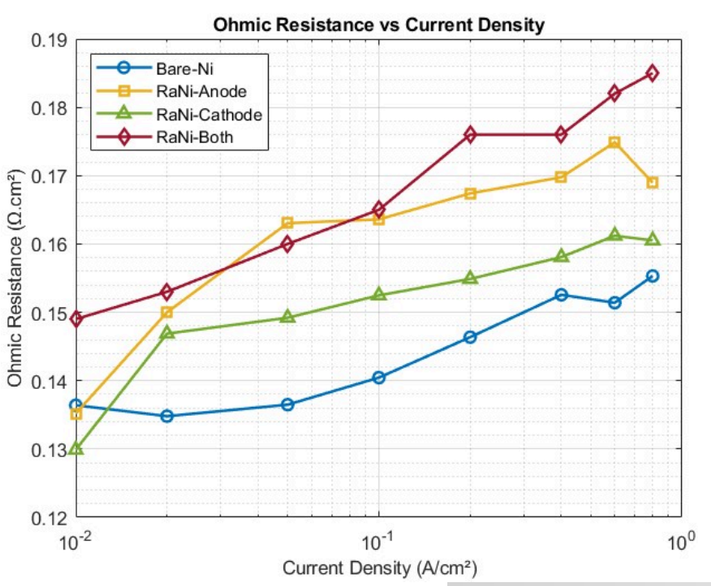
RESULTS

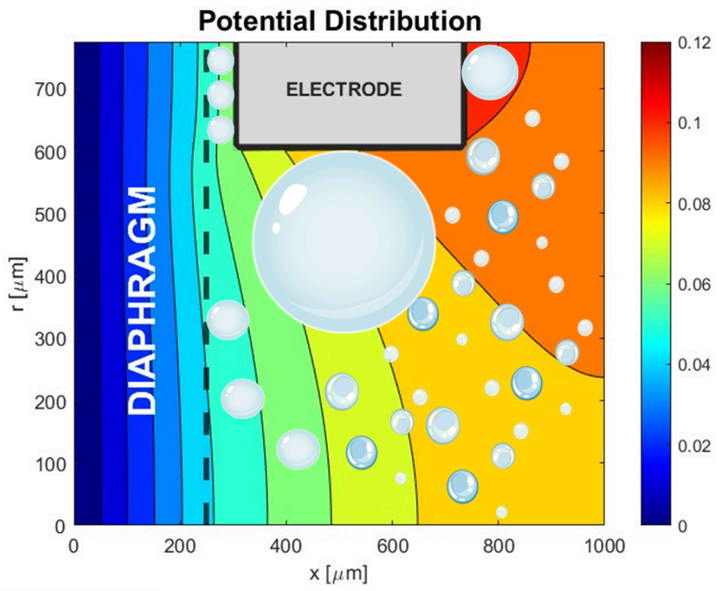
A combined experimental and modeling approach was used to integrate imaging results with electrochemical measurements, verifying and predicting ohmic resistance using the model.

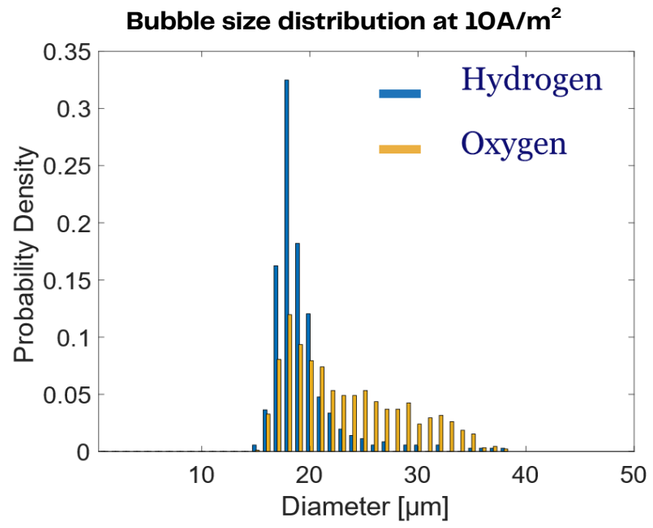
Analysis

A higher gas fraction due to coated electrodes in the electrode diaphragm gap increases ohmic resistance

Zero-gap results show a 60% gas fraction in the bulk and 30% in the electrode diaphragm gap







Hydrogen bubbles smaller than oxygen bubbles

Bubble sizes increase with current density

Conclusion

Imaging and electrochemical measurements show that higher gas fractions, especially in the diaphragm gap, increase ohmic resistance. Zero-gap configurations optimize efficiency. Understanding this resistance can enhance electrolyzer energy efficiency.

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