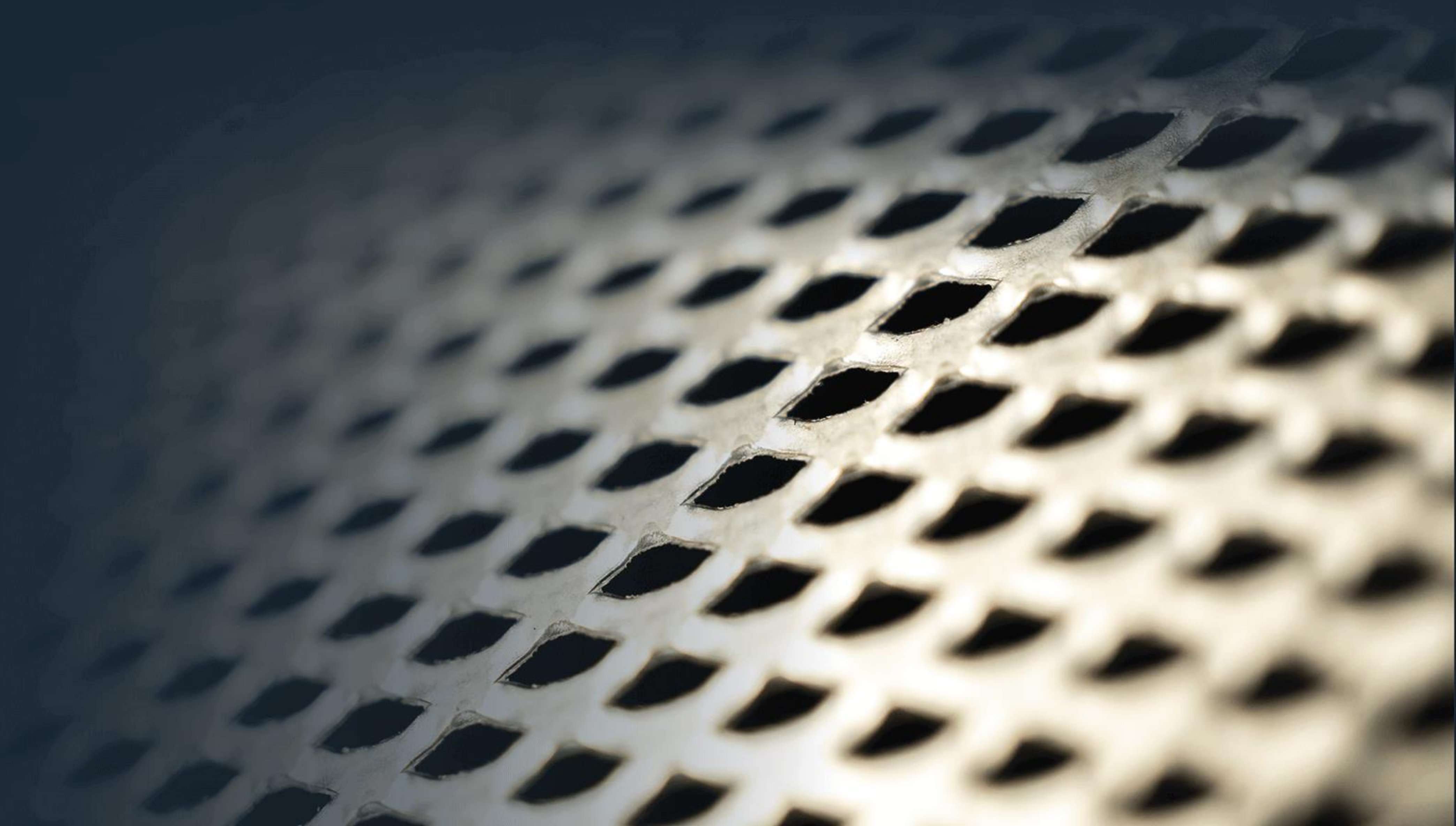
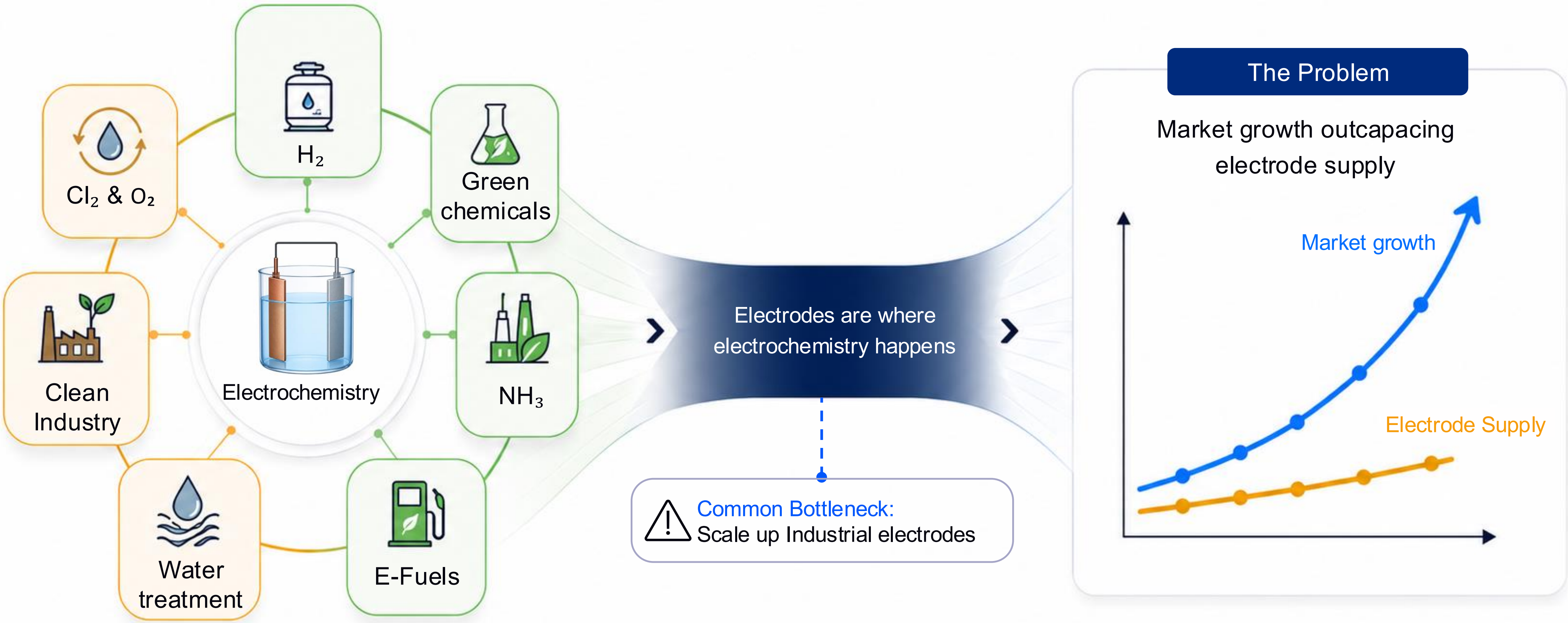
JOLT

Next generation electrodes for enhanced & decentralized electrolysis
Innovative catalytic coatings for industrial electrodes



Electrochemistry powers clean industry



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

What makes an industrial electrode Valuable?

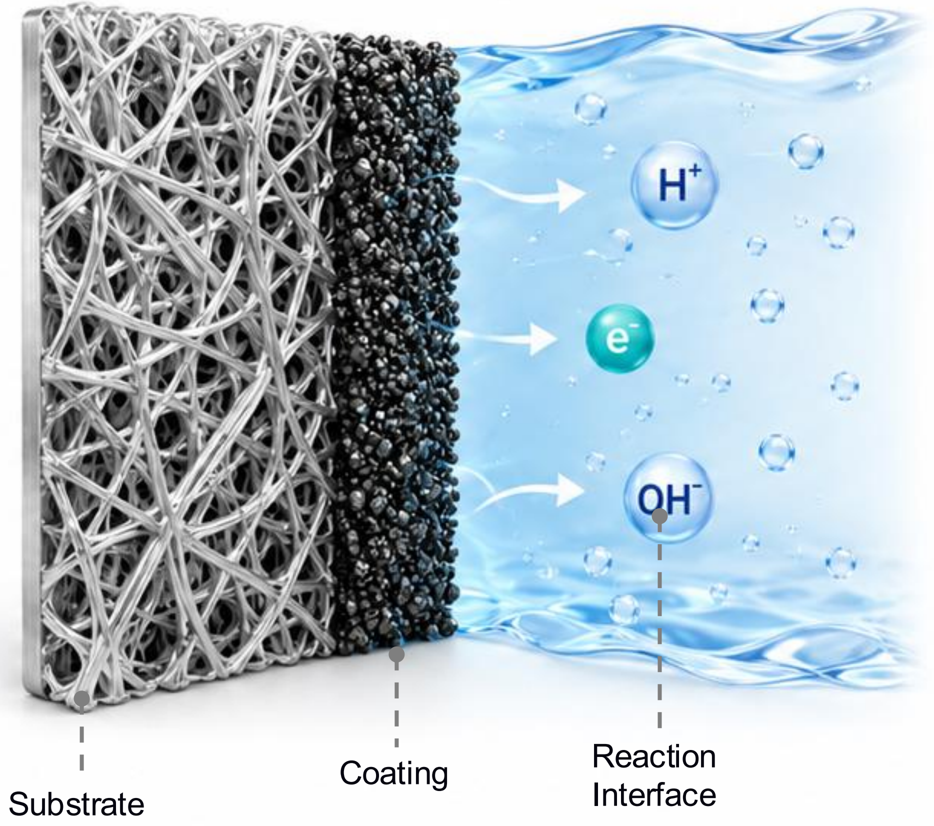
Manufacturability, Performance, and Lifetime

Scale Up

Designed for industrial electrode manufacturing at
10^5 - 10^6 m²/year

High Durability

Stable over long operation times
> 5-8 years depending on segment



Low Overpotential

High efficiency and low energy loss

Selectivity

Drives the desired reaciton

The catalyst coating is the **functional layer** that turns a metal, polymer, carbon substrate into a **valuable activated electrode**

JOLT

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

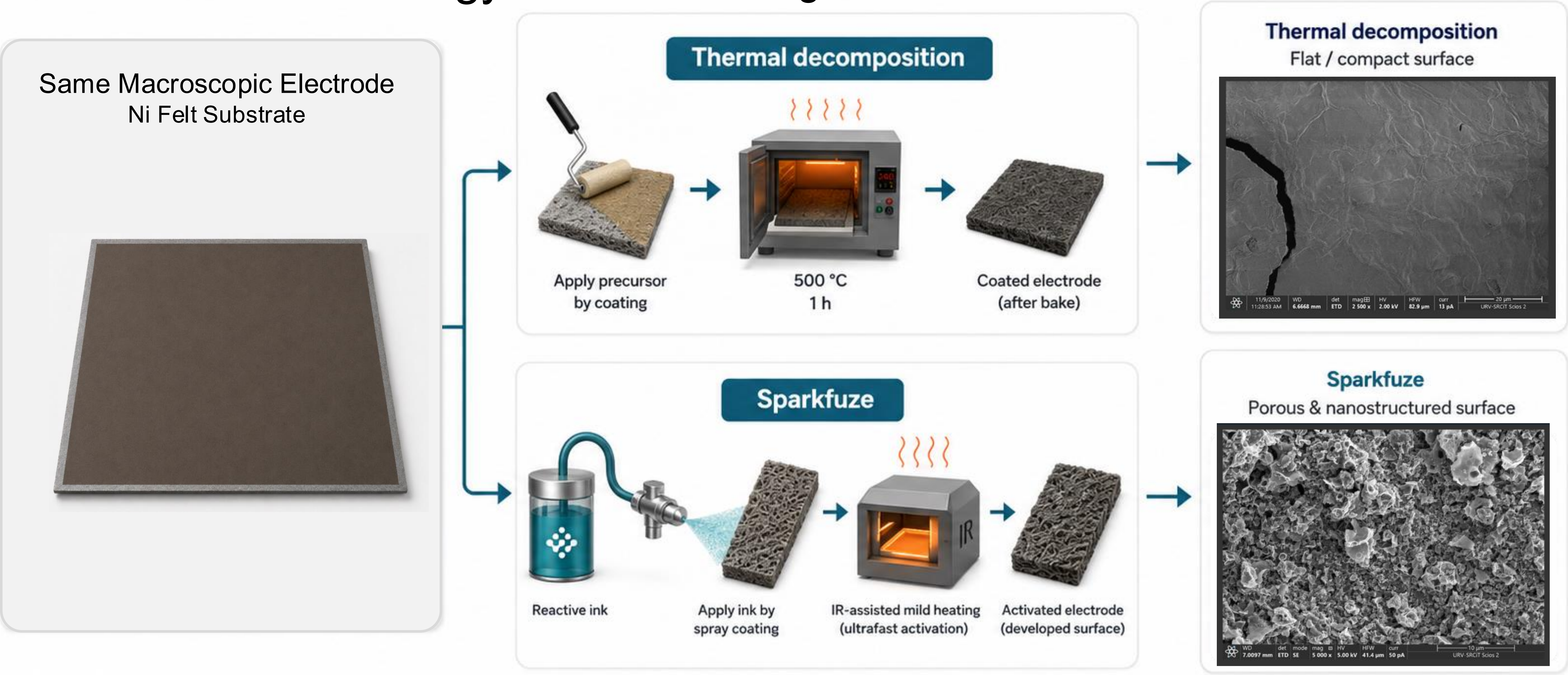
- Electrode ready for stack integration

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

World's First Fully Automated & Continuous Coating Line

- Unlimited 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
- Just-in-time
- Near demand & on demand
- Made in minutes – not days

JOLT's Technology – 3D Ni coatings



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

JOLT's Technology – 2D Ti coatings

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Same Macroscopic Electrode

Ti plate substrate

Adhesion (Scotch test)

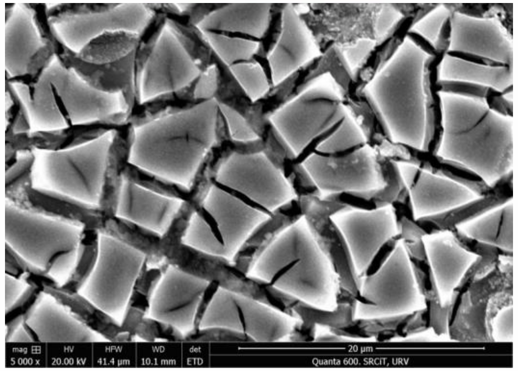
1º test 2º test

Thermal decomposition

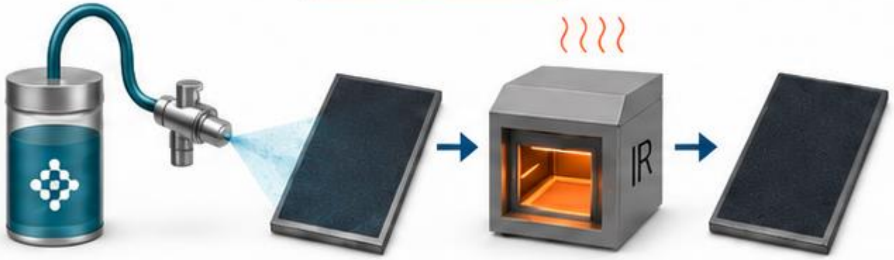
Apply precursor by roll coating → 500 °C 1 h → Coated electrode (after bake)

Thermal decomposition

Flat / compact surface



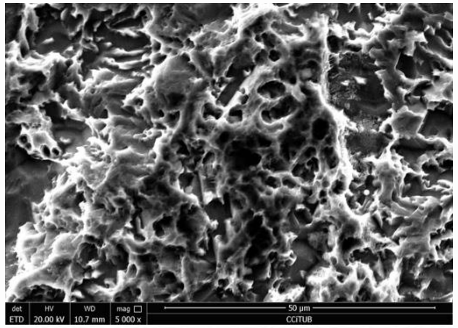
Sparkfuze



Reactive ink → Apply ink by spray coating → IR-assisted mild heating / (ultrafast activation) → Activated electrode (developed surface)

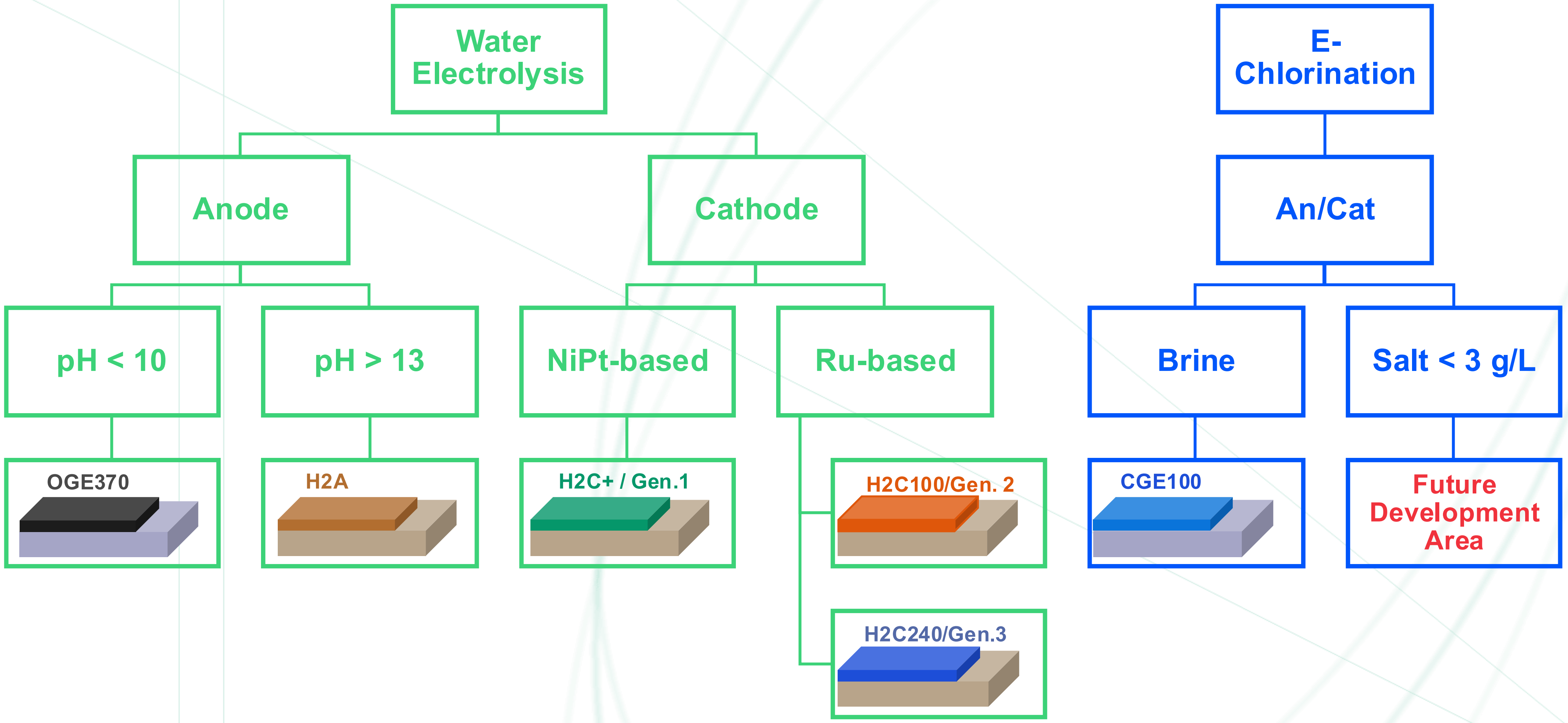
Sparkfuze

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

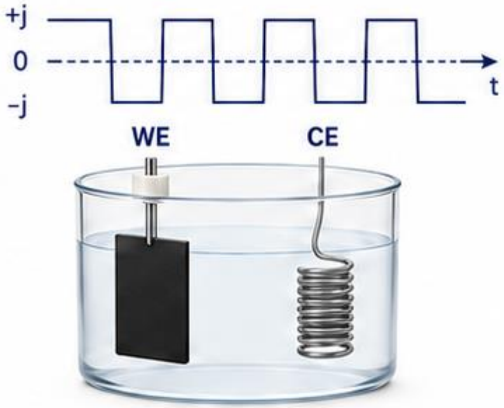
- j = 2 A/cm²
- 30 wt% H_2SO_4
- T = 30 °C

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

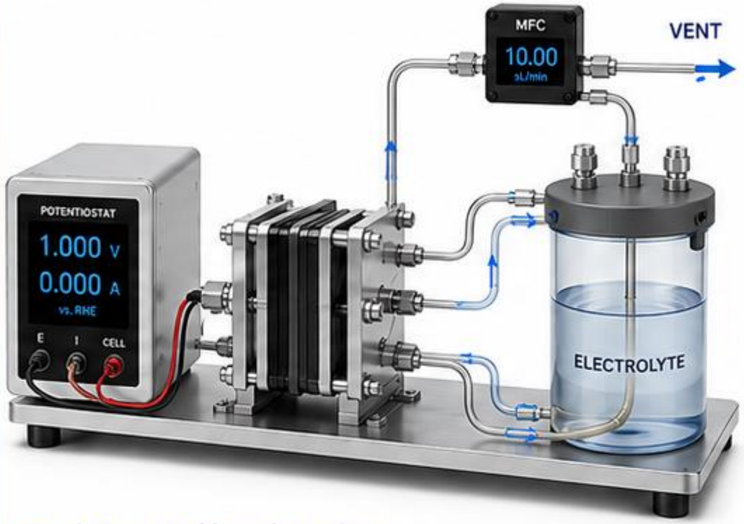
- j = +1.5 A/cm² to -0.15 A/cm²
- every 1 min
- [KOH] = 30%
- T = 80 °C

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

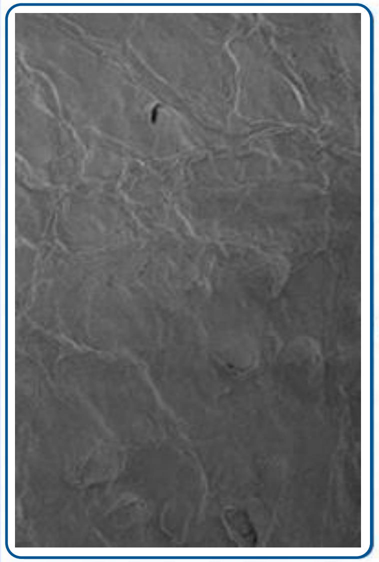
Macroscopic electrode view

Same substrate, different surface architecture

2. Morphology comparison

Thermal decomposition

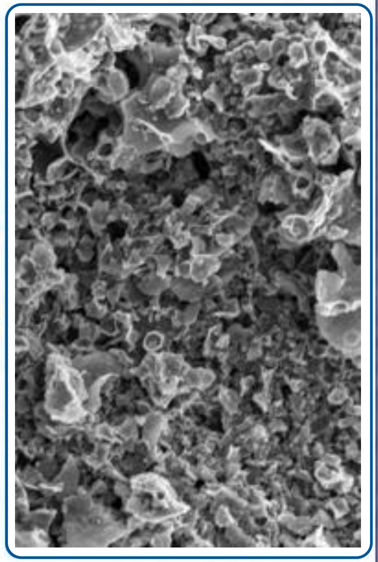
Flat / compact surface



Higher roughness / accessible area

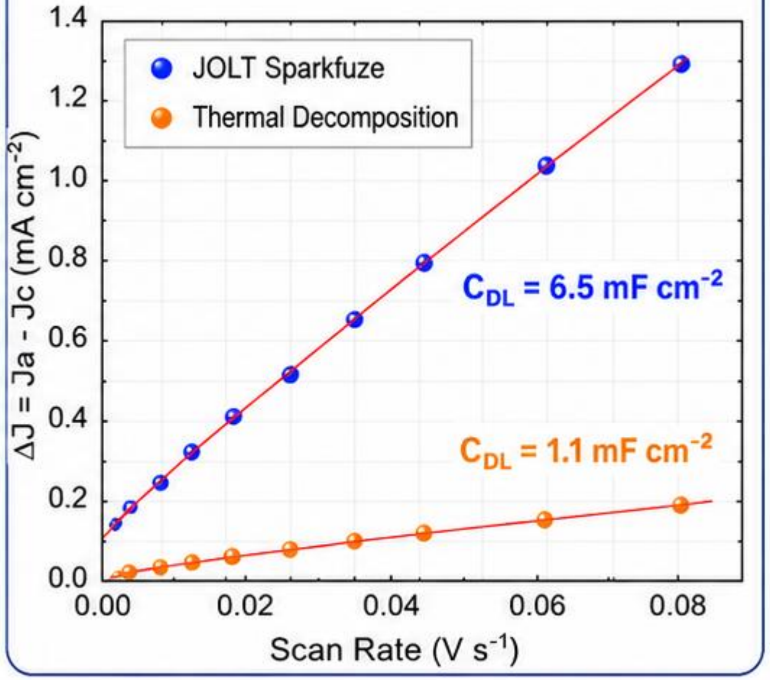
Sparkfuze

Porous & nanostructured surface



3. Double-layer capacitance (ECSA proxy)

Higher ECSA proxy

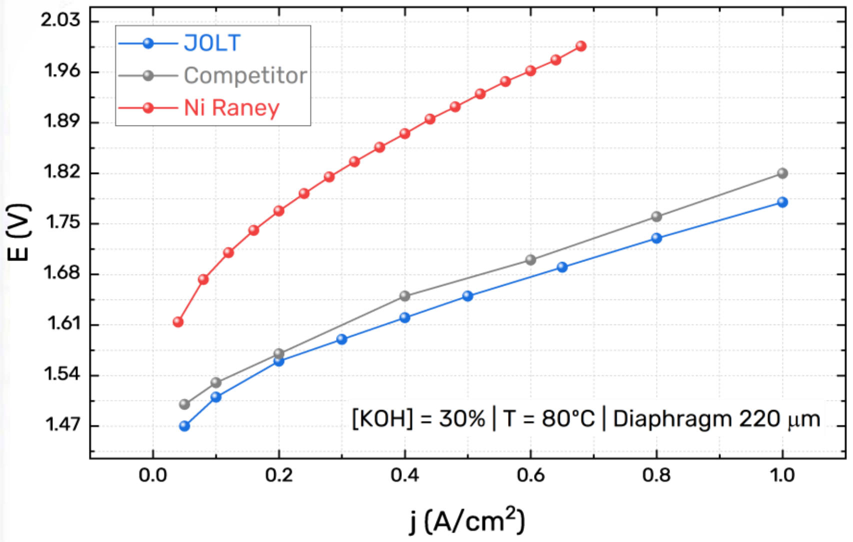


Surface architecture, not only composition, drives electrochemical performance.

Activity

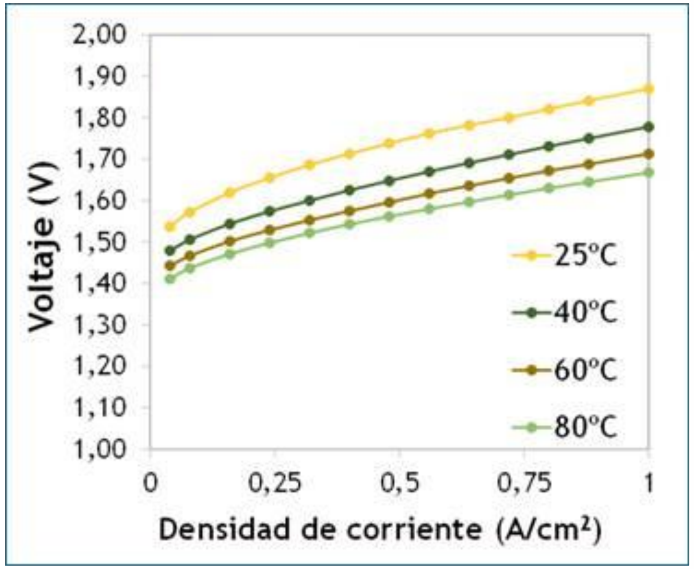
Sparkfuze coatings deliver lower energy losses under application-relevant current densities

1 Alkaline Electrolysis



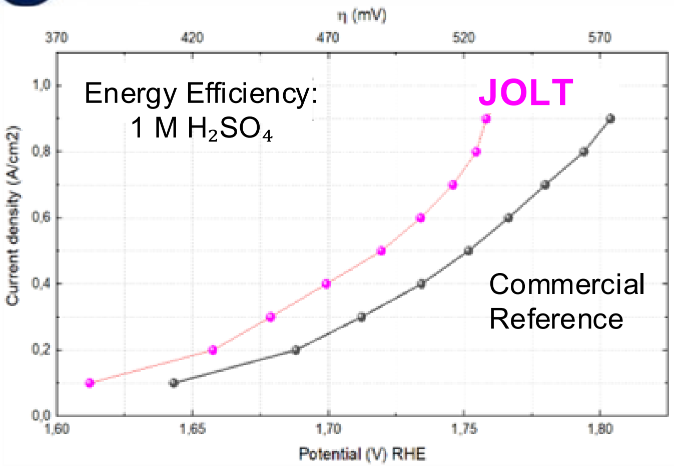
Red: Ni Raney: E_{Cell} **= 1.95 V @ 0.5 A/cm²**
Blue: JOLT: E_{Cell} **= 1.77 V @ 1 A/cm²**
Gray: Competitor: E_{Cell} **= 1.83 V @ 1 A/cm²**

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.

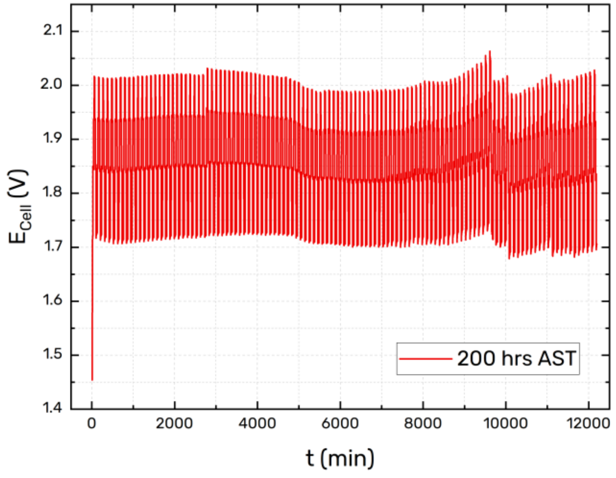
Durability

Stability must be demonstrated under application-relevant stress test.

1. AWE stability

AST conditions

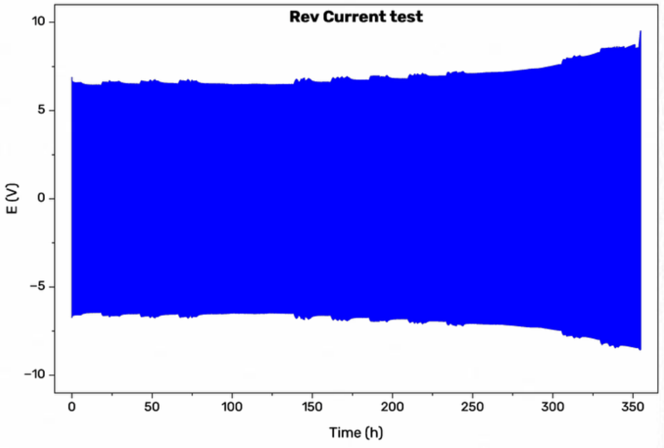
- High-current alkaline operation
- 30 wt% KOH
- T = 80 °C
- AST protocol



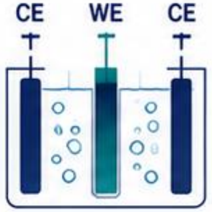
2. E-chlorination stability

Reversal-current conditions

- Current reversal stress
- ±100–200 mA cm^{-2}
- NaCl-containing electrolyte
- T = 30 °C

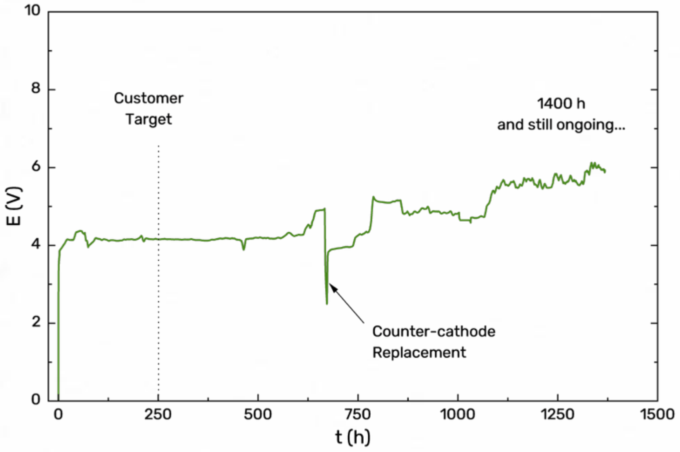


3. Oxygen evolution stability



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.

From Mega Plants to Millions of Devices:

Stable Electrodes Enable the Decentralisation of Electrochemistry

JOLT

TODAY: CENTRALISED MEGA PLANTS

- Operate at massive scale
- Require constant, stable power
- Complex infrastructure
- High CAPEX & long lead times
- High distribution & logistics cost
- Limited flexibility & location dependence

LIKE THE PAST:

Mainframe (1960s) → PC (1980s) → Smartphone (2000s)

Proven Stability Under Fluctuating Power / Reverse Polarity

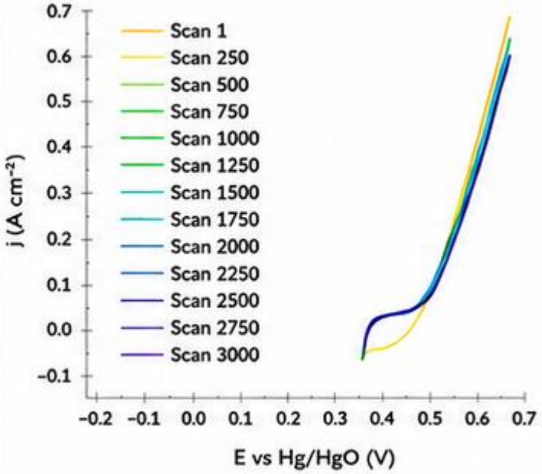
Enabling a New Era of Distributed Electrochemical Systems

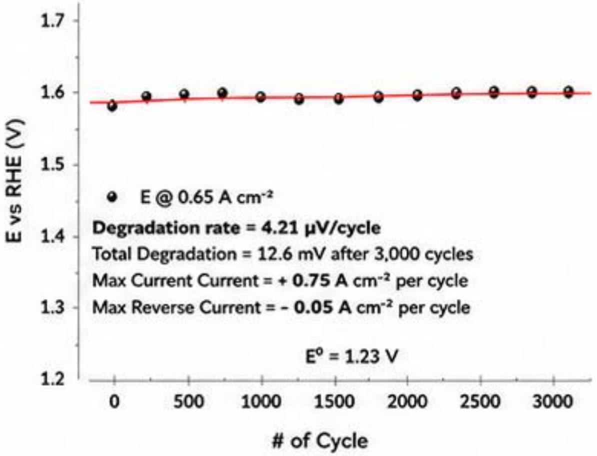
Accelerated Stress Tests – Reverse Current @ - 50 mA cm⁻²:

1500 (fwd) + 1500 (bck) LSV to 0.75 A cm⁻²

Keep vertex potential until stabilization

T= 80°C





Equivalent to switching on/off twice a day for 10 years

NO Leaching Observed

TOMORROW: DECENTRALISED EVERYWHERE

Containerised Systems
Modular, plug-and-play systems for municipal water, industry, mining & more

Local Industrial Units
On-site production of chlorine, hypochlorite, acids, hydrogen, safe drinking water, etc.

Community Pods
Reliable, low-footprint solutions for schools, hotels, hospitals, agriculture & utilities

Blue Salt™ Consumer Appliances
Salt + water → on-demand generation of HOCl for cleaning, disinfection, chlorinated drinking water & water treatment at home

LIKE THE FUTURE:

Large Scale Manufacturing Plants → 3D Printing (On-Demand)

POWER-CYCLING STABILITY + LOW-COST ELECTRODES = UNLIMITED POSSIBILITIES

- **Ultra-Low CAPEX** – No expensive DSA®/ IrO_2/RuO_2 coatings
- **Unlimited Scale** – Manufactured at commodity cost
- **Works with Any Power** – Grid, solar, wind, battery or hybrid
- **Decentralised Production** – Closer to demand, lower transport cost
- **More Sustainable** – Lower energy, materials and infrastructure
- **Electrochemistry for Everyone, Everywhere** – Enabling the next wave of industrial & societal change

Just as computing moved from mainframes to PCs, electrochemistry is now moving from mega plants to millions of modular systems.

JOLT electrodes make this transformation possible.

Many Thanks