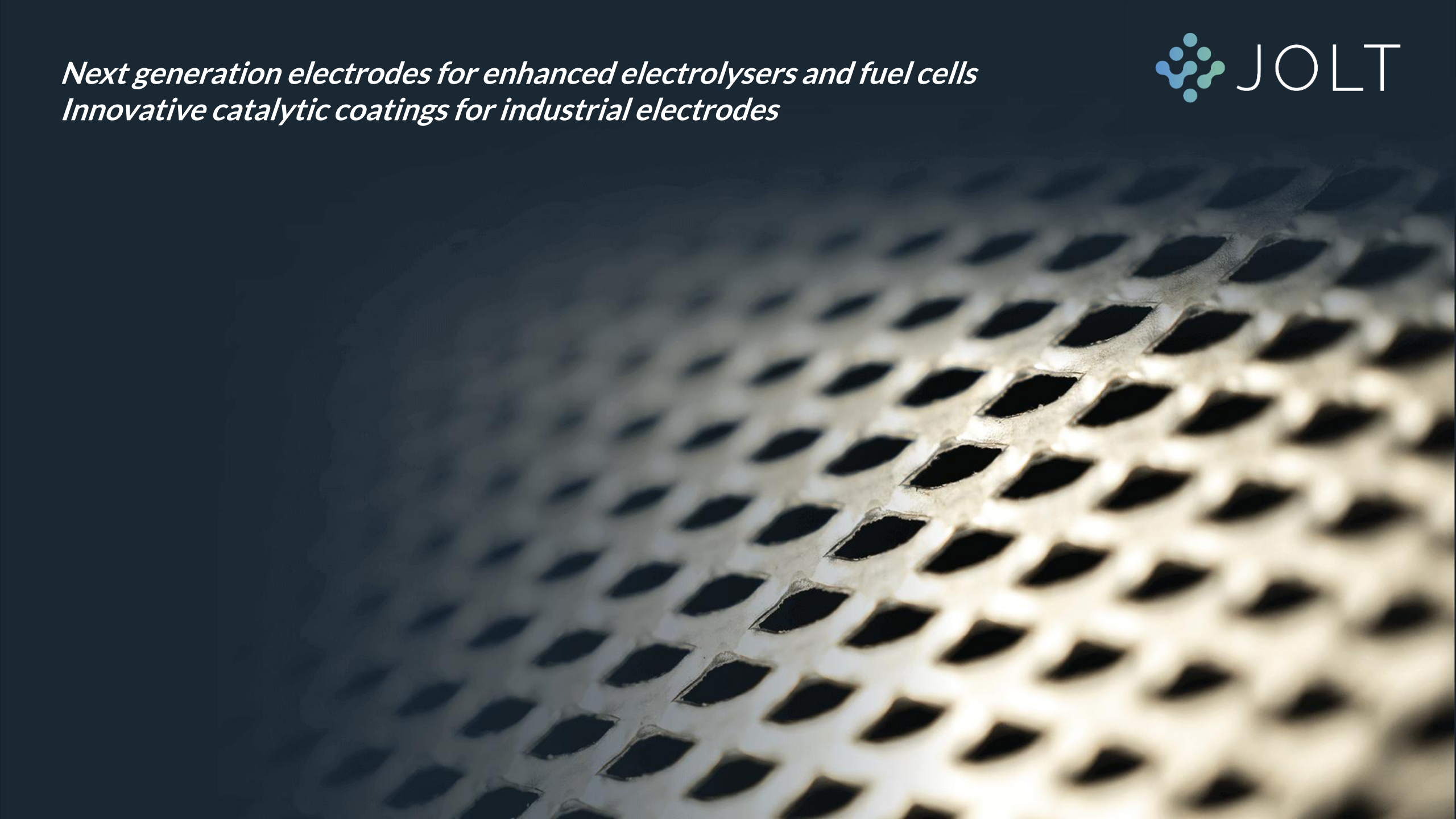
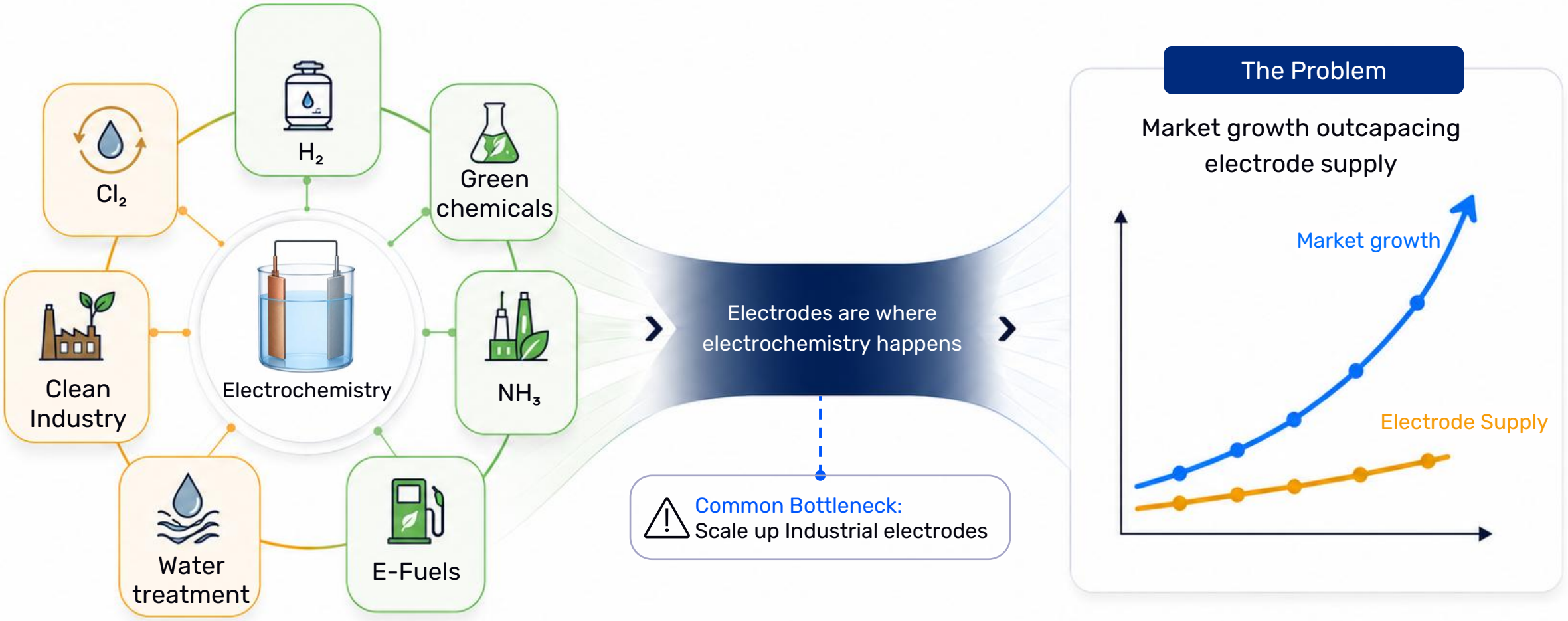
Next generation electrodes for enhanced electrolysers and fuel cells
Innovative catalytic coatings for industrial electrodes

JOLT



Electrochemistry powers clean industry



The transition to **green chemicals**, H_2, and **clean industry** depends on scalable electrodes

What makes an industrial electrode Valuable?

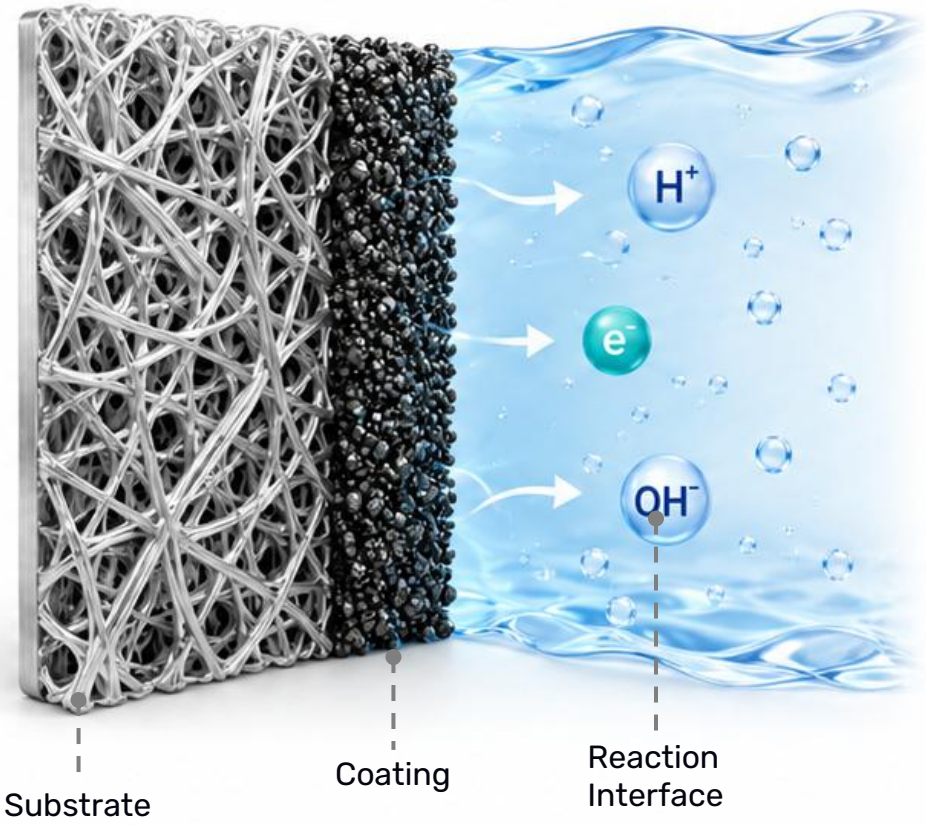
Manufacturability, Performance, and Lifetime

Scale Up

Designed for industrial electrode manufacturing at 10^5 - 10^6 m^2/year

High Durability

Stable over long operation times
> 5-7 years



Low Overpotential

High efficiency and low energy loss

Selectivity

Drives the desired reaciton

The coating is the **functional layer** that turns a substrate into a **valuable electrode**

Existing Electrocatalytic Coating Solutions

All current approaches involve trade-off

Chemical Bath



Chemical Tunability	🟡
Time	🔴
Temperature	🟡
Power	🟢
Scalability	🔴
Process	Batch

Electroplating



Chemical Tunability	🟢
Time	🟡
Temperature	🟡
Power	🔴
Scalability	🔴
Process	Batch

Thermal Decomposition



Chemical Tunability	🟡
Time	🔴
Temperature	🔴
Power	🟡
Scalability	🟢
Process	Continuous

Key takeaway

Thermal decomposition is the **strongest industrial starting point** because it is **continuous and scalable.**

JOLT builds from this baseline in the next slide.

JOLT's Technology

sparkfuze™ by JOLT

01 Pre-Treatment*



- Surface activation through degreasing and etching

02 Ink Formulation



- Proprietary reactive ink formulated for performance

03 Coating



- Universal spray coating adaptable to varied shapes, sizes, and surfaces

04 Ultrafast Curing



- T < 250°C
- t = 40–60 s

05 Ready to be Installed



- Electrode ready for stack integration

Engineered for performance | **Designed for scalability** | **Built for real-world integration**

Automated coating line

- High Scalability
- Off the shelf equipment
- Lowest CAPEX & OPEX
- Up & running in 10-12 months
- Runs off 150 kw of solar
- Clean & safe – can run anywhere
- Drop-in replacements
- Near demand & on demand



JOLT's Technology – 3D Ni coatings

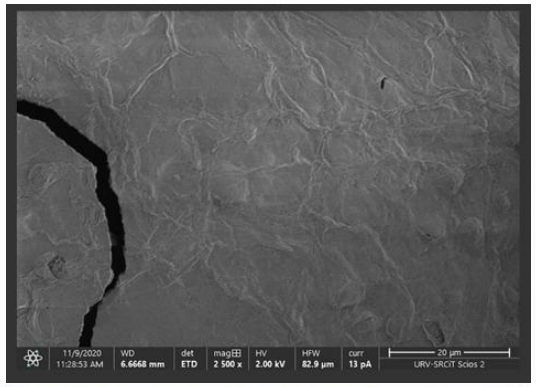
Same Macroscopic Electrode
Ni Felt Substrate



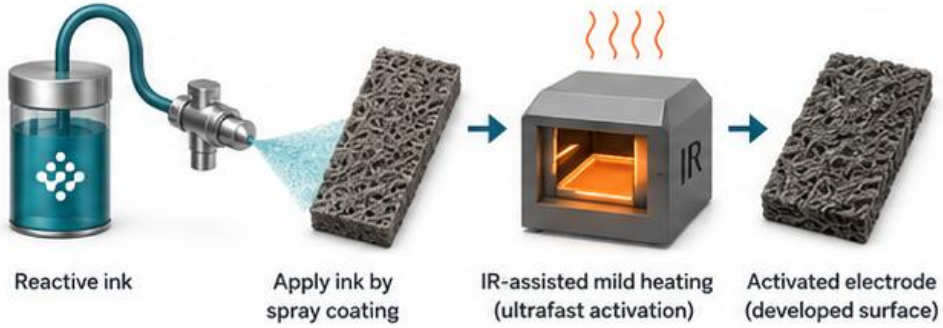
Thermal decomposition



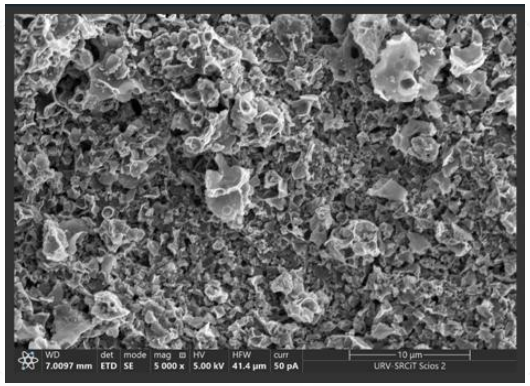
Thermal decomposition
Flat / compact surface



Sparkfuze



Sparkfuze
Porous & nanostructured surface



Same substrate and catalyst composition — Sparkfuze generates a higher-surface-area morphology.

JOLT's Technology – 2D Ti coatings

Same Macroscopic Electrode

Ti plate substrate



Adhesion (Scotch test)



Thermal decomposition



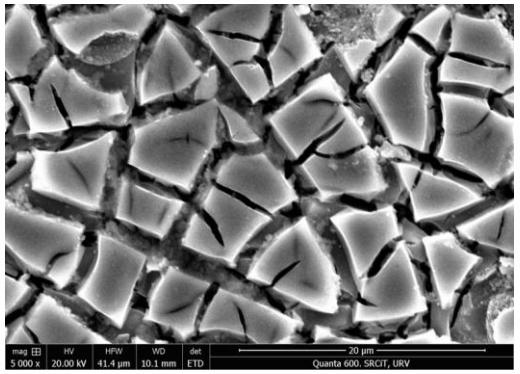
Apply precursor by roll coating

500 °C 1 h

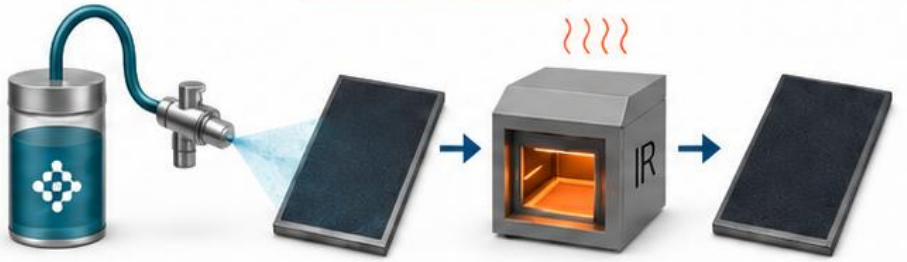
Coated electrode (after bake)

Thermal decomposition

Flat / compact surface



Sparkfuze



Reactive ink

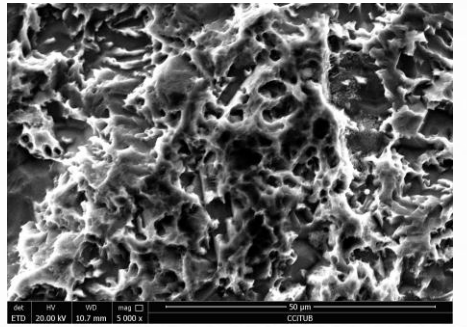
Apply ink by spray coating

IR-assisted mild heating / (ultrafast activation)

Activated electrode (developed surface)

Sparkfuze

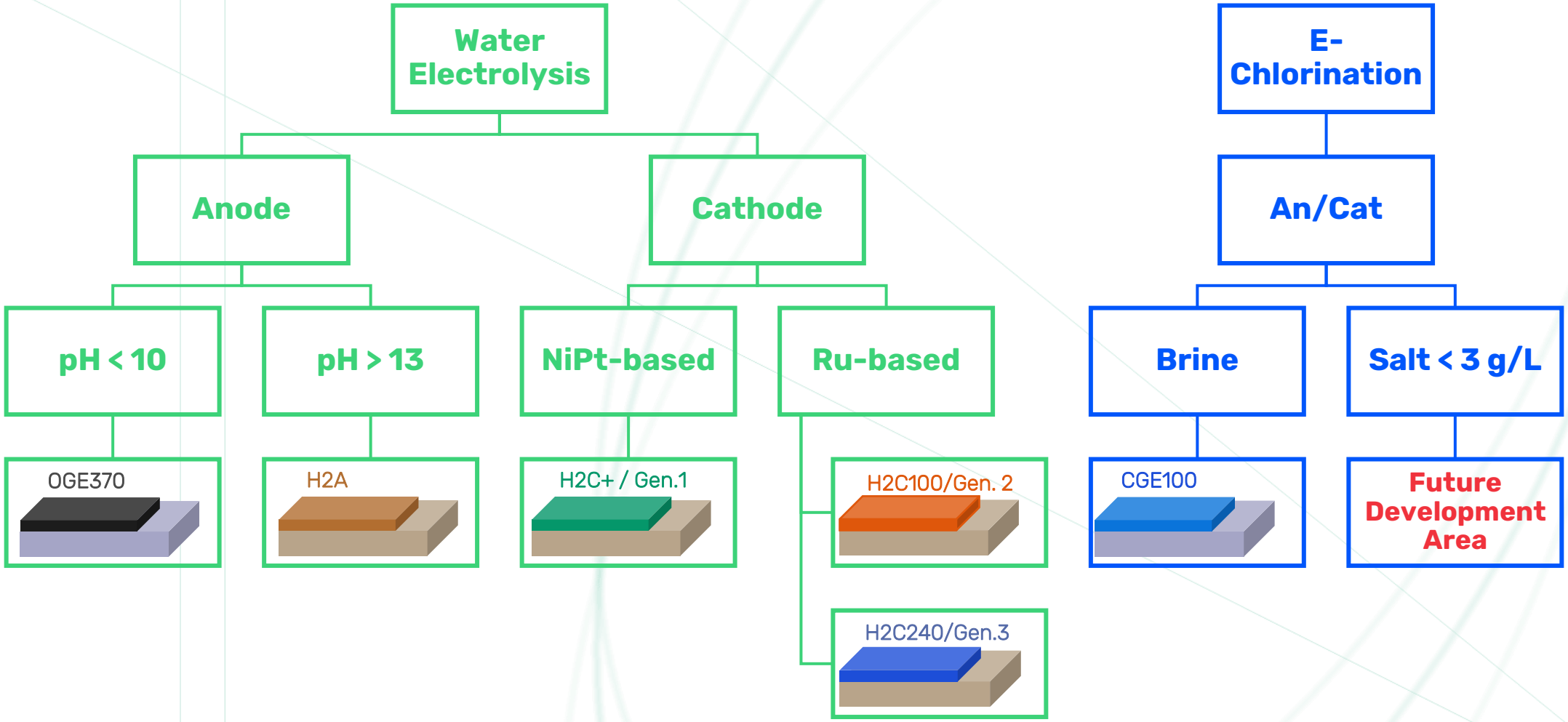
Porous & nanostructured surface



Same substrate and catalyst composition — Sparkfuze generates a higher-surface-area morphology.

sparkfuze™

Family



Validation

A multi-methods approach to test performances and durability under relevant conditions

1. Constant current

Steady operation in sandwich or 2-electrode configuration



3 electrodes in a vessel
WE sandwiched between 2 CE

2 electrodes in a vessel
High-current CE evaluation

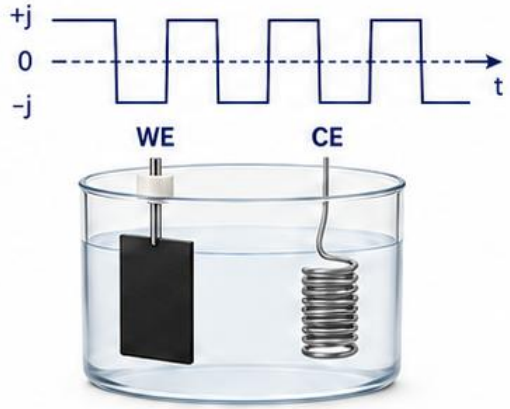
Tested conditions

Acidic
- j = 2 A/cm²
- 30 wt% H_2SO_4
- T = 30 °C

Alkaline
- j = 1–5 A/cm²
- 30 wt% KOH
- T = 80 °C

2. Reverse current

Durability under current reversal



2 electrodes
CE = Pt wire

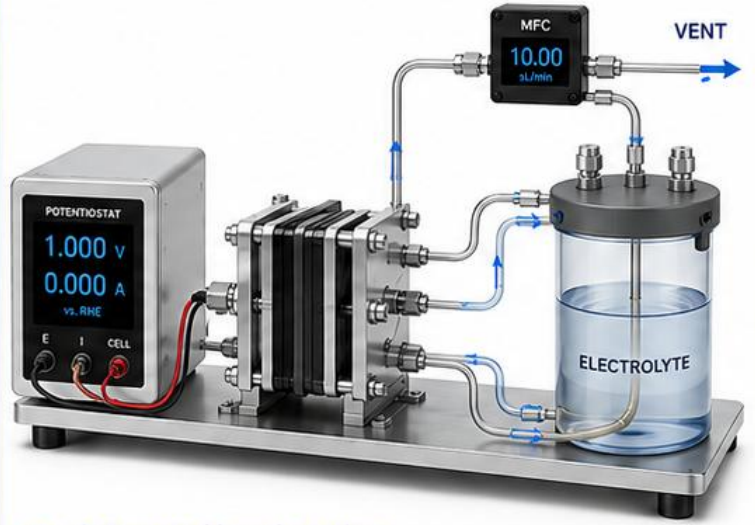
Tested conditions

OER / HER
- j = +1.5 A/cm² to -0.15 A/cm²
- every 1 min
- [KOH] = 30%
- T = 80 °C

Electrochlorination
- j = ±100 mA/cm² or ±200 mA/cm²
- every 1 min
- [NaCl] = 4 g/L + [Na_2SO_4] = 70 g/L
- T = 30 °C

3. Flow cell for H_2

Performance in operating conditions



- Automated bench station
- Protocols currently being defined
- Joint program with TNO

Under development

Our purpose

Validate electrode coatings for industrial relevance: activity, durability, and scalability.

Testing principles

- Application-relevant conditions
- Accelerated stress evaluation
- Quantitative and reproducible
- Protocols aligned with industrial standards

Morphology

Same substrate and catalyst composition – Sparkfuze generates higher surface area.

1. Representative coated electrode



Macroscopic electrode view

Same substrate, different surface architecture

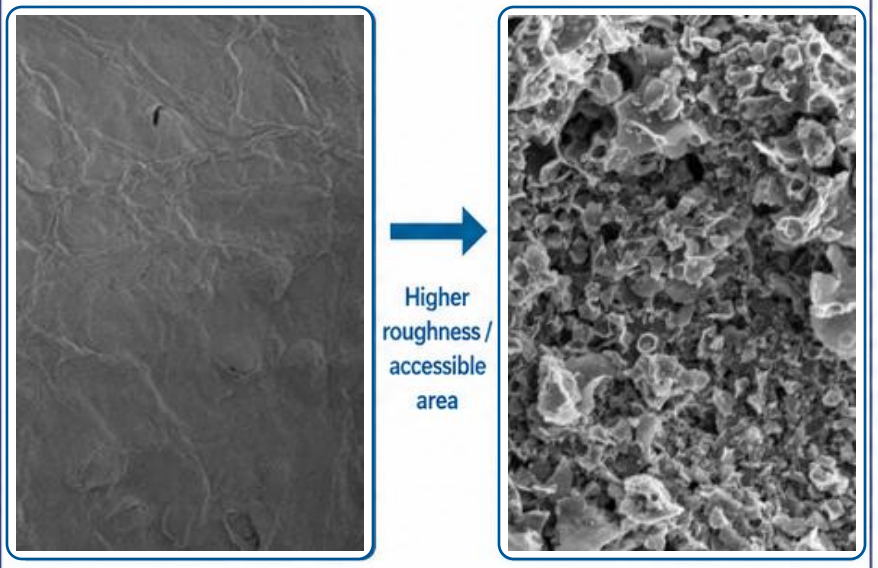
2. Morphology comparison

Thermal decomposition

Flat / compact surface

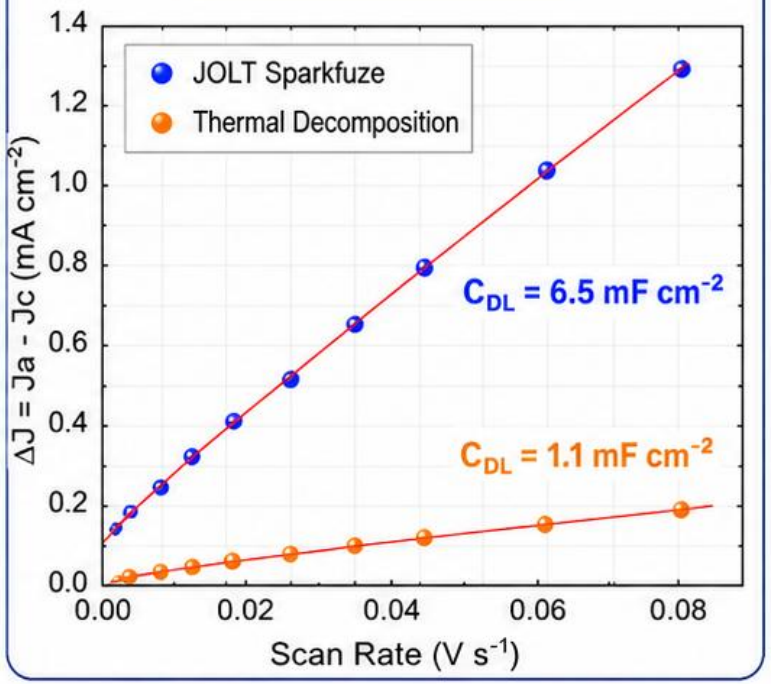
Sparkfuze

Porous & nanostructured surface



3. Double-layer capacitance (ECSA proxy)

Higher ECSA proxy

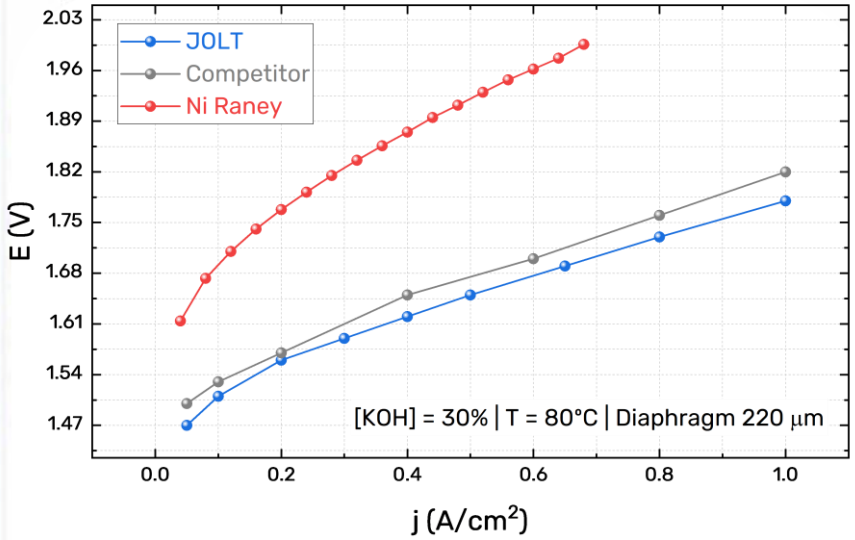


Surface architecture, not only composition, drives electrochemical performance.

Activity

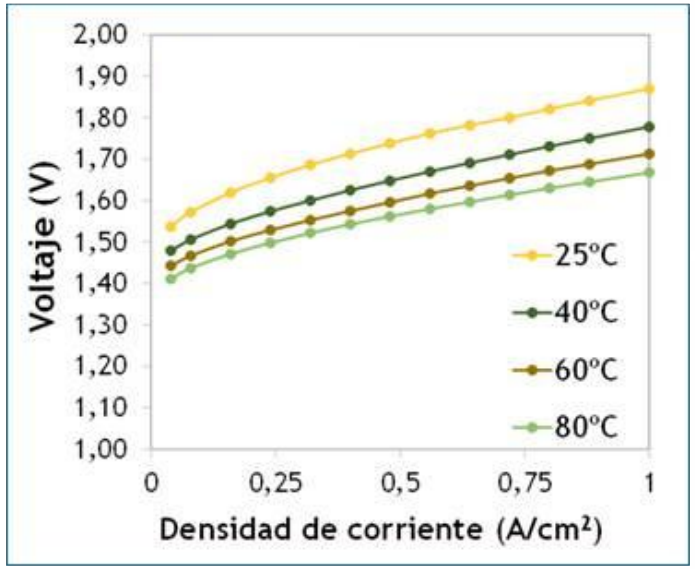
Sparkfuze coatings deliver lower energy losses under application-relevant current densities

1 Alkaline Electrolysis



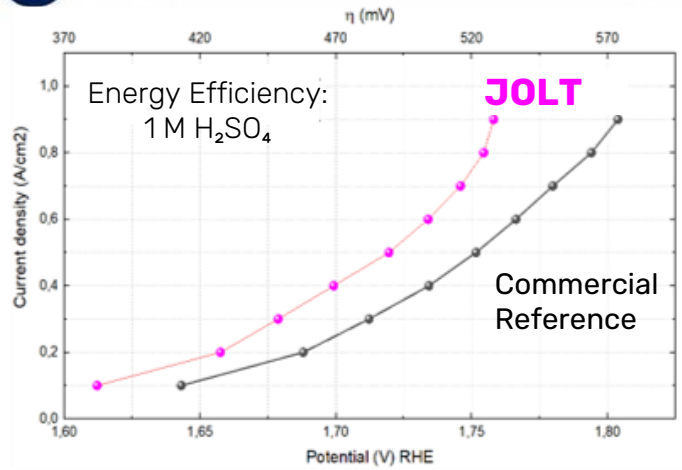
Red: Ni Raney: E_{Cell} = 1.95 V @ 0.5 A/cm²
Blue: JOLT: E_{Cell} = 1.77 V @ 1 A/cm²
Gray: Competitor: E_{Cell} = 1.83 V @ 1 A/cm²

2 AEM Electrolysis



JOLT: E_{Cell} = 1.65 V @ 1 A/cm²

3 Acidic Oxygen Evolution



JOLT = +10% Energy Savings vs Competitors

Lower overpotential means higher efficiency at industrial current densities.

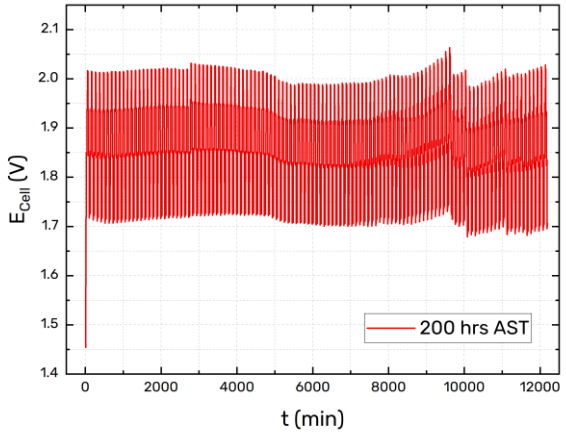
Durability

Stability must be demonstrated under application-relevant stress test.

AWE stability

AST conditions

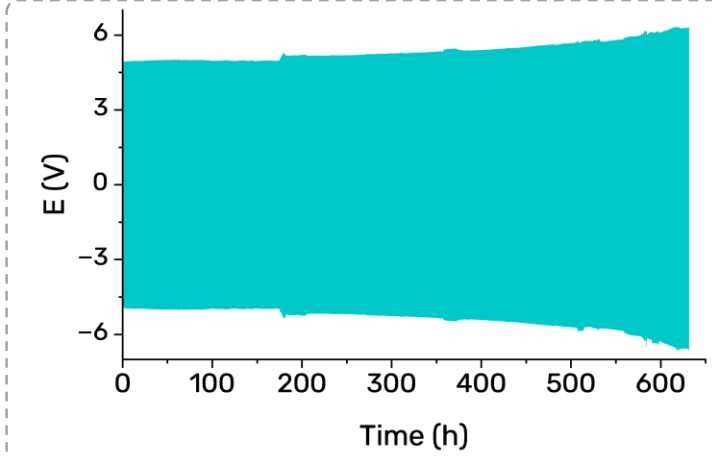
- High-current alkaline operation
- 30 wt% KOH
- T = 80 °C
- AST protocol



E-chlorination stability

Validated for 10,000 h

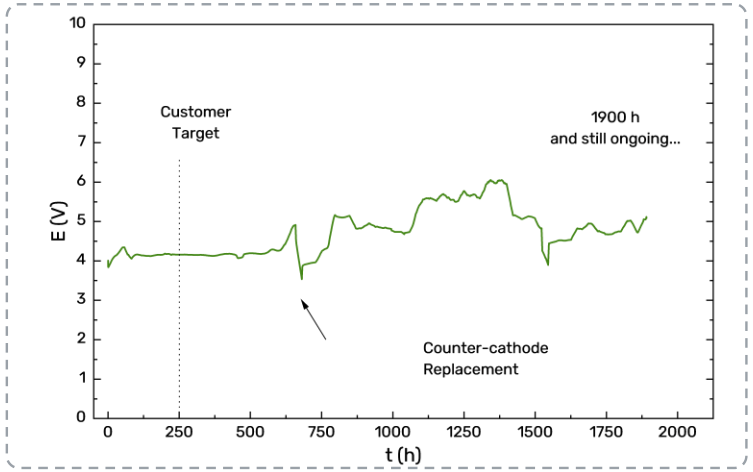
- Current reversal stress
- ±40 – 60 mA cm^{-2} every 60 seconds
- NaCl-containing electrolyte
- T = 30 °C



Oxygen evolution stability

Constant current

- j = 2 A cm^{-2}
- 30 wt% H_2SO_4
- T = 30 °C
- Long-duration stability



Industrial relevance requires stability under application-specific stress conditions.

Many Thanks