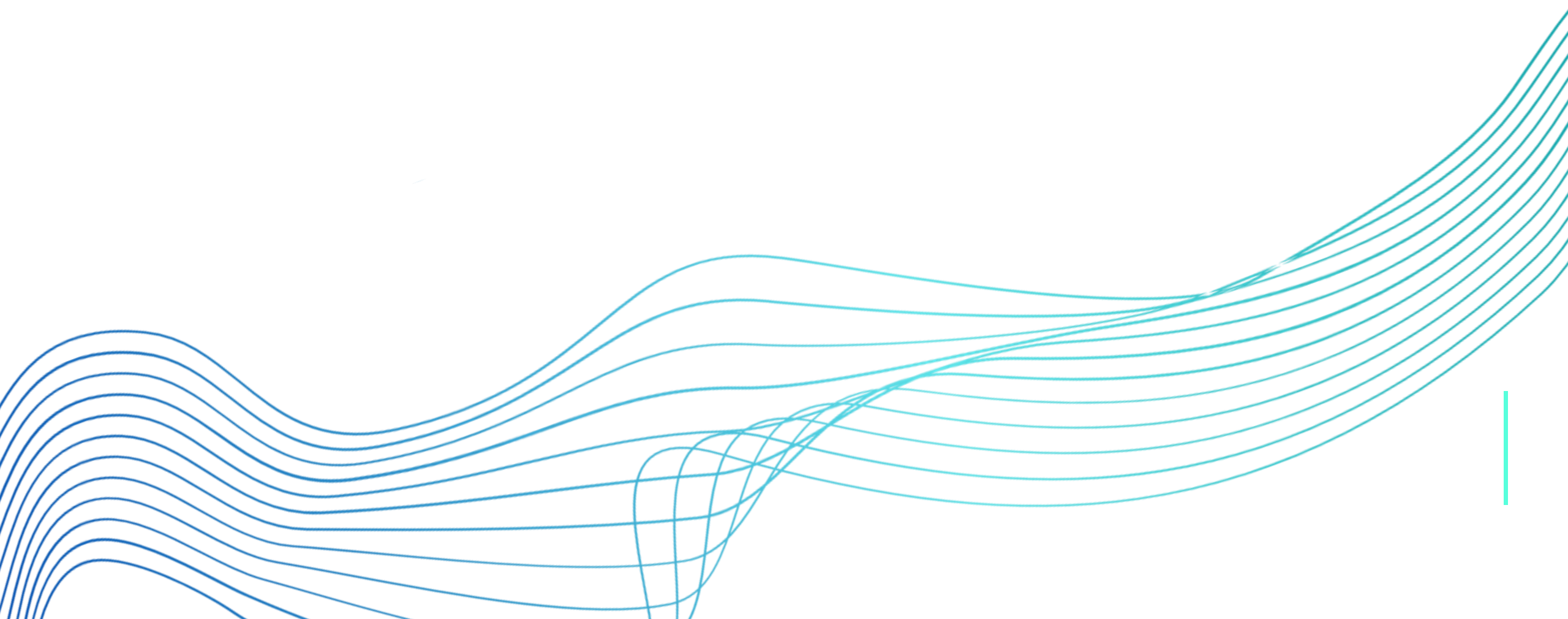
HYDROX HOLDINGS LTD

Unlocking the future

GREEN HYDROGEN SOUTH AFRICA

Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung



The standard method to extract hydrogen from water through electrolysis has for the past 200 years remained unchanged. Two electrodes separated by a membrane. Even the latest state-of-the-art PEM electrolyser (invented more than 60 years ago) all utilize a membrane.

Hydrox Holdings is proud to pioneer the FIRST MEMBRANELESS ELECTROLYSER through their patented DEFT system which promises to be that “truly disruptive technology”

THE CHALLENGE

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HIGH PRODUCTION COSTS

HARD TO ABATE SECTORS - MARINE AND TRANSPORT

TEMPERATURE LIMITATIONS - WASTE HEAT REMOVAL

THE DEFT SOLUTION

Less complexity, fewer components and longer lifespans drive reductions in the associated CAPEX and OPEX. Membraneless operation enables direct linkage to renewable energy sources avoiding the cost of power conditioning equipment.

Lowering the cost of electrolytic hydrogen is the gateway to the widespread adoption of green hydrogen in the mobility and marine sectors. This extends to energy storage applications and large scale conversion of hydrogen into ammonia, methanol and e-fuels.

Conventional electrolysers loose between 25-30% of their electrical input as waste heat. This drives up the price of electrolytic hydrogen making it uncompetitive to that of fossil fuels. DEFT, without a membrane, allows for higher temperature, higher efficiency production.

GAMECHANGE
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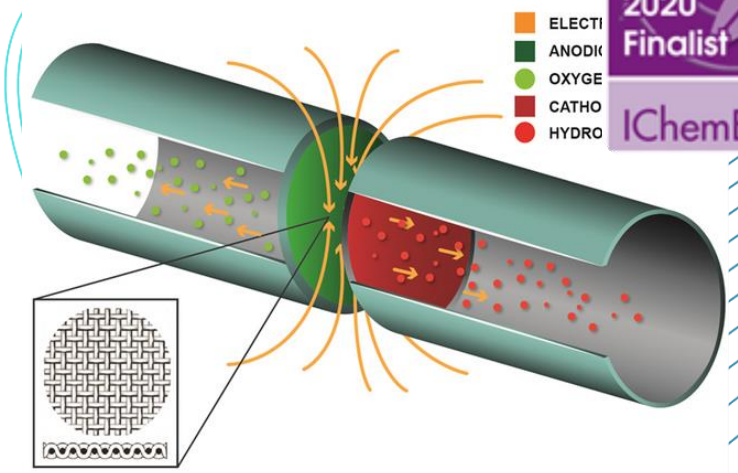
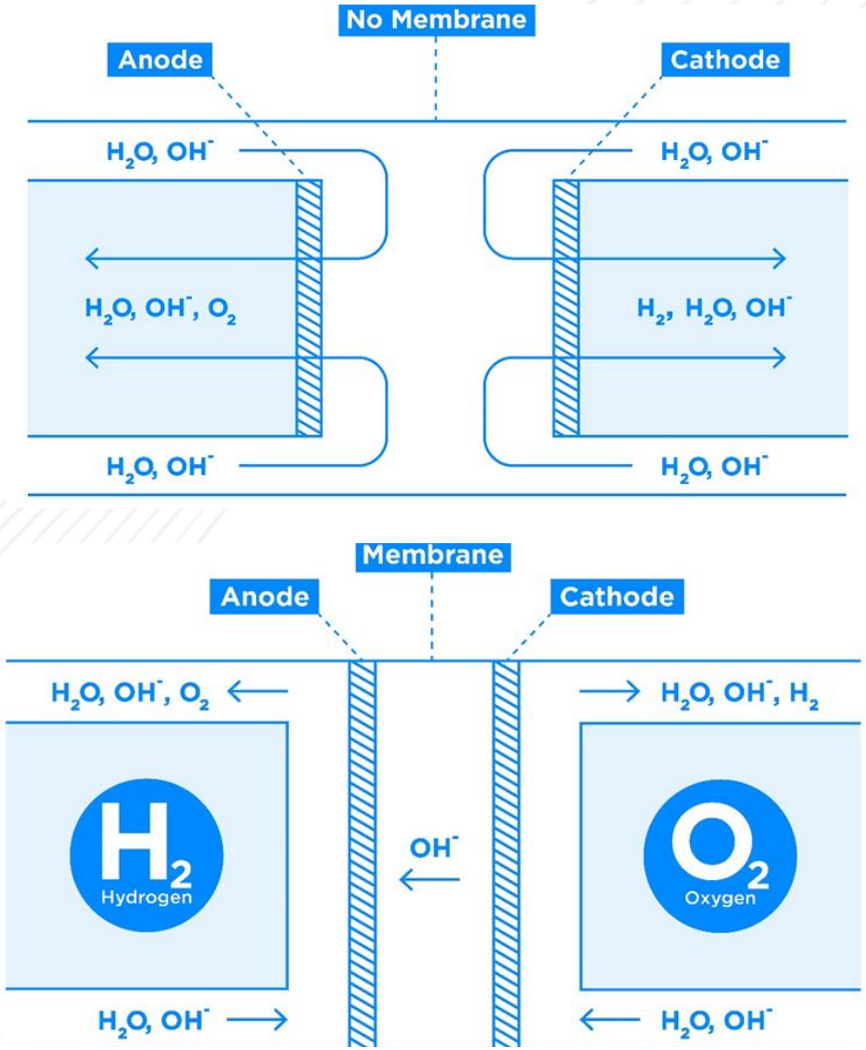
Hydrox Holdings DEFT solution eliminates the need for a membrane by utilizing the flow of electrolyte to keep the hydrogen and oxygen gases separated and pure.

Membraneless operation reduces the cost and complexity of green electrolytic hydrogen production by simplifying the design and operation of electrolyser cells.

Without the limitations imposed by the inclusion of a membrane the DEFT technology is able to push the boundaries going beyond the operating realm of conventional electrolysers.



DEFT ADVANTAGES



Due to the absence of a membrane the DEFT system can operate off sea water and has the potential to treat acid mine water

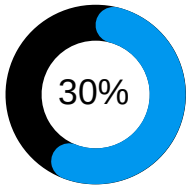
The DEFT system can handle fluctuating currents associated with renewable energy sources as there is no membrane. This eliminates the need for power conditioning equipment

Lower capital costs; less components and a smaller footprint as a consequence of a higher current density (the DEFT system is ideally suited to handle high production volumes of gas)

Lower maintenance costs and longer life spans. Eliminated risk of unexpected shutdowns as a consequence of membrane degradation and rupture.

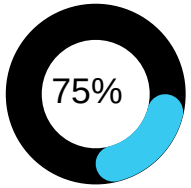
Lower operating voltages as a result of higher current densities; This has a positive effect on the electrolysers efficiency.

HIGH TEMPERATURE



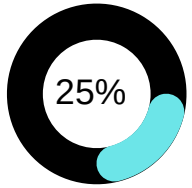
Energy to Waste Heat

With conventional, low temperature electrolysers up to 30% of the electrical input is wasted through heat generation/removal



High Energy Cost

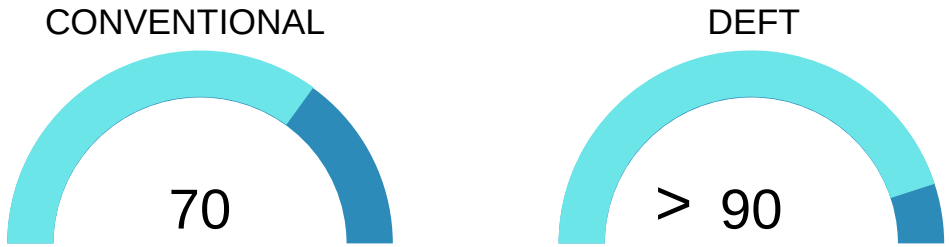
The cost of the energy/electrical input accounts for 65 - 75% of production costs.



High Temperature - Cost Saving

Operating at elevated temperatures reduces energy consumption and production costs. A 25% reduction in the production cost of green hydrogen is a very real possibility.

Improved Electrical Efficiency



The DEFT technology can operate at elevated temperatures which drastically increases energy efficiencies as energy losses through waste heat is minimized.

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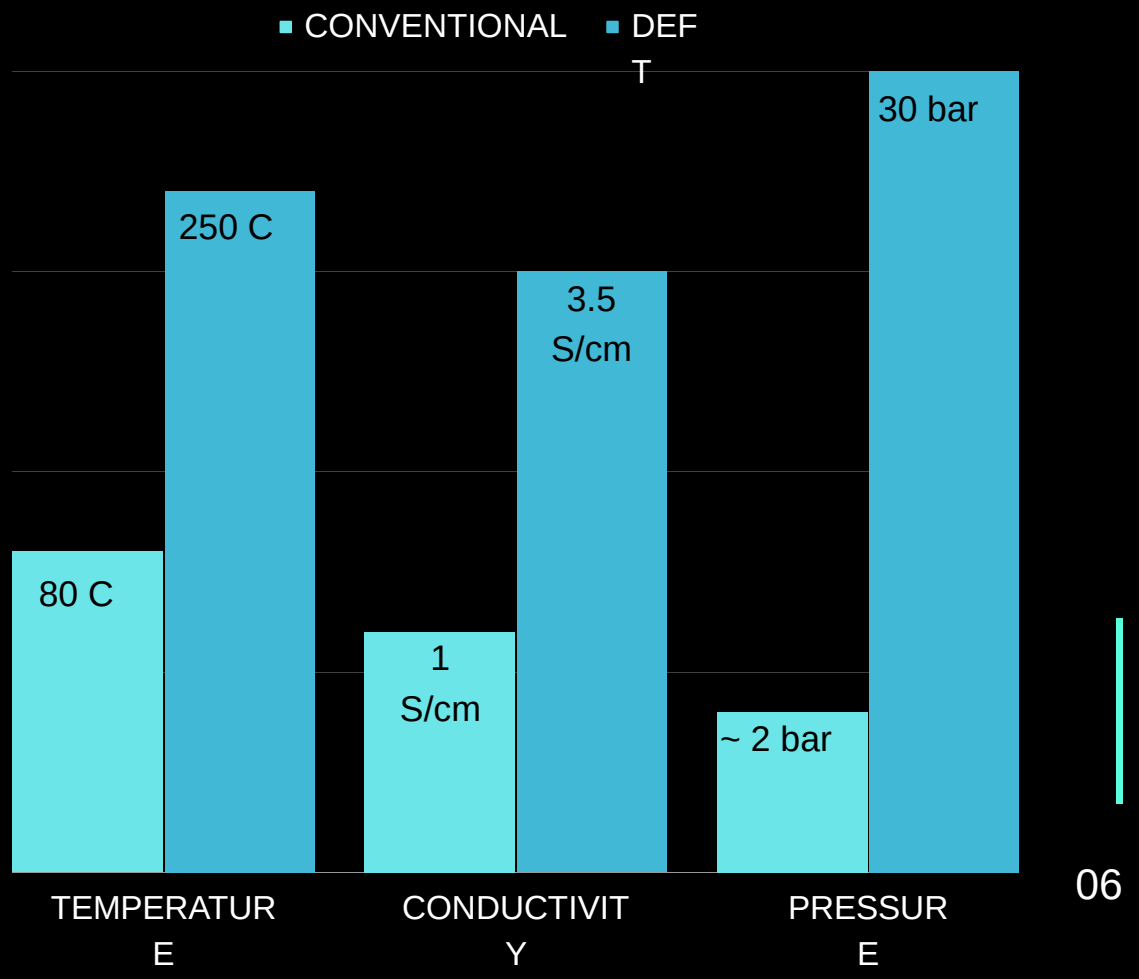

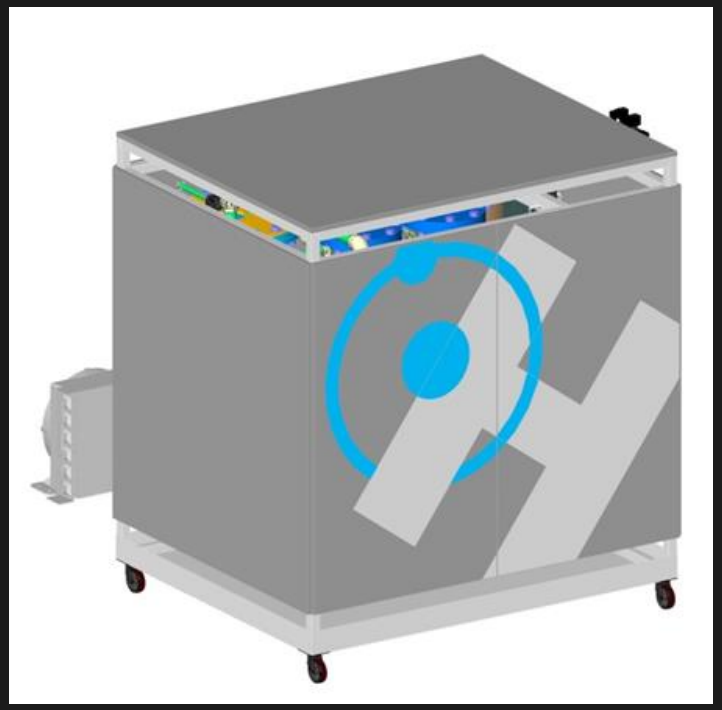

OEM TECHNOLOGY

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+- 15 kW Divergent Electrode Flow Through (DEFT) and an Advance Alkaline Electrolyser (AAE) built and tested in in house facilities.

In-house design of the electrolyser stack and the balance of plant.

- Electrolyser
- Electrolyte circuit
- Utilities
- Gas separation/Handling
- Power conditioning
- Control and Instrumentation

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CORRIE DE JAGER

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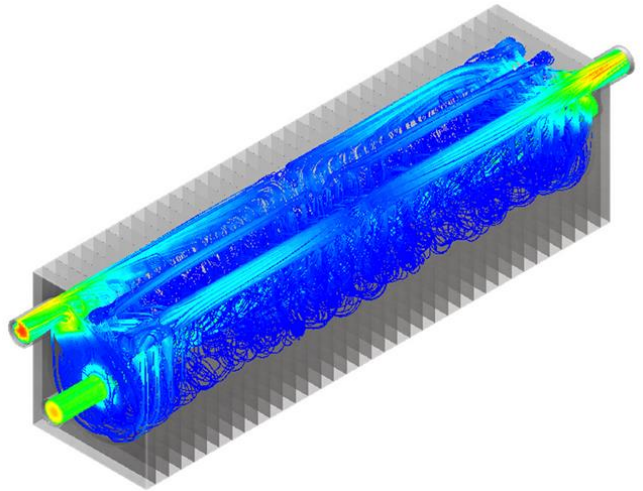

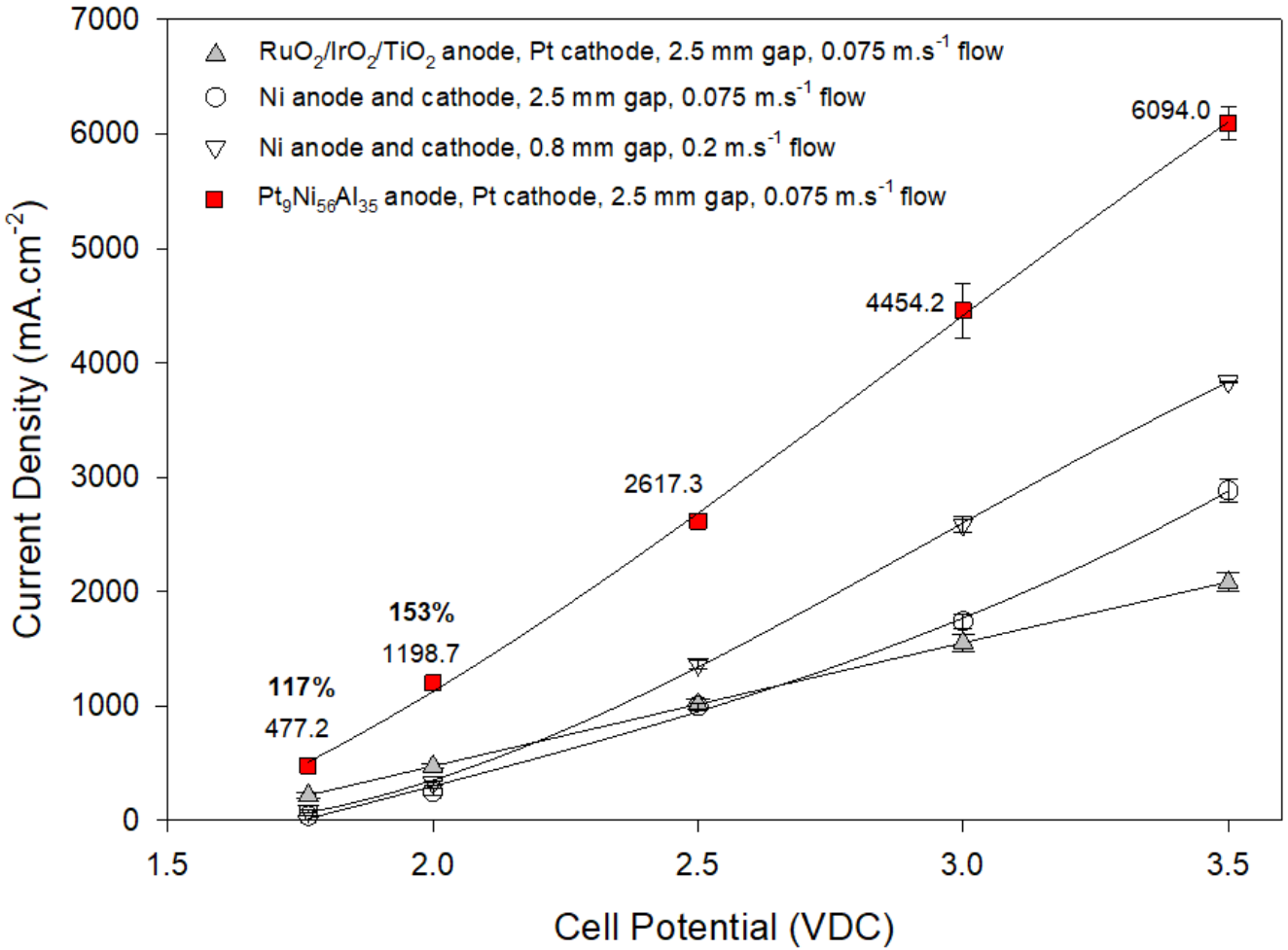
7000
6000
5000
4000
3000
2000
1000
0
1.5
2.0
2.5
3.0
3.5
Current Density (mA.cm-2)
Cell Potential (VDC)
RuO2/IrO2/TiO2 anode, Pt cathode, 2.5 mm gap, 0.075 m.s-1 flow
Ni anode and cathode, 2.5 mm gap, 0.075 m.s-1 flow
Ni anode and cathode, 0.8 mm gap, 0.2 m.s-1 flow
Pt9Ni56Al35 anode, Pt cathode, 2.5 mm gap, 0.075 m.s-1 flow
6094.0
4454.2
2617.3
153%
1198.7
117%
477.2