

HIGH PERFORMANCE PEM WATER ELECTROLYSIS TECHNOLOGIES

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Shanghai H-Ray Science & Technology Co.,Ltd

2026-08-05



The core technology and team of Shanghai H-RAY S&T company is comprised of Shanghai Advanced Research Institute, Chinese Academy of Sciences.

The company has developed and produced key PEM electrolysis components, such as MEAs and Stacks. It has also created proprietary mass-production technology for high-efficiency PEM stacks and independently designed multiple models of integrated PEM electrolyzer systems.

The company has an annual production capacity of 200 MW for PEM systems, marketed under the RYZER® series. These systems provide efficient, reliable, and high-performance solutions for various industrial applications, with a focus on energy savings, low maintenance costs, and long-term operational excellence.



Ready to deliver large-scale PEM electrolysis systems Made in Shanghai, Made for the World



CE and ASME Certifications

2022

Shanghai

200 MW

2024

2026

Shanghai Plus

500MW

2030

Global Cooperation

>1 GW

Implementation of **modern robots**
Fully automated production line.
Industry 4.0 Digitalization implemented

Inhouse engineering and manufacture
and China industrial Ecosystem allows us
continues cost optimization.

Capacity growth plan to achieve \$400/kw
of PEM system and above 1 GW per year
depending on Green H2 demand

MEA factory



Testing Platform



Stack & System
Assembly factory



System factory



Testing Center



Manufacture factory and
Operation site



Fully automatic product line with dust-free workshop to ensure the best MEA, Stack and System



Roll-to-roll



Slitting



Fitting



Detection



MW level System testing



Stack testing kW level



System assembly



Stack assembly

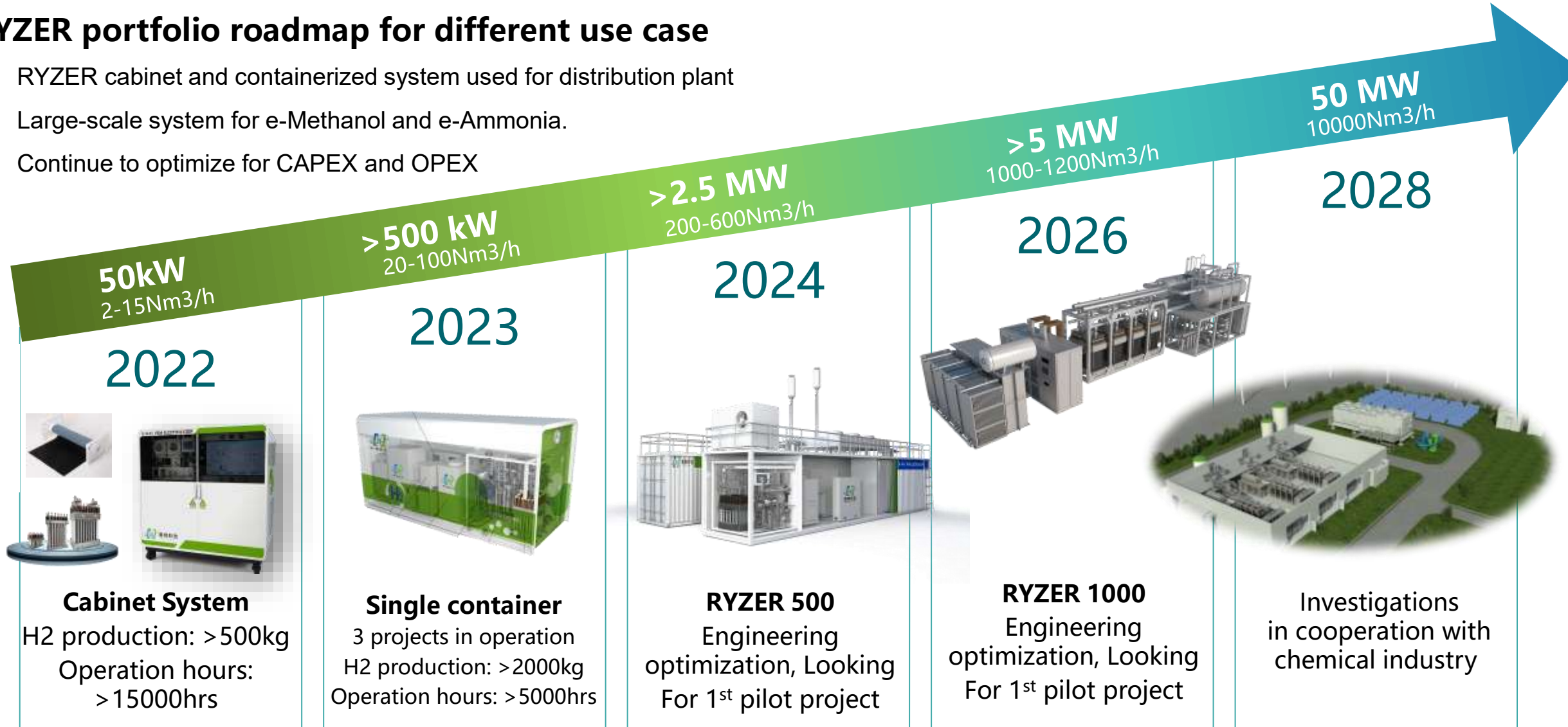


RYZER portfolio scales up every 2 years driven by market demand and co-developed with our partners and customers



RYZER portfolio roadmap for different use case

- RYZER cabinet and containerized system used for distribution plant
- Large-scale system for e-Methanol and e-Ammonia.
- Continue to optimize for CAPEX and OPEX



The company has been granted or has filed applications for 20 patents, including two PCT international patents. It has received prestigious recognitions such as National High-tech Enterprise and Shanghai Specialized, Refined, Unique, and Innovative Emerging Enterprise. The company is ISO9001 quality management system certified, and its products have obtained CE certification through DEKRA.

Certification and Honor



Quality Control >>>

ISO 9001, CE and ASME certifications, the whole process quality control through our daily manufacturing from raw materials to terminal products.

Honors & Patents >>>

- Construction Method of Ordered Membrane Electrode Assembly Based on Precious Metal Hollow Nanotube Array;
- An Ordered Nanostructured Membrane Electrode Assembly and its Preparation Method;
- Preparation Methods of the Catalyst Coated Membrane and Membrane Electrode Assembly for PEM Water Electrolysis;
- Current Collector and its Preparation Methods and Applications;
- An Hydrogen Purification System and Method;
- Reliable sealing and High Consistency Assembly of PEM Stacks;
- A Connecting Component, System, and Method for Hydrogen Alarm;
- A Molecular Sieve Regeneration Column and its Regeneration Method.



Startup Competition (Winning Enterprise) Trophy



Startup Competition (Winning Enterprise) Certificate



Emerging Enterprise Certificate



High-tech Enterprise Certificate



The background is a solid teal color. In the center, there is a large, white, abstract shape that resembles a stylized flower or a series of overlapping petals. This shape contains the text.

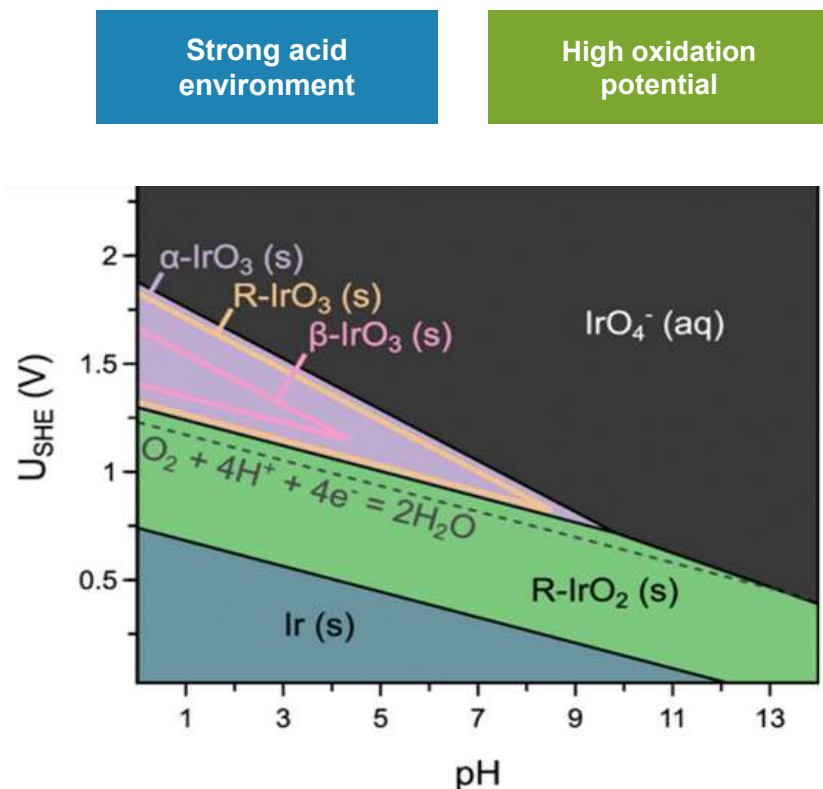
02

Advantage of H-RAY

Advantage: Catalyst R&D capability

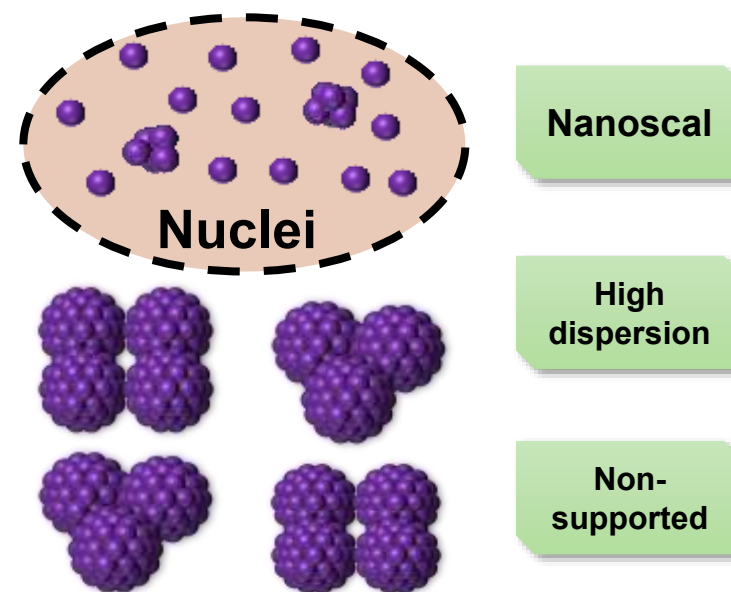
- The environment for the oxygen precipitation reaction during water electrolysis is harsh

- The selection of highly efficient catalysts is limited



It is difficult to find anti-corrosion properties, High electron conductivity carrier

Non-supported catalyst Ir、 IrO_2

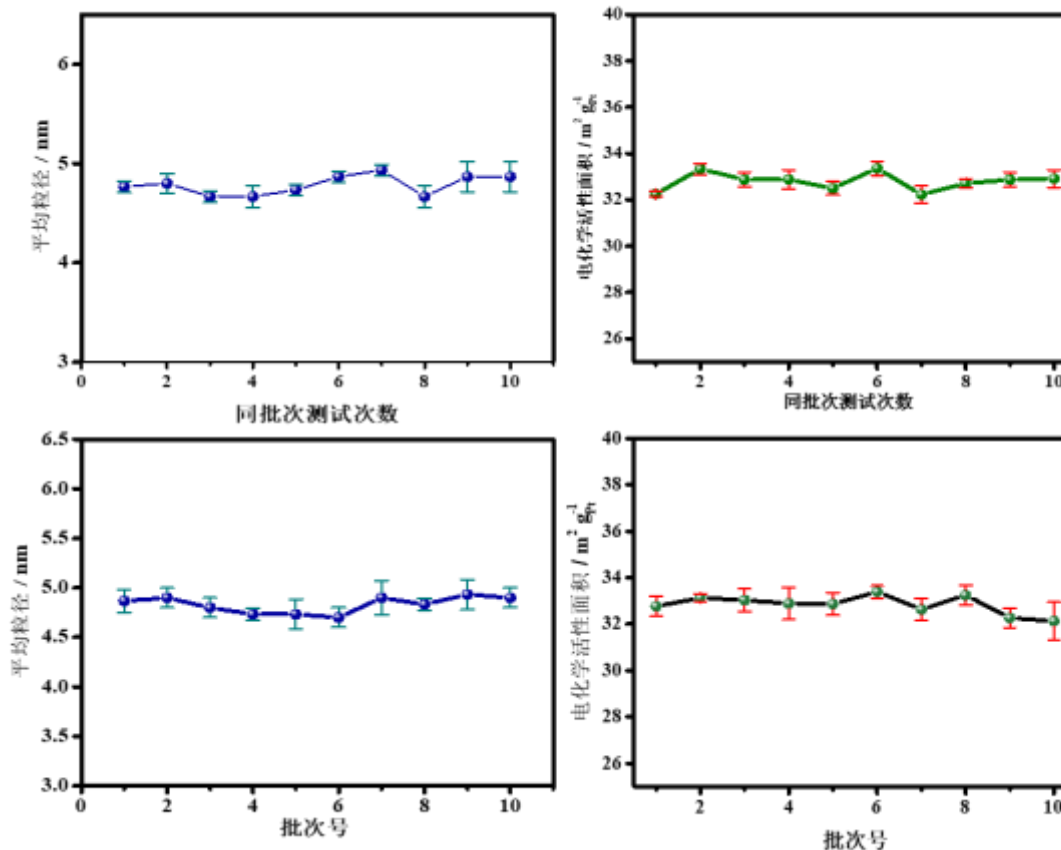


Ir black, Ir-based oxides High electrical conductivity, acid resistance and strong oxidation resistance

What are the main technical challenges of controlling particle size while ensuring high dispersion for non-supported IrO_2 catalysts

Advantage: Catalyst R&D capability

- Catalyst mass production of Pt/C, Pt black, Ir black, IrO₂, PtRu alloy, etc. has been achieved
Single-batch 500g grade preparation: high uniformity and consistency



百升**超声辅助**连续反应釜



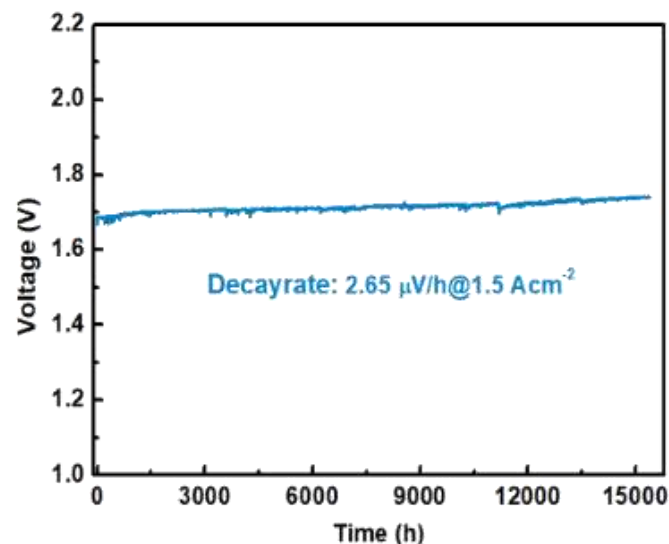
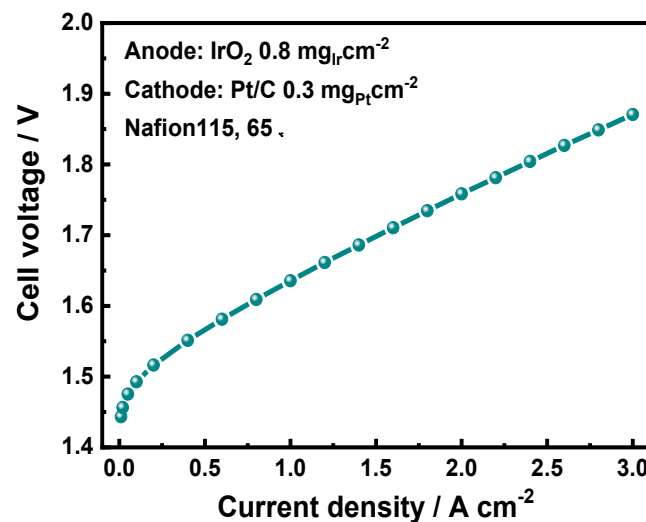
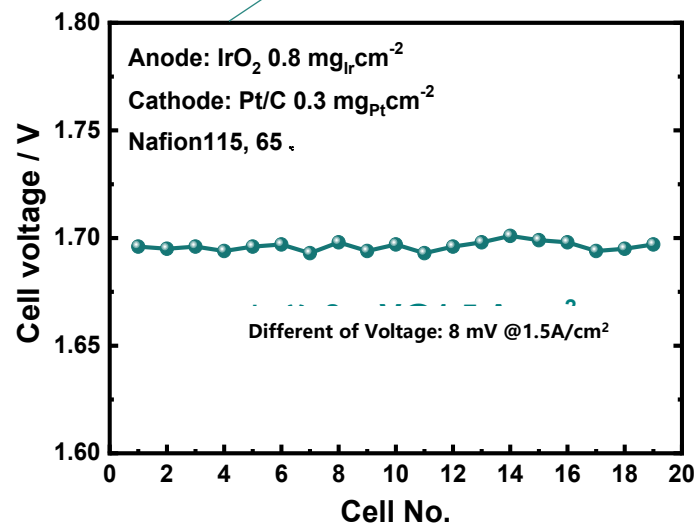
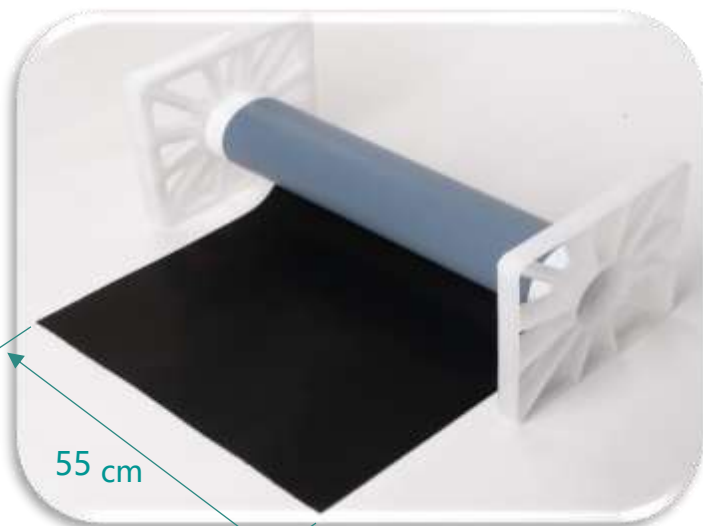
全自动连续清洗过滤系统



催化剂量产

Advantage: Large-scale MEA technologies

MEA Testing Results Based on Nafion 115



High Efficiency

1.71 V@1.5 Acm⁻²

1.80 V@2.0 Acm⁻²



Excellent Consistency

Max difference is only 8mV



Outstanding stability

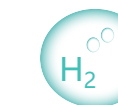
≤5 μV/h@10,000h



Low Precious Metal Usage

0.8 mg_{Ir}/cm²

0.3 mg_{Pt}/cm²



Low H₂ content in O₂

<0.5% @0.2Acm⁻²

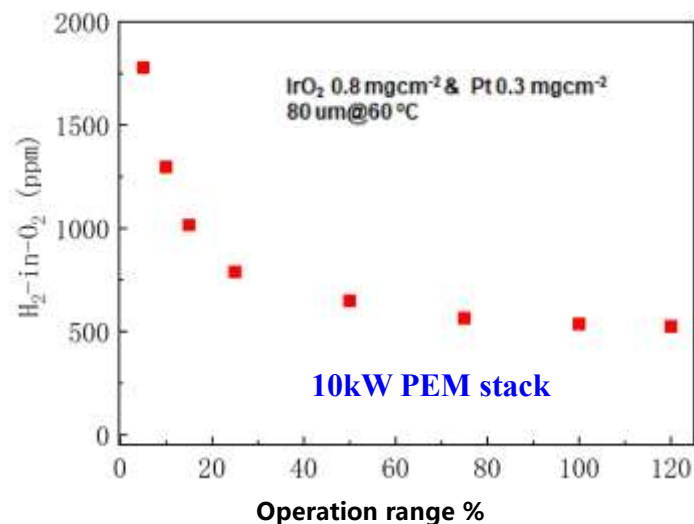
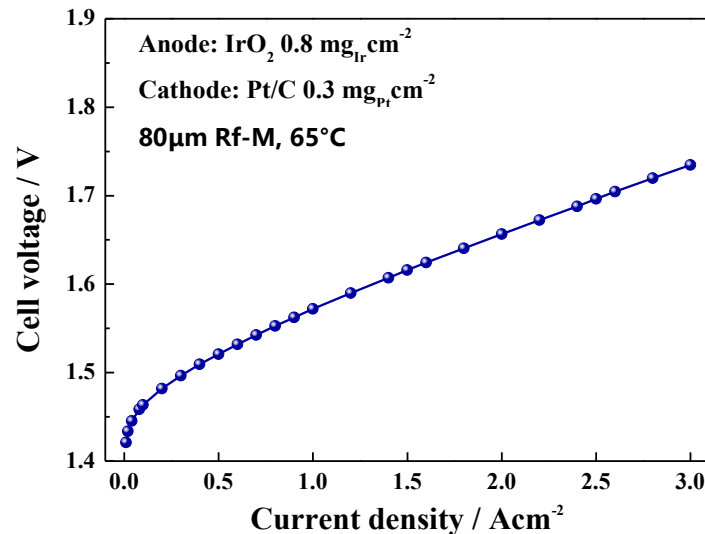
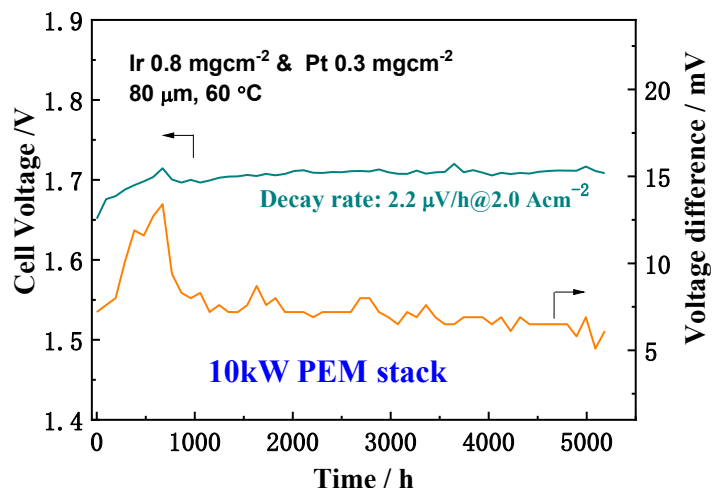
(3.5 MPa)

Advantage: Large-scale MEA technologies

MEA Testing Results Based on Thin Reinforced Membrane

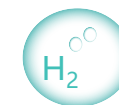


Large-Scale MEA



High Efficiency

1.71 V@2.0 Acm⁻²
1.80 V@3.0 Acm⁻²



Low H₂ content in O₂

<0.5% @ 0.2Acm⁻²
(3.5 MPa)



Outstanding stability

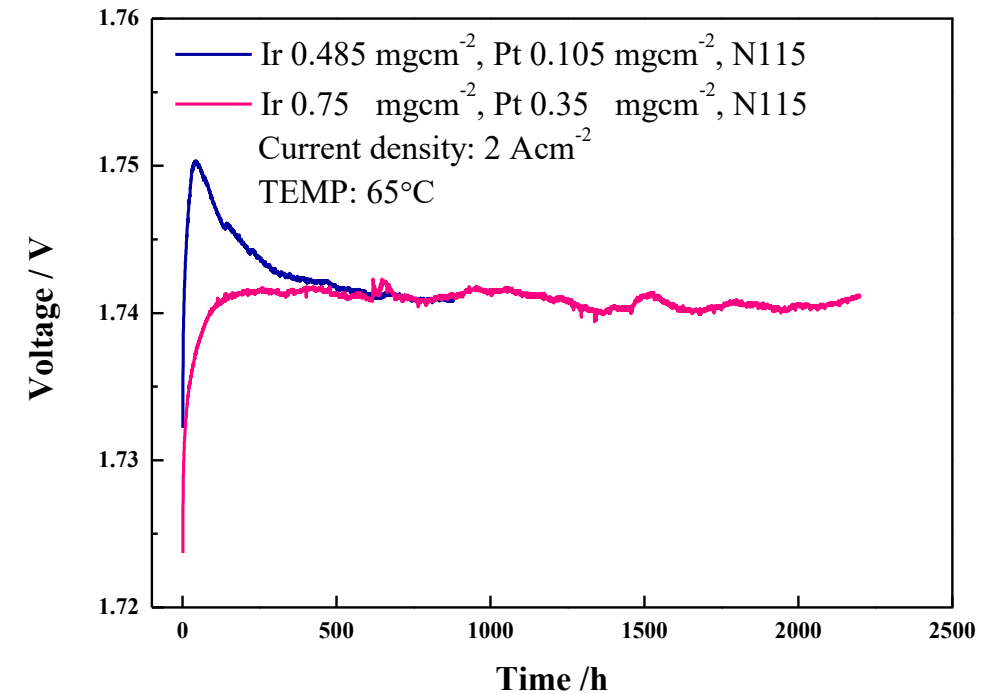
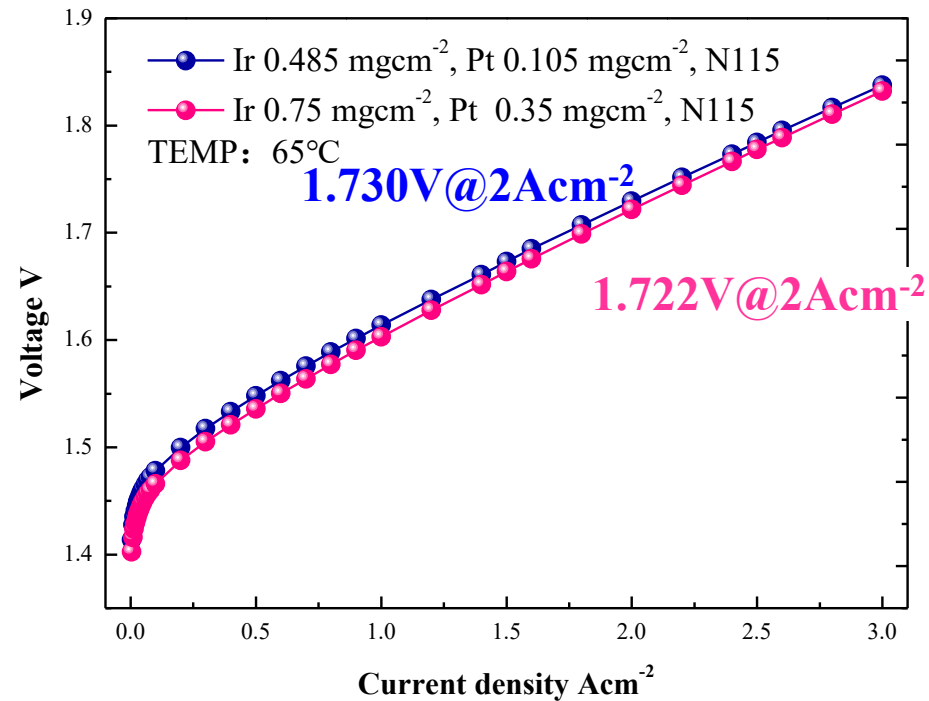
≤5 μV/h@10,000 h



Lower Precious Metal Usage

0.8 mg_{Ir}cm⁻²
0.3 mg_{Pt}cm⁻²

Advantage of MEA of H-RAY: Low Precious Metal

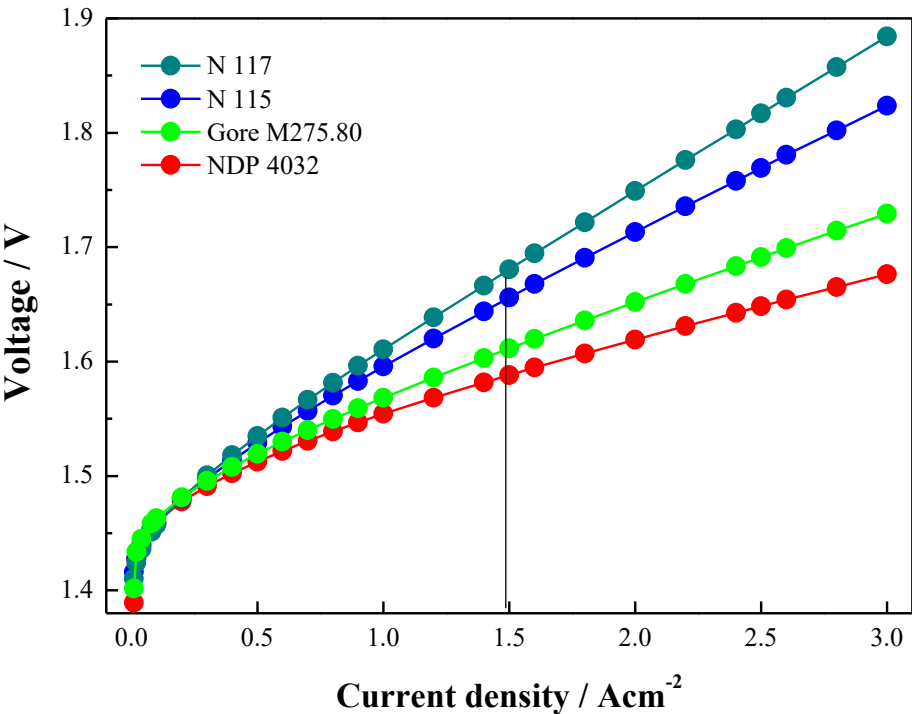


Under comparable performance conditions, the total precious metal loading has been reduced from **1.1 mg cm^{-2}** to **0.6 mg cm^{-2}**

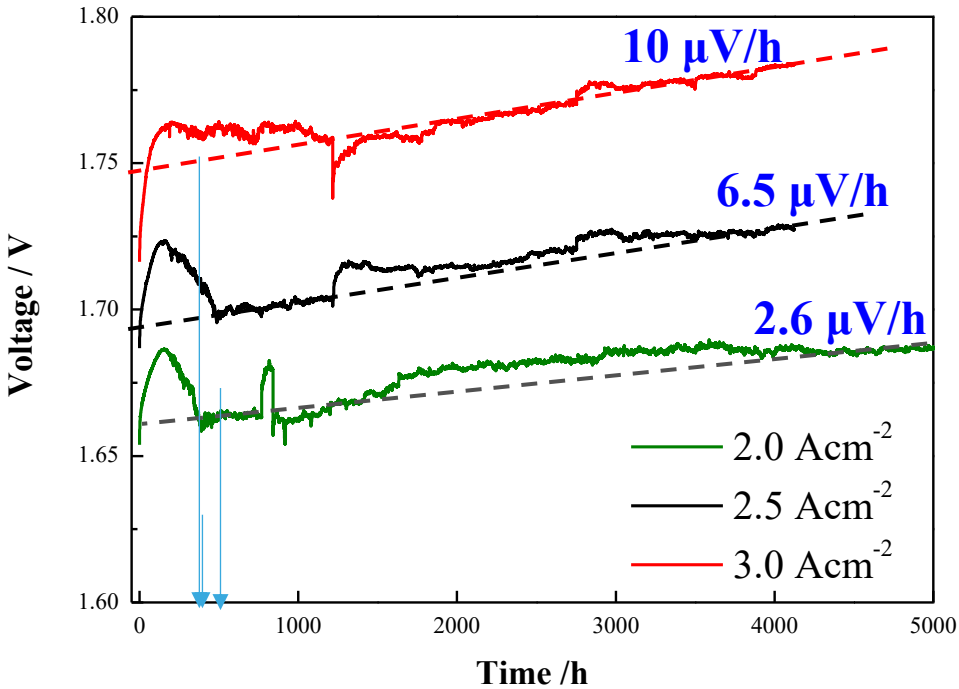
Advantage: higher performance of MEA



high efficiency, low precious metals , Long-operation life and ultra-low hydrogen in oxygen

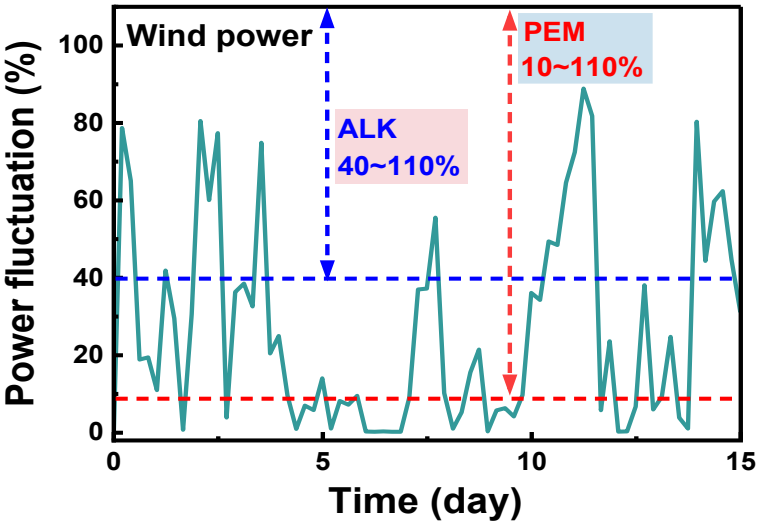
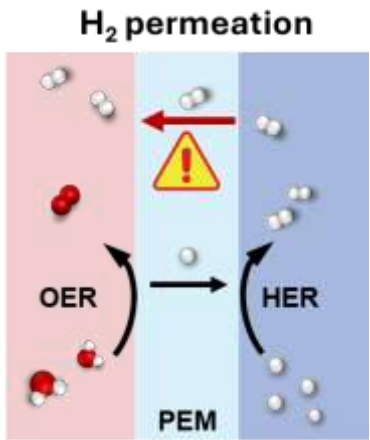


	Thickness /um	1Acm ⁻²	2Acm ⁻²	3Acm ⁻²
N117	175um	1.6107	1.7490	1.8842
N115	130um	1.5958	1.7133	1.8236
M275.80	80um	1.5683	1.6519	1.7293
XXX 4032	60um	1.5542	1.6191	1.6763

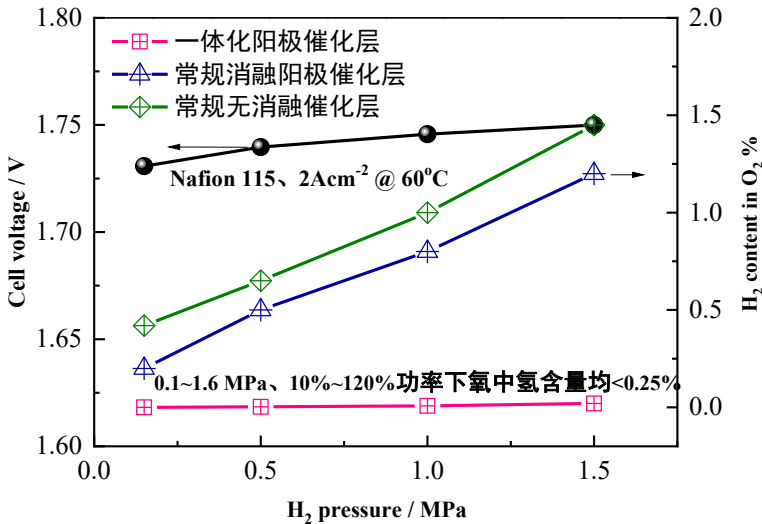


	Current density A/cm ²	Voltage V	Decay rate $\mu\text{V/h}$	Lifetime h
1	2.0	1.67	2.6	160000
2	2.5	1.70	6.5	68500
3	3.0	1.74	10	40000

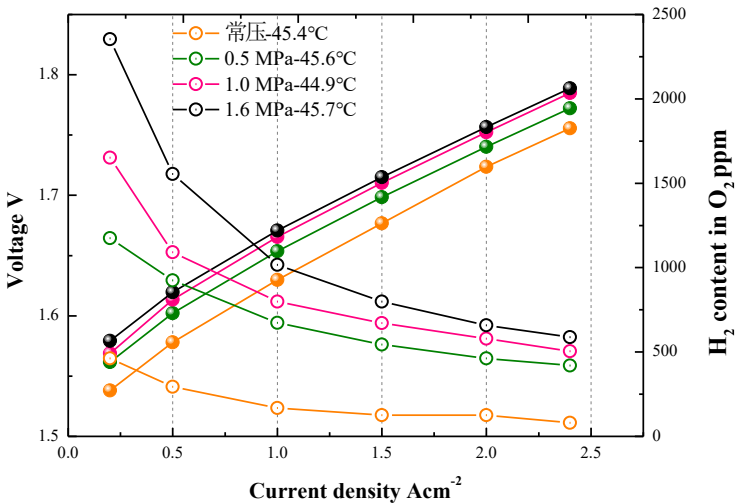
Advantage: ultra-low H2 in O2 technology



Hydrogen/oxygen ablation rate and mechanism?



Full-range verification of 10KW-class stack

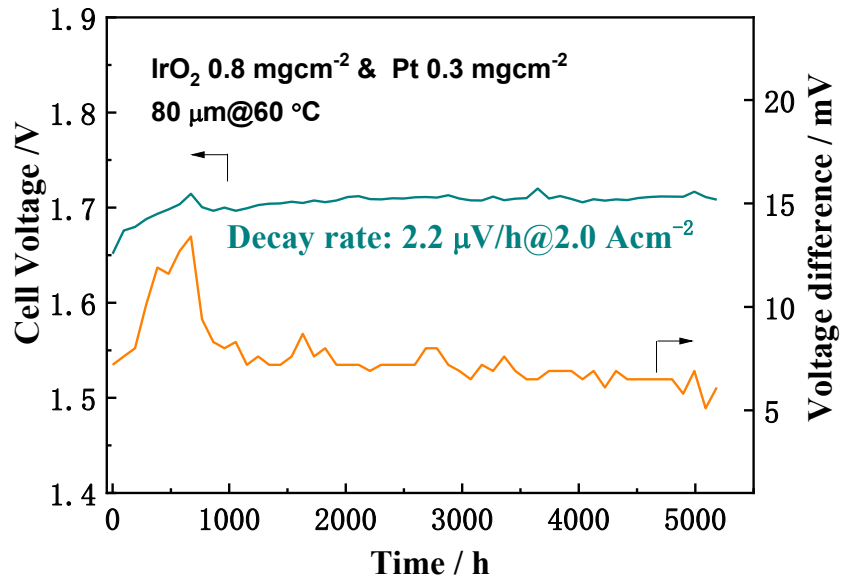


Hydrogen content in the oxygen of the integrated catalytic layer <0.25%

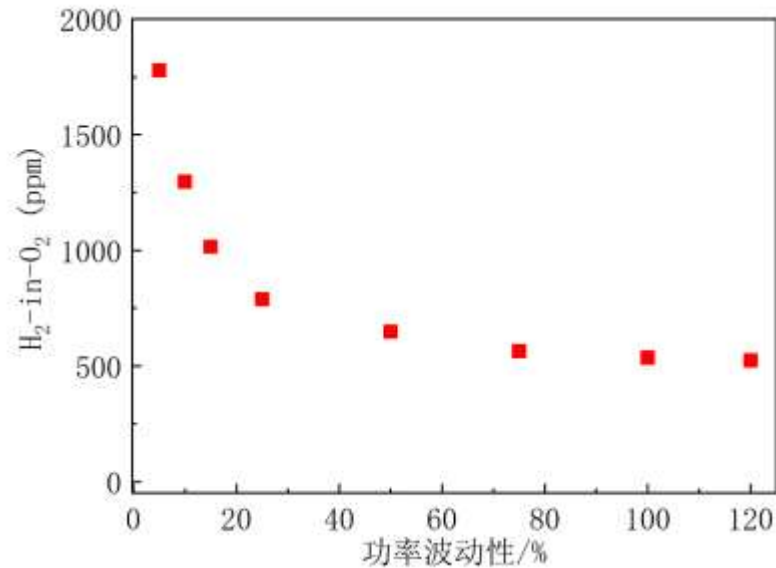
Pressure	Low load condition		Rated load condition	
	0.2A/cm ²	H ₂ /O ₂ ppm	2A/cm ²	H ₂ /O ₂ ppm
0.1 MPa	1.5380	462	1.7237	126
0.5 MPa	1.5617	1174	1.7403	462
1.0 MPa	1.5689	1652	1.7524	580
1.6 MPa	1.5792	2353	1.7566	659

H₂ in O₂/ppm

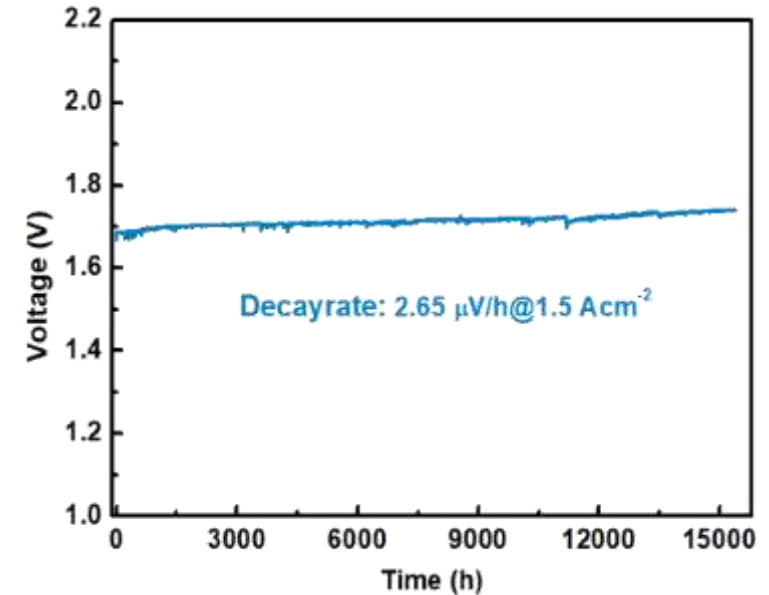
Performance Validation via 100kW level PEM stack



Stack level decay rate $\leq 2.2 \mu\text{Vh}^{-1}$
Cell voltage difference is $\leq 10 \text{ mV}$.



H_2 in O_2 is $\leq 0.2\%$ after 5000 h.



Degradation $\leq 3 \mu\text{V/h@}15,000\text{h}$

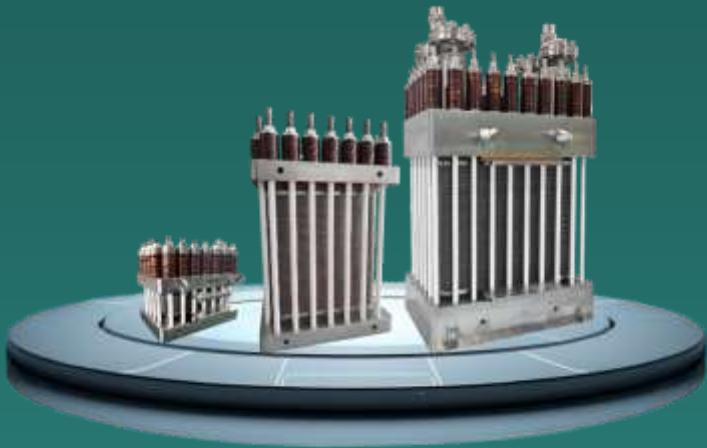




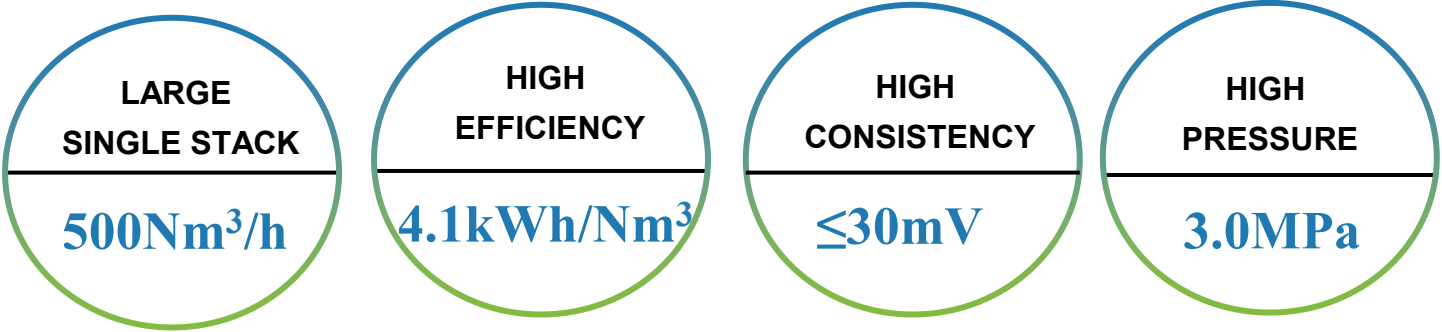
03

H-RAY's Achievements

PEM electrolysis Stack Achievements



Customers



Performance Guarantee

Item	Value
DC Power Consumption	4.1 kWh/Nm ³ @1.5A/cm ² (N115)
DC Power Consumption	4.1 kWh/Nm ³ @2.0A/cm ² (80μm)
H2 in O2 (5% load)	0.50%
H2 in O2 (10% load)	0.20%
H2 in O2 (100% load)	0.20%



50 kW

10Nm³/h PEM electrolyzer for
Power station
Based on
Cabinet system

HaiNan Power Station

Hydrogen for Hydrogen-cooled generator

Project

Customer: HaiNan Power station
Country: China
Location: HaiNan
Installation: Mar. 2024
Product: RYZER-10CMH-3.0-CAB

Technical feature

- Approved system for long-term economic operation in Industrial environments
- Provision of 24/7 operation
- High degree of automation
- High pressure of H₂ output
- H₂ purity: >99.99%

Use cases



Hydrogen for cool down the generator

Challenge

- Meet Power plant Safety Regulations with indoor arrangement
- Short installation time



125 kW

25Nm³/h PEM electrolyzer for
Glass company
Based on
Containerized system

Messer Gas Station Hydrogen for Glass company



Project

Customer: Messer (ChongQing)
Country: China
Location: ChongQing
Installation: Dec. 2024
Product: RYZER-25CMH-3.0-CON

Technical feature

- Approved system for long-term economic operation in Industrial environments
- Provision of 24/7 operation
- Highly integrated containerized system
- High pressure of H₂ output
- H₂ purity: >99.99%
- High degree of automation

Use cases



Hydrogen for Industrial application

Challenge

- Areas with high temperature and humidity
- Short installation time
- Continuous and uninterrupted operation, wherein the load fluctuates in accordance with downstream process requirements.



100 kW

20Nm³/h PEM electrolyzer for
hydrogen refueling station

Based on
Containerized system

CIMC ENRIC Hydrogen refueling Station

Project

Customer: CIMC ENRIC
Country: China
Location: Guangzhou
Installation: Oct.2024
Product: RYZER-20CMH-3.0-CON

Technical feature

- Comply with the safety regulations of hydrogen refueling stations
- Intermittent operation is adopted based on the number of vehicles
- Highly integrated containerized system
- H₂ pressure: 3.0MPa
- H₂ purity: >99.999%
- High degree of automation

Use cases



Hydrogen for Hydrogen refueling station, hydrogen use for forklift

Challenge

- Areas with high temperature and humidity
- Short installation time
- Intermittent operation, wherein the load fluctuates in accordance with downstream Vehicles requirements.



Shandong LEAD Hydrogen refueling Station



500 kW

100Nm³/h PEM electrolyzer for
hydrogen refueling station

Based on
Containerized system

Project

Customer: LEAD
Country: China
Location: Shandong
Installation: April. 2025
Product: RYZER-20CMH-3.0-CON

Technical feature

- Comply with the safety regulations of hydrogen refueling stations
- Intermittent operation is adopted based on the number of vehicles
- Highly integrated containerized system
- H₂ pressure: 3.0MPa
- H₂ purity: >99.999%
- High degree of automation

Use cases



Hydrogen for Hydrogen refueling station, hydrogen use for forklift

Challenge

- Areas with high temperature and humidity
- Short installation time
- Intermittent operation, wherein the load fluctuates in accordance with downstream Vehicles requirements.

DEC Fuzhou PEM system for offshore wind farm testing



5Nm³/h-1.6MPa
5Nm³/h PEM electrolyzer
integrated Cabinet system

Project

Customer: DEC Fuzhou institute
Country: China
Location: Pingtan island
Installation: 2025.5
Product: RYZER-5CMH-1.6-CAB

Technical feature

- High current density
- **Low Precious Metal Usage**
- **Fluctuating power supply** from offshore wind turbine
- Durability testing for PEM electrolyzer system in Marine environment

Use cases

- 
- Offshore wind Power – Hydrogen in offshore platform

Challenge

- fluctuating power supply from offshore wind turbine
- Safety Regulations
- Outside arrangement in Offshore platform
- A marine environment characterized by high salinity and high humidity



5Nm³/h-10kW

5Nm³/h PEM electrolyzer

10kg Hydrogen storage

10kW fuel cell system

200kWh (electricity storage CAP
for Power-H₂-Power

Based on
integrated Containerized system

CASA P2H2P Pilot project

Power-Hydrogen-Power



Project

Customer: CASA
Country: China
Location: Beijing
Installation: 2025.06
Operation: 2025.08
Product: E3-H5-FC10-CON

Technical feature

- During the day, electricity is generated by PV panels, while excess energy is stored as hydrogen for nighttime use via a fuel cell
- Hydrogen storage in solid metals (5kg) and in High pressure vessel (1kg)
- Provision of 24/7 operation
- High degree of automation
- High integrated system

Use cases



Power – Hydrogen - Power



Hydrogen for Industrial application

Challenge

- Tibetan Plateau, PV plant generate hydrogen and Hydrogen storage and use hydrogen at night via fuel cell system
- Safety Regulations
- Outside arrangement in Cold and high-altitude areas



5Nm³/h-10MPa

5Nm³/h PEM electrolyzer

Compressed to 10MPa

Hydrogen storage 10L

integrated Cabinet system

KENTE Hydrogenation catalysis in the reaction vessel



Project

Customer: KENTE
Country: China
Location: Zhejiang
Installation: 2025.10 (planned)
Product: RYZER-5CMH-10-10L-CAB

Technical feature

- PEM electrolyzer, compressor and buffer tank integrated into a cabinet system
- Storage 10L as a buffer
- use hydrogen for catalysis in reaction vessel
- Safety Regulations
- High reliability, high security for customer processing line

Use cases



Power – Hydrogen – compressed to 10MPa (use hydrogen for catalysis in reaction vessel)

Challenge

- Hydrogen generation and compressed into storage 10L and use hydrogen for catalysis in reaction vessel
- Safety Regulations
- Place into processing line



500 kW

100Nm³/h PEM electrolyzer for
Power Station

Based on
Containerized system



TUTUKA 6x660MW Power Station Hydrogen for Hydrogen-cooled generator



Project

Customer: Eskom 6x660MW
Country: South Africa
Location: TUTUKA Power station
Installation: 2025.11 (planned)
Product: RYZER-100CMH-3.0-CON

Technical feature

- The product has passed HAZID analysis, HAZOP, SIL and LOPA analysis
- CE certification (IE60079, AS3000, PED, ATEX)
- Provision of 24/7 operation
- High degree of automation
- H₂ pressure: 3.0MPa
- H₂ purity: >99.99%

Use cases



Hydrogen for cool down the generator



Hydrogen for Industrial application

Challenge

- Meet Power plant Safety Regulations
- With Outside arrangement
- CE certification (IE60079, AS3000, PED, ATEX)

Sewage treatment plant

Hydrogen and Oxygen for wastewater treatment



50 kW 

10Nm³/h PEM electrolyzer for
Sewage treatment plant
Based on
Containerized system



Project

Customer: Inconvenient
Country: Germany
Location: Inconvenient
Installation: 2026.09 (planed)
Product: RYZER-10CMH-3.0-CON

Technical feature

- The product has passed HAZID analysis, HAZOP, SIL and LOPA analysis
- CE certification (IE60079, AS3000, PED, ATEX)
- Provision of 24/7 operation
- High degree of automation
- H₂ pressure: 3.0MPa
- H₂ purity: >99.999%
- Dew point: -75° C
- O₂ purity: >99.999%
- O₂ pressure: 2.8MPa

Use cases



Hydrogen and Oxygen for Sewage treatment plant

Challenge

- Meet Sewage treatment plant Safety Regulations
- All-in-one concept, All of Balance of plant arranged into one container.
- CE certification (IE60079, AS3000, PED, ATEX)

CASA P2H2P Pilot project

Power-Hydrogen-Power

国内某硬质刀具：刀具



Project

Customer: EDDIE 艾迪锐能
Country: China
Location: 山东
Installation: 2026.08
Product: RYZER-30CMH-6N-CON

Use cases



Hydrogen for Industrial application

Technical feature

- Electricity is generated by photovoltaic (PV) panels installed on the rooftop. Hydrogen is produced via electrolysis powered exclusively by the lowest-cost PV electricity, then stored in Type III high-pressure vessels rated at 35 MPa, with a maximum storage capacity of 50 kg—sufficient to support at least five days of continuous operation following system failure.

Challenge

- High degree of automation
- High integrated system
- Provision of 24/7 operation
- High reliability

30Nm³/h

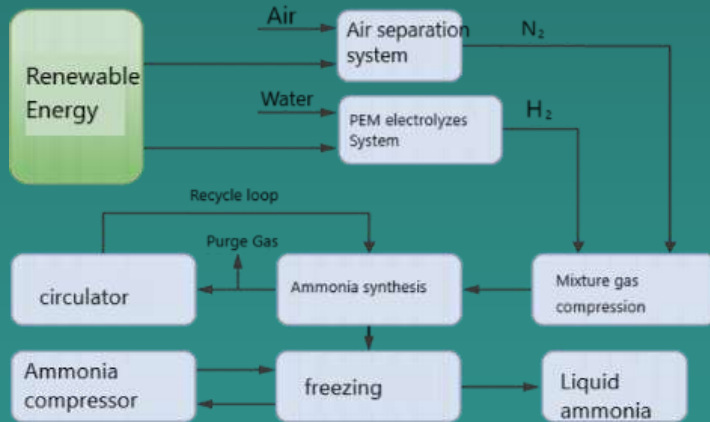
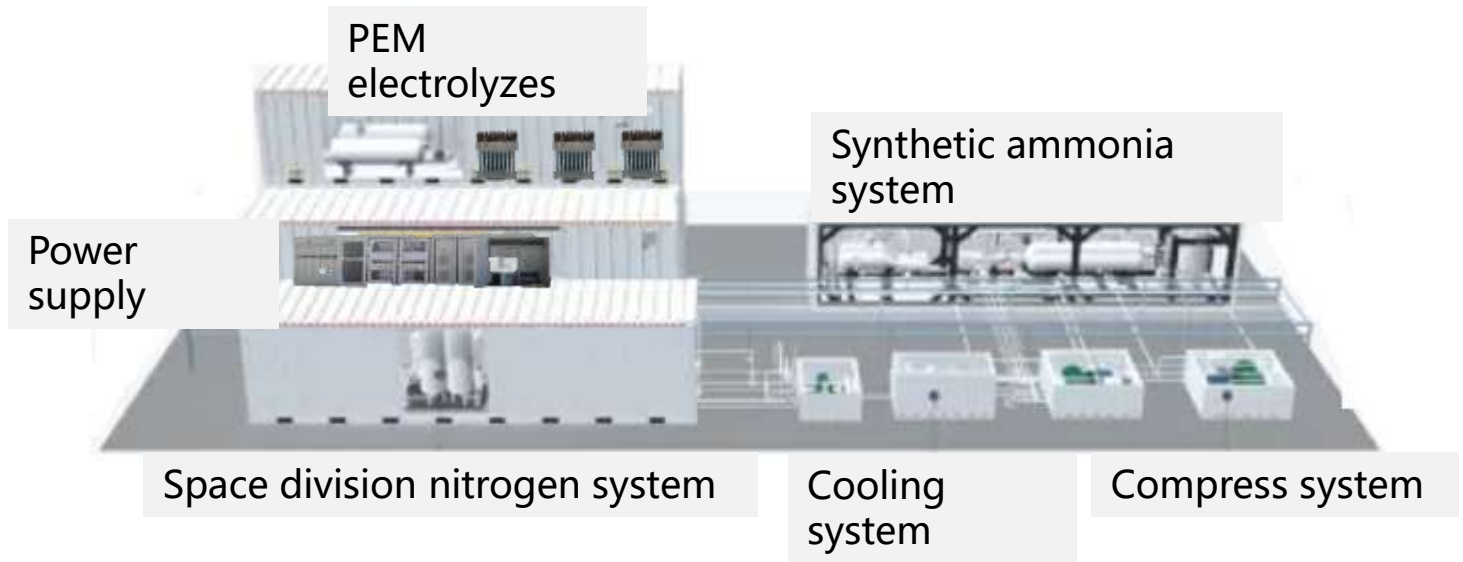
Two 15Nm³/h PEM Stacks

Hydrogen compressor

50kg Hydrogen storage

integrated Containerized system

Green Ammonia pilot project



Ammonia Production	3000tpa	10,000tpa	20,000tpa
Hydrogen consumption (Nm ³ /h)	500~1000	2500~5000	5000~10000
Renewable energy demand (MW)	3.5~7MW	20~40MW	40~100MW
20% energy from BBS	35MW (max)	200MW (max)	500MW (max)
Footprint of whole system	4x40HC	6x40HC	9x40HC

THANKS !

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