

Innovative hydrogen energy equipment, promoting integrated development of PV, storage, and hydrogen technologies

TRINA HYDROGEN (SPAIN) TECH S.L.U.



© About The Company

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Trina Green Hydrogen, an affiliate of Trina Group, is a pioneer in the hydrogen energy industry. Since its founding, it has been dedicated to in-depth development and exploration in the hydrogen energy sector. Its core business covers the R&D, production and sales of alkaline and PEM water electrolysis hydrogen production equipment as well as BOP system devices, while delivering full-spectrum hydrogen energy solutions and professional services. Drawing on the group's solid advantages, it adheres to the integrated development philosophy of "solar-energy storage-hydrogen energy". By making progress at both equipment and system levels, it empowers the sound development of the global hydrogen energy industry.

Trina Green Hydrogen currently holds a 1GW production capacity for alkaline water electrolysis hydrogen production equipment, with a maximum planned capacity reaching 4GW to accommodate various technical types. Its manufacturing base is situated in Yangzhou Comprehensive Bonded Zone, Jiangsu Province, where a 10MW equipment testing platform has already been put into operation. Future layouts include R&D bases for electrochemistry and anti-corrosion technologies, as well as CNAS-accredited laboratories for hydrogen energy research. It has established a comprehensive hydrogen equipment manufacturing hub integrating production, academia, research and inspection, standing out as one of the world's most highly automated, fully-functional modern and intelligent production bases in the industry.

1GWProduction equipment
capacity**4**GWMax planned
capacity**10**MW

Test Platform



Corporate Milestones

- Create a new ecology in the industry dominated by Trina, Committed to become a global leader in optical storage smart energy solutions.
- Committed to becoming the world's leading provider of integrated H₂ energy solutions

1997

Trina Solar was established

2006

Listed on the New York Stock Exchange

2014

PV module shipments ranked first in the China

2015

Set energy storage business layout

2020

Become the first photovoltaic smart energy enterprise to be listed on the SSE STAR Market

2025

Trina Solar's perovskite-crystalline silicon tandem technology has broken the world record twice in a row. Global shipments of 210mm modules exceed 200 GW. Global shipments of Trina Energy Storage surpass 12 GWh.



2021

Arrange for Hydrogen business

Establish Trina Green Hydrogen

2023

First 1000 Nm³/h Alkaline water electrolysis issued

First commercial order signing

2024

Breakthroughs achieved in overseas orders

Yangzhou production base completed

Second-generation thousand-cubic alkaline electrolyzer sets new industry energy consumption record

2025

Established subsidiary in Spain

Successful overseas order

Delivery of the first integrated hydrogen production and refueling product delivery of the first

2026

Delivery of the first large-scale hydrogen production project order

Solar-storage-hydrogen integrated actual test platform completed and put into service

Cumulative global orders exceed 100MW

© Business Footprint



210 Module Shipments **200+ GW** > PV bracket shipments **32+ GW** > Energy storage shipments **12+ GW** > Hydrogen orders **100+ MW**

As of June 2025

©Global Hydrogen Energy Industry: Striving for Large-Scale Commercialization by 2030

EU

- Completing low-carbon hydrogen certification
- Subsidies favoring green hydrogen
- Mandatory hydrogen blending in infrastructure
- Securing pricing

power

USA

- Strong short-term stimulus from IRA subsidies
- Long-term outlook remains uncertain
- Accelerated implementation of hub projects

APAC

- Australia: Focusing on green hydrogen exports
- India: Full commitment to green hydrogen
- Japan: Focus on transport, primarily importer
- South Korea: Focus on transport & power generation

ME

- National strategy coupled with massive investment
- Building a global green hydrogen export hub
- Aiming for 10 million-tonne capacity by 2030
- Seeking to dominate the Eurasian supply chain

Commonality: A three-pronged approach of subsidies, certification, and infrastructure is being adopted. Developing large-scale commercial applications has become a consensus.

© China : From "Technology Demonstration" to a "National Strategic Future Industry" (2025-2026)

Strictly Control Grey Hydrogen, Scale Up Green Hydrogen

Leveraging the abundant wind and solar resources in the "Three Norths" regions, we will build national large-scale green hydrogen production bases, restructuring the supply system from the source.

2025 Production Capacity Target:

Exceed 250,000 t/y

Hierarchical Breakthrough of Application Scenarios

Prioritize deep decarbonization in high-energy-consuming industries, then penetrate transportation, and expand to comprehensive energy services, forming a steady rhythm from pilot to popularization.

Core Implementation Priority:

**Industrial Decarbonization >
Transport**

Cost-Parity Substitution for Grey Hydrogen

Driving cost reduction through tech progress, scale effects, and industrial maturity is the core economic foundation for commercial substitution and market explosion.

2030 Target Cost Range:

¥15 - ¥25 / kg

Core Path: Green Hydrogen as Mainstay, Industry First, Transport Breakthrough, Diverse Scenarios

Driven by policy and market, the industry first achieves deep decarbonization in industry, promotes FCEVs in commercial use, and builds a clean, low-carbon, and efficient hydrogen ecosystem, with renewable hydrogen production as the core driver for long-term sustainable development.

© Four Major Industry Challenges Facing Large-Scale Green Hydrogen Projects



High Costs

The high proportion of green electricity costs (70%-80%) and huge initial investment are the primary economic barriers blocking project implementation.

Core Constraint: Electricity Price

Green electricity accounts for 70-80% of total costs. The persistently high electricity price directly determines hydrogen production costs and becomes the biggest obstacle to project profitability.

Technical Bottlenecks

Insufficient performance of core equipment and shortcomings in storage and transportation technology limit large-scale and long-distance hydrogen applications.

Unstable Electrolyzer Performance

The conversion efficiency and durability of electrolysis technology still need improvement. Inadequate technical indicators directly increase the cost pressure of long-term operation.

Inadequate Infrastructure

The lack of end-user networks and hydrogen pipelines hinders the efficient operation of the entire industry chain and restricts market expansion.

Lack of Hydrogen Transmission Pipelines

The absence of a widely covered hydrogen pipeline system like natural gas makes cross-regional transportation and large-scale allocation of hydrogen a major shortcoming of industrial development.

Market Application Mismatch

Singular application scenarios and the lack of cost advantage make it difficult for green hydrogen to replace traditional hydrogen on a large scale in the short term.

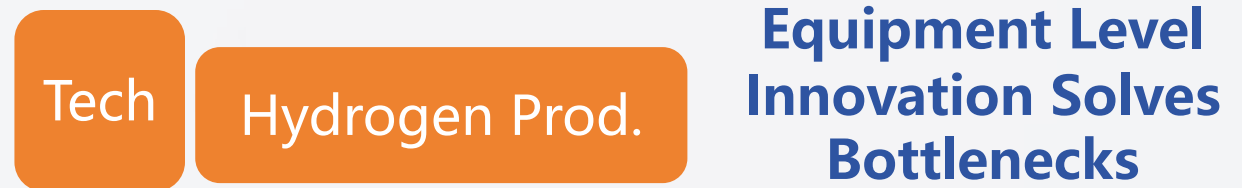
Demand-Scenario Mismatch

Current green hydrogen is mainly used in chemical raw materials and transportation fuels. It is hard to establish hydrogen production scenarios in areas where hydrogen demand is concentrated.

© Solving the Challenges of Large-Scale Hydrogen Production Projects with a Dual Approach of "Equipment + System"



- Continuously iterate core technologies to reduce key material costs effectively.
- Adopt technical routes featuring high current density, low energy consumption and stable long-term operation.
- Realize manufacturing cost reduction through large-scale production and standardized processes.



© High-performance Electrolysis Hydrogen Production Equipment

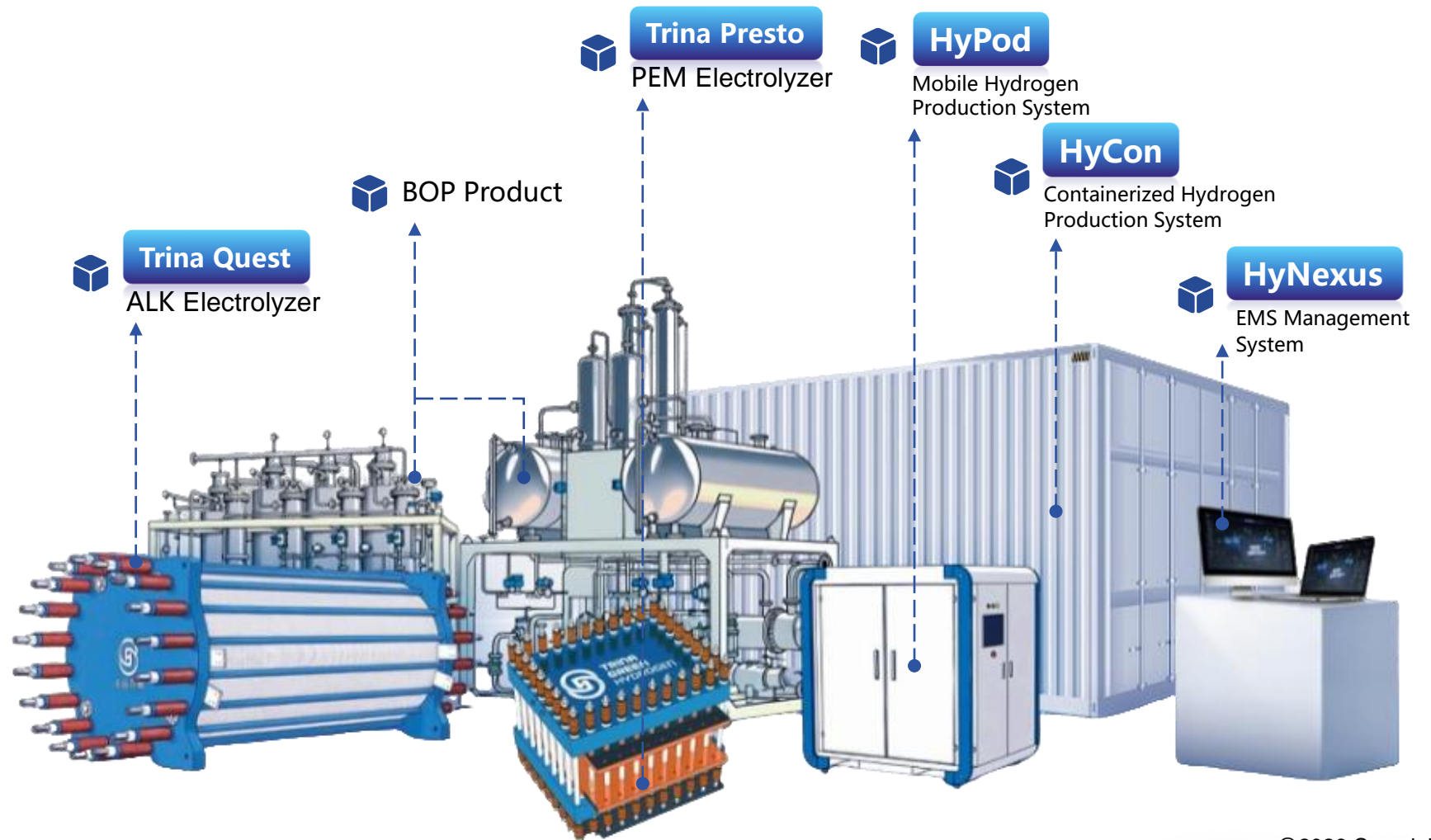
Safe
Reliable

Stable
Low load

Sustainable
Long lifespan

Systematic
Fully loaded guarantee

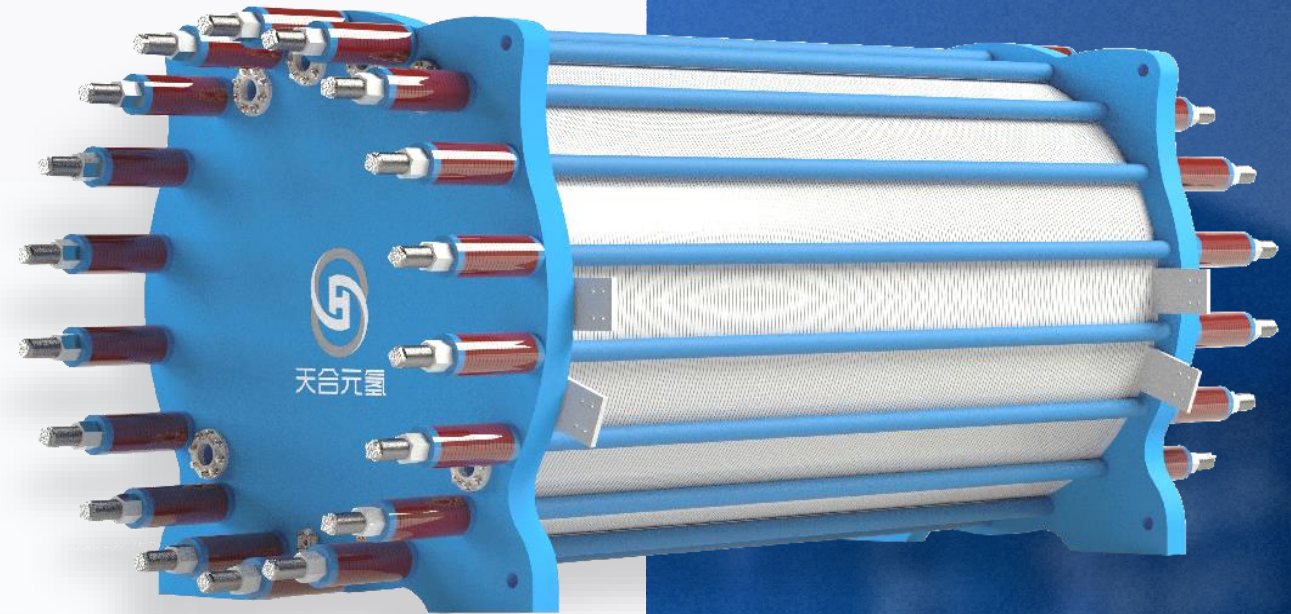
Superior
Efficient



Trina Quest ALK Electrolyzer

Customizable hydrogen production capacity 100~2000 Nm³/h

Specification and model	TQ1000	TQ2000
Rated Hydrogen production (Nm ³ /h)	1000	2000
Rated Oxygen production (Nm ³ /h)	500	1000
Operating pressure (MPa)	1.8	1.8
DC power consumption (kWh/Nm ³)	4.0-4.4	
Rated power (MW)	5	10
Powerful fluctuation range (%)	30-110	
Operating temperature (°C)	90±2	
Electrolyte	30%KOH	



Adaptation to large chemical application scenarios



Flexible to variable load conditions



Gas purity guaranteed

Core Challenges of Large-scale Hydrogen Production Projects



Electrolyzer
Performance

× High Power
Consumption

× Substandard Gas
Purity

× Alkali
Leakage



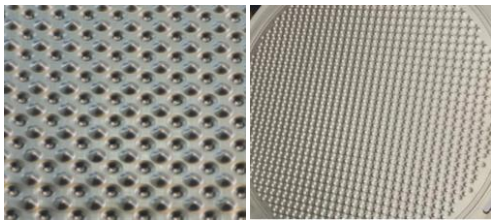
**Comprehensive
Quality Guarantee**

Safety/Stability/Economy

◎ Cut energy consumption via structure & material dual optimization

R&D

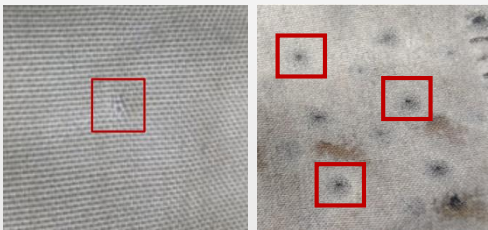
Ensure stability and safety through structural design



Traditional mastoid structure

Carbon steel stamping + nickel plating

Mature and stable yet uneven plating with high energy consumption



Diaphragm extrusion rupture

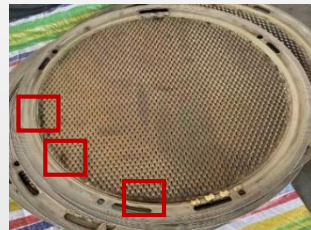
Diaphragm ablation



Traditional plate mesh structure

Plating Carbon steel expanded mesh + nickel

Uniform flow field, poor corrosion resistance and easy peeling



Coating peeling and corrosion at welds



New-type plate mesh structure

Pure nickel mesh

Uniform flow field & strong corrosion resistance, yet high cost



Adopted solution



New elastomer structure

Pure nickel plate mesh + elastic mesh

Strong corrosion resistance but prone to deformation in long-term operation



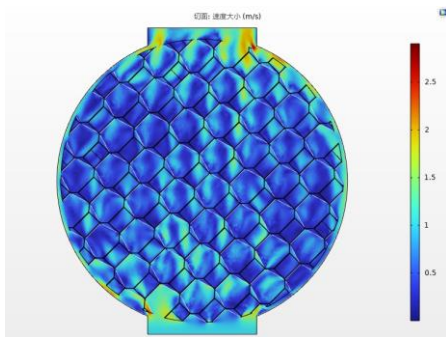
Plastic deformation or collapse

◎ Cut energy consumption via structure & material dual optimization

R&D

Simulate and verify the rationality of the structure

Placement direction of support net (relative to the direction of the import and export connection)



Angle direction



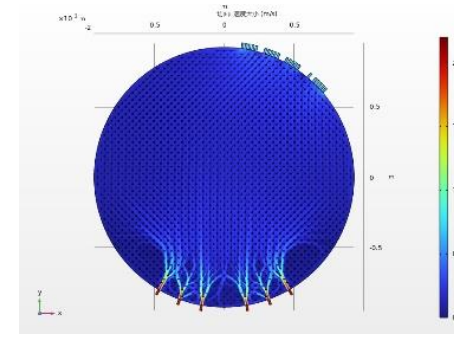
Reasonable hole type and direction



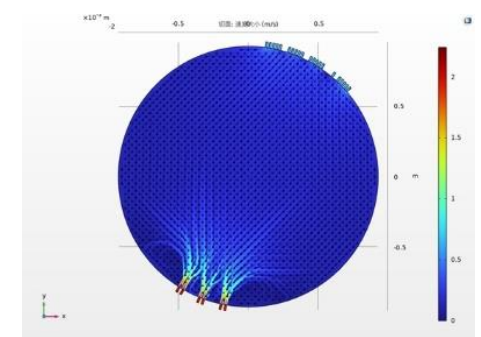
Adopted solution

Can effectively improve the uniformity of electrolyte distribution
Reduce the dead zone area and erosion phenomenon of the flow field to reduce diaphragm damage

Alkali solution import design



Import A



Import B



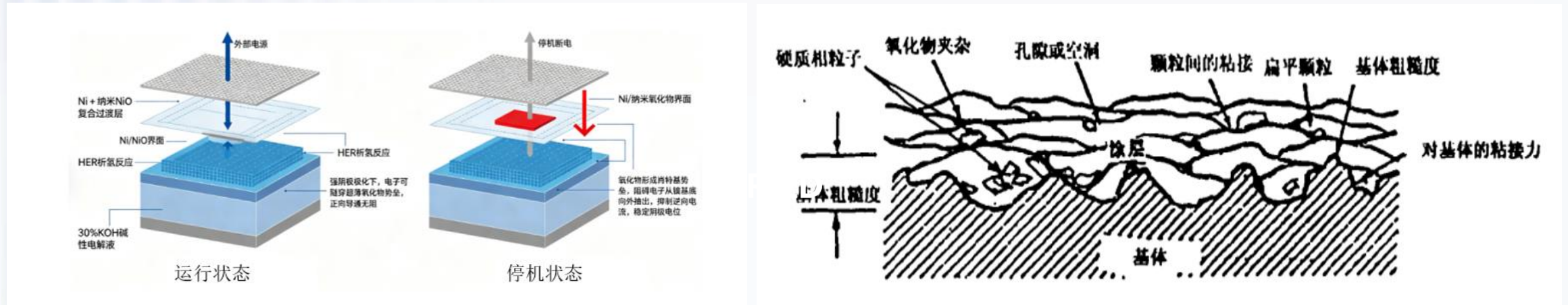
Adopted solution

Adapting to the optimal flow rate is beneficial for reducing bubble retention as bubbles are discharged with the electrolyte
Reduce the ohmic resistance of the electrolytic cell and lower overall power consumption.

◎ Cut energy consumption via structure & material dual optimization



Considering overall safety from a material perspective



Building a barrier based structure >

Constructing an electronic barrier and Schottky junction at the electrode interface to achieve forward electron tunneling conduction and reverse electron extraction obstruction, thereby suppressing reverse current at the material level.

Optimize spraying process >

Optimize the spraying process, improve the metallurgical bonding ratio at the interface, and enhance the bonding strength between the coating and substrate interface.

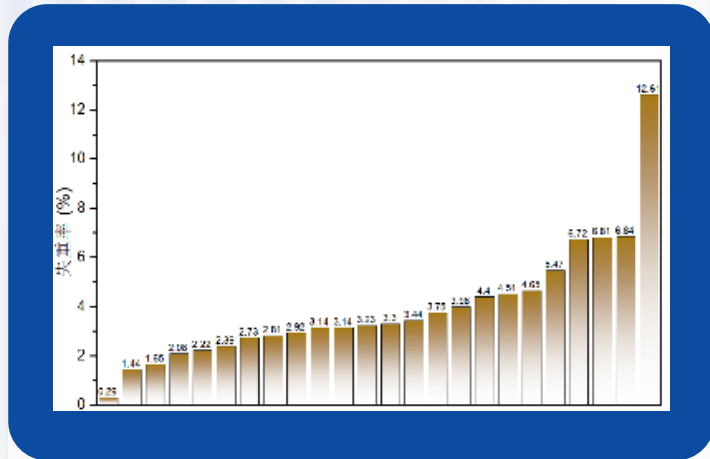
Stacked modified electrode >

Performing in-situ doping modified electrodes on nickel mesh substrates fundamentally solves the problem of interfacial adhesion.

◎ Cut energy consumption via structure & material dual optimization

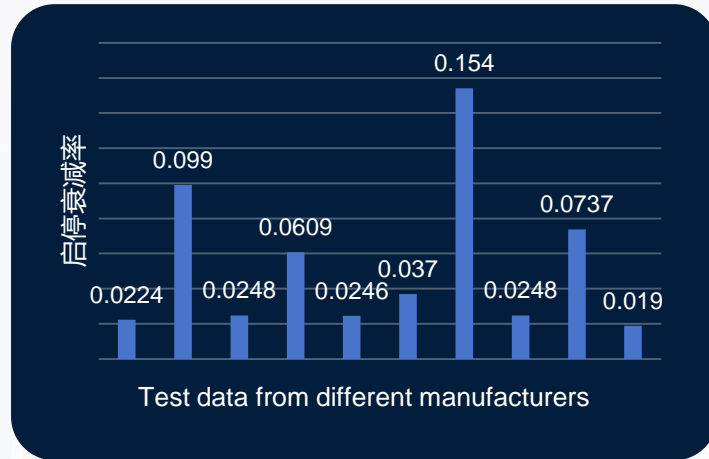
Test

Strict screening of optimal electrode materials through thousands of start stop tests



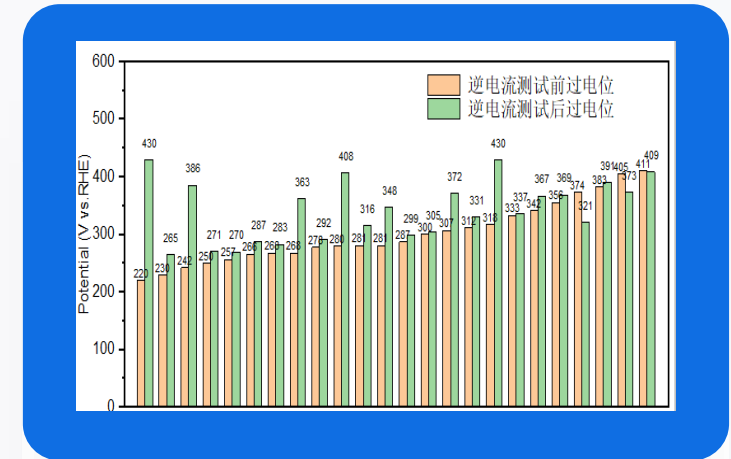
Ultrasonic Testing

Require weight loss rate of
46 mesh < 5%, 40 mesh < 8%



1200 Start-Stop Tests

Require voltage attenuation
rate to be less than 3%



Anti Reverse Current Test

Require overpotential
rise < 50mv/100cycle

◎ Cut energy consumption via structure & material dual optimization



Full process monitoring of incoming material inspection and processing



Electrochemical workstation



Test Platform



Ultrasonic Tester



Online automatic detection of size and flatness
Real time quality traceability and monitoring to improve product yield



AI Visual Weld Quality Monitoring System
Real time monitoring of electrode welding quality, abnormal alarm



Incoming quality inspection is carried out through instrument sampling and sampling
Ensure that the incoming materials meet the design requirements

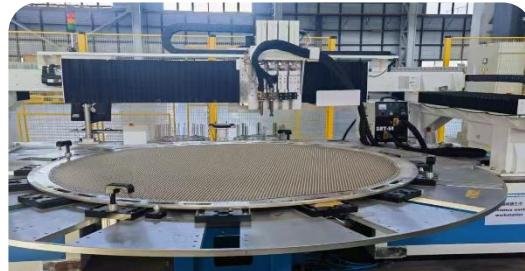
◎ Cut energy consumption via structure & material dual optimization

A/S

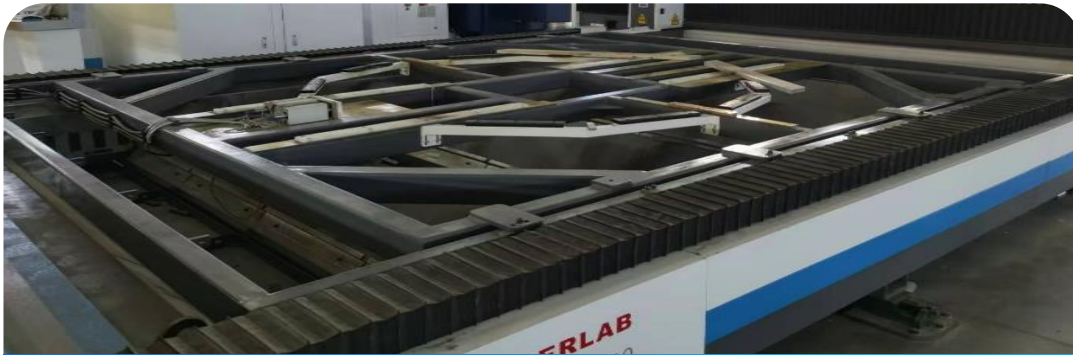
Automatic tracking system ensures smooth and consistent welding seams



AI Vision V3.0 Weld Seam Tracking System, Real time Tracking Technology, Laser Weld Seam Adaptive Tracking and Focus Tracking Compensation



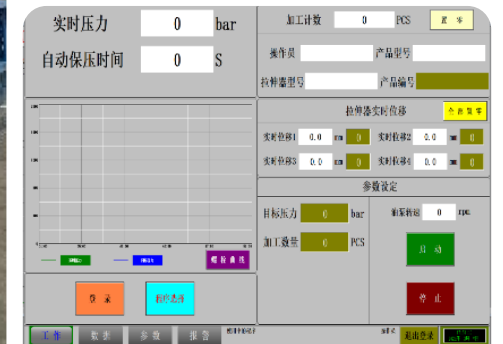
Automatic installation and welding of tablet materials, using multiple welding processes to effectively reduce contact resistance and power consumption of electrolytic cells



Laser "ultra bright" beam cutting and shaping technology optimizes the optical path system to achieve ultra-low splash cutting, resulting in smoother and more uniform cutting edges



Implementation of human-machine interface operating system for electrolytic cell assembly



◎ Solve gas purity non-compliance through raw material research

R&D

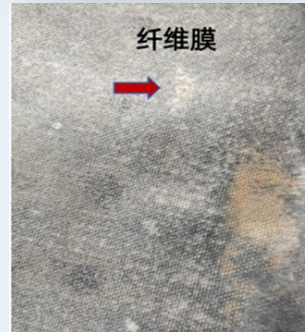
Composite diaphragm has poor corrosion and high temperature resistance, while PPS is more stable

Composite diaphragm coating peeling off during long-term operation



Long term operation of composite membranes can lead to coating detachment, which can easily cause membrane damage. Poor corrosion and high temperature resistance, not suitable for long-term use at present

PPS diaphragm damage



High requirements for raw material performance

PPS membrane catalyst detachment and enrichment metal contamination



Optimizing the tank structure can reduce catalyst detachment

PPS diaphragm erosion

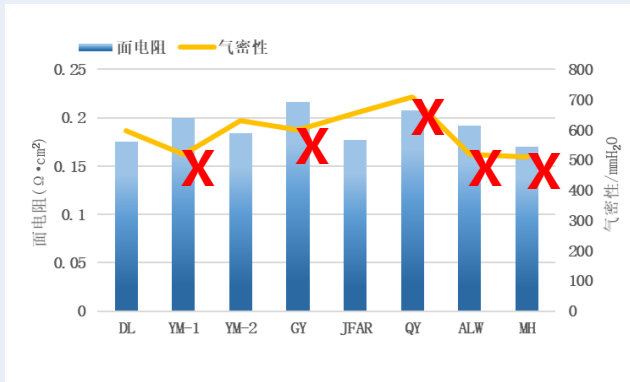


Optimize the support network structure

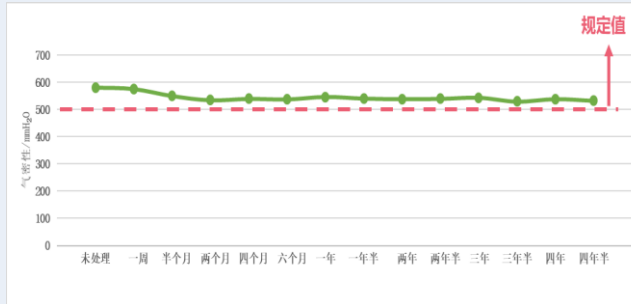
◎ Solve gas purity non-compliance through raw material research

Test

1000+h slot test, screening stable PPS diaphragm performance



Comparison of PPS diaphragm airtightness and surface resistance



Preferred PPS diaphragm airtightness long-term immersion test (30%KOH, 90°C)

Through comprehensive evaluation testing
Screen high air tightness and low surface resistance diaphragms

Through long-term high-temperature alkaline immersion test
Screening for airtight and stable membranes

© Solve gas purity non-compliance through raw material research



Comprehensive inspection and acceptance of raw materials

Possible issues with PPS raw materials



Porous



Jumper



Cotton Ball

Strict incoming material quality inspection

Fundamental Testing

- No broken longitude/latitude
- No loose yarn
- No missing longitude/latitude
- No jumper wires
- The wireless head is clearly exposed

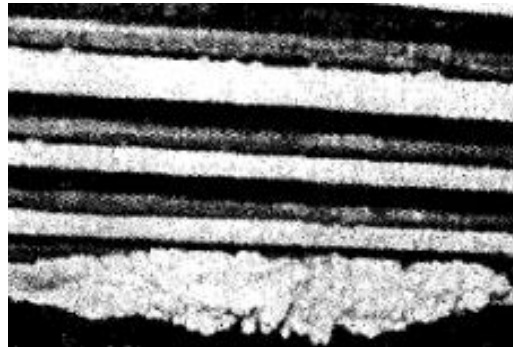
Performance Testing

- Airtightness $\geq 500\text{mmH}_2\text{O}$
- Surface resistance $< 0.2 \Omega \cdot \text{cm}^2$
- Water absorption time $< 1\text{s}$
- Longitudinal/latitudinal tensile strength $\geq 2000\text{N}/5\text{cm}$

Eliminate alkali leakage phenomenon from the bottom logic

R&D

The material and assembly method of the gasket are key factors



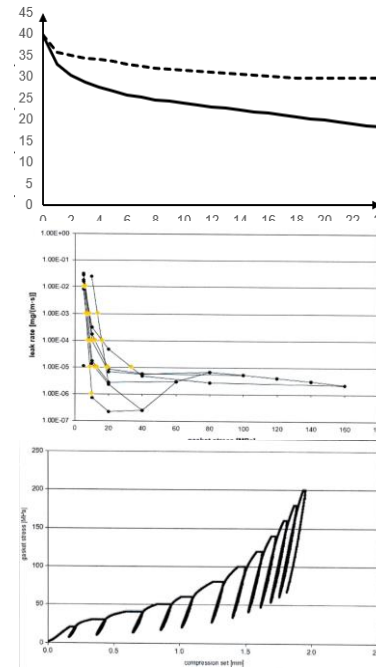
Root Cause

- Gasket creep and relaxation lead to reduced sealing force
- Uneven force on the sealing gasket during assembly
- The self weight affects the collapse of the waist, and the sealing interface separates
- Residual stress is generated during the processing of the polar frame, which is released during actual use, resulting in the failure of sealing surface separation.
- Traditional runtime re tightening maintenance usually involves fixed time re tightening, lacking real-time monitoring, resulting in delayed re tightening.



Improvement Plan

- Reduce stress relaxation, improve the formulation of gasket raw materials, and increase the content of polystyrene ester to raise the softening point of the gasket to about 200 °C and the stress relaxation rate to $\leq 30\%$.
- The pre tightening force of the assembly matches the compressive performance of the gasket, ensuring that the gasket is not crushed or damaged.
- Strictly determine the assembly preload according to the design calculation value, with a load of 1.5QminL acting on the gasket; Monitor the bolt load during the assembly process, and control the load dispersion within $\pm 100\text{N}$;
- The temperature in each hot steaming zone is controlled at $100 \pm 3 \text{ }^\circ\text{C}$.



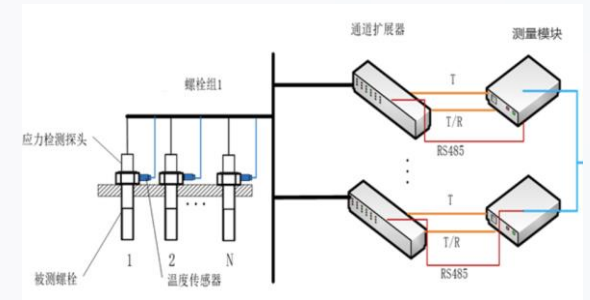
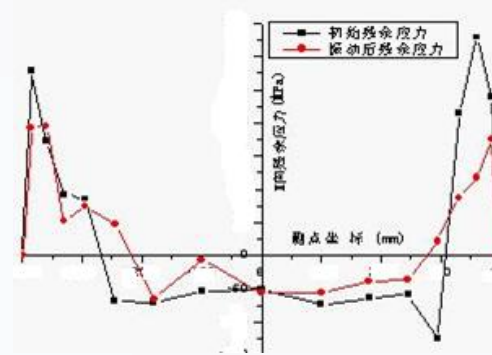
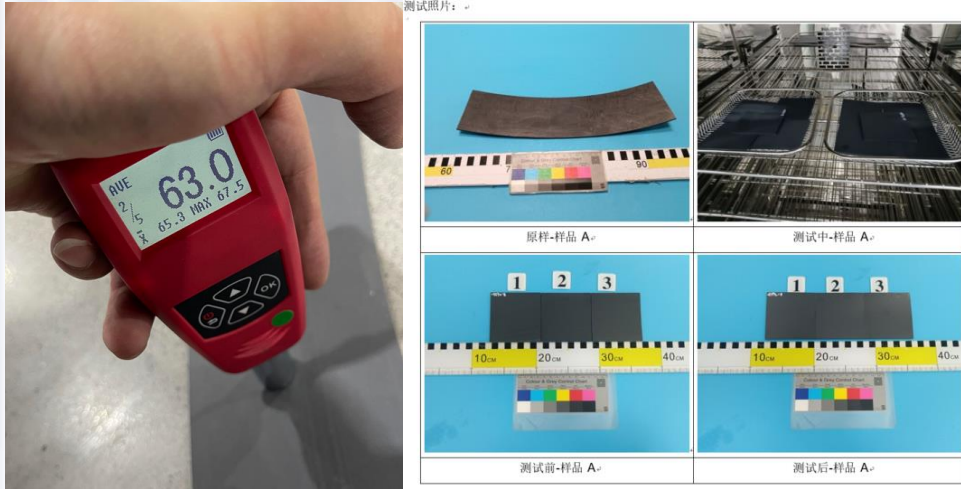
Eliminate alkali leakage phenomenon from the bottom logic

PROD

Sampling review to ensure that raw materials are qualified

生产

Add monitoring devices and strictly control the flatness



Gasket >	Performance	Indicator	Trina's data
Material data exceeds the owner's requirements	Density/g/cm ³	2.2~2.4	2.23
	Tensile Strength MPa	≥14	18.5
	Elongation at break %	≥170	223
	Compressive Strength MPa (25%Transform)	≥40	47
	Compressive Strength MPa (80%Transform)	160-240	262
	Qsmax MPa	≥180	200
	Creep relaxation %	≤30	13.2

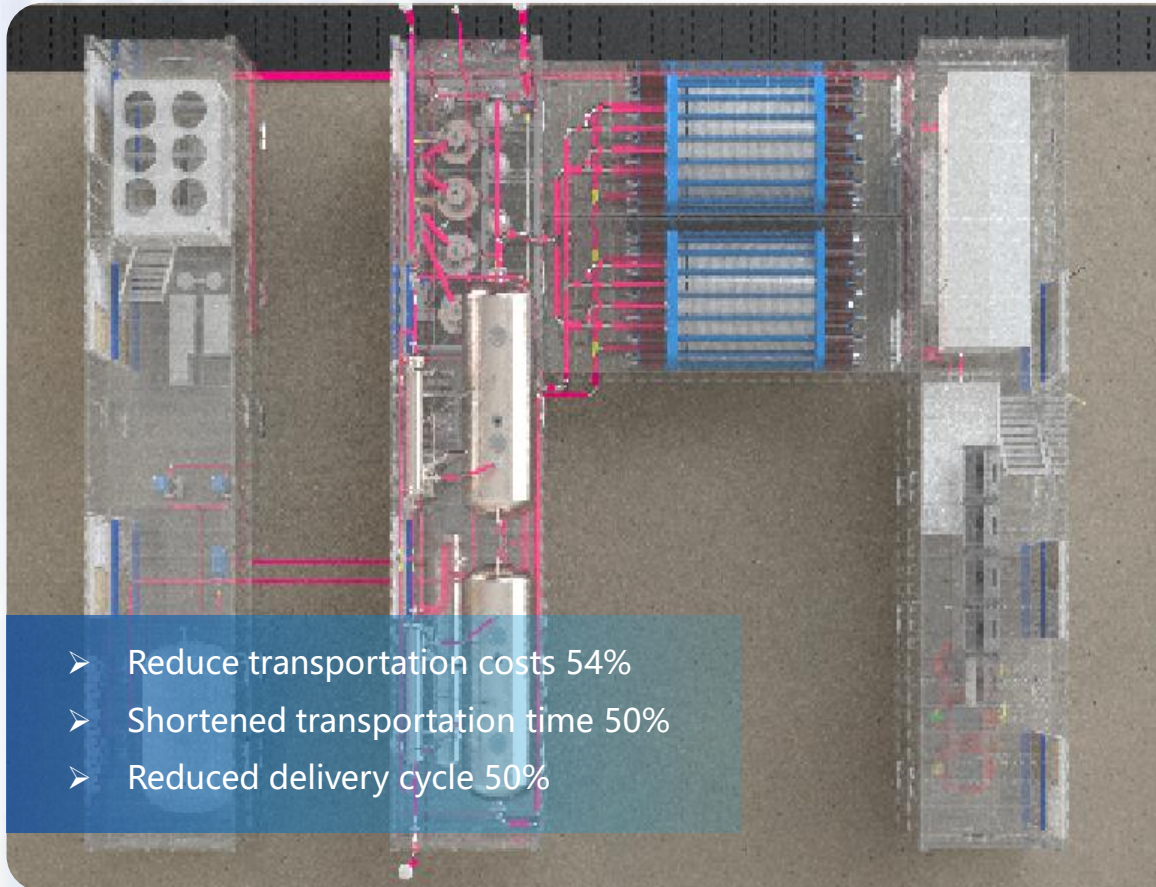
Polar frame >

1. Strictly control the flatness of the pole frame to be $\leq 0.1\text{mm/m}$;
2. Stress relief treatment is carried out on the pole frame, and stress is eliminated through vibration. The peak tensile and compressive stress of the pole frame is significantly reduced, the difference in tensile and compressive stress is smaller, and the curve is smoother.

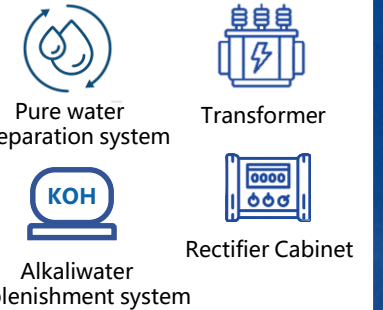
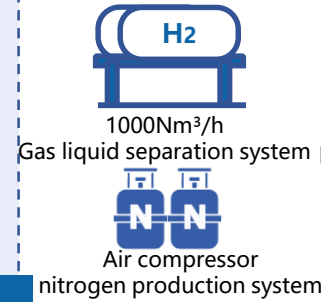
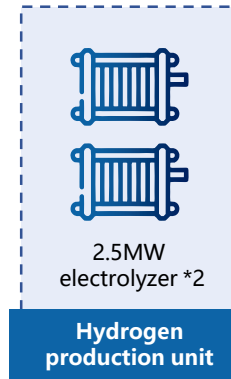
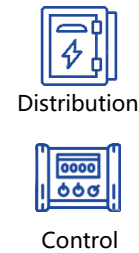
Bolt >

Add an online bolt pre tightening force monitoring device to the head of the tightened bolt in the groove, connect it to the backend PLC system, set a critical threshold for leakage pre tightening force, and when the bolt pre tightening force approaches the threshold, the system will alarm and re tighten it in a timely and effective manner to avoid leakage.

© **PlugFlow** Modular overall solution



Trina PlugFlow 5MW Solution



40 foot standard box * 8 + 20 foot standard box * 2
Covering an area of approximately 300m²



- Reduce transportation costs 54%
- Shortened transportation time 50%
- Reduced delivery cycle 50%

Standardized design/Modular application/Multi tank hybrid system

Proactive Warranty

Preventive Maintenance

- Regularly conduct in-depth evaluations of system performance
- Real time trend analysis of water quality and electrolyte concentration
- Electrical connection thermal imaging and fastening status inspection
- Accuracy verification and drift compensation of key sensors

Corrective Maintenance

- Strategic Supplier Spare Parts Sharing Management System
- Experienced senior engineers provide on-site support
- Expert team in water electrolysis industry empowers comprehensively
- Quick matching and precise repair of accident case library



Comprehensive Quality Assurance Service Matrix

Basic security services

- Acceptance support
- Regular inspection
- Accident repair
- Spare Parts Management

Value added empowerment evaluation

- professional training
- Equipment life extension assessment
- System upgrade and expansion

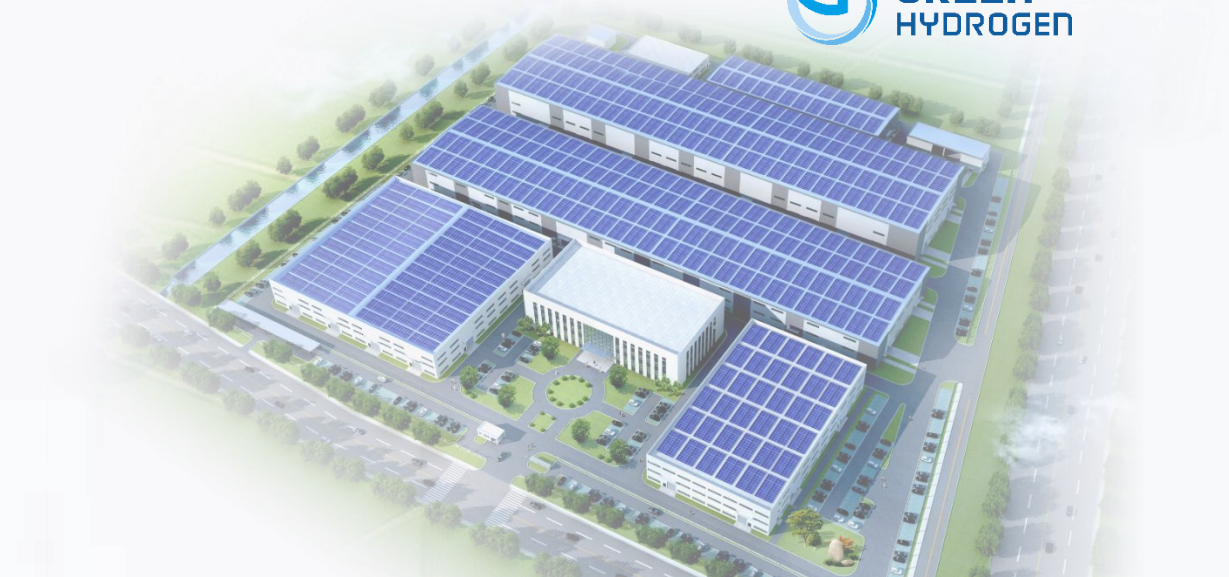
Deep maintenance technology

- Preventive maintenance
- R&D level maintenance
- Replacement of overdue components

Smart Management Services

- Intelligent platform
- Emergency response machine platform
- Equipment Dynamic Report

◎ Production base: Industry leading in intelligence level



- Plate automatic welding line
- Flow-channel auto production line
- Plate mesh-Electrode auto welding line
- Stack assembling line

The production line integrates various technologies such as automatic control, acousto-optic detection, VI algorithm, big data, cloud platform, etc., realizing the world's leading "4-100%" intelligent production line

 **100%** Automation

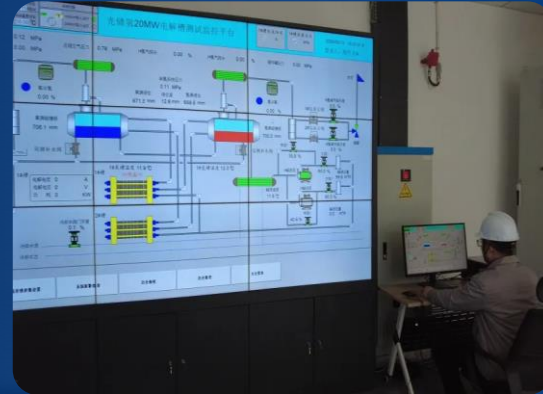
 **100%** Quality self-determination

 **100%** Product digitization

 **100%** Information sharing



◎ Solar-Storage-Hydrogen Testing Platform: Strictly Conduct Factory Testing



Platform Introduction

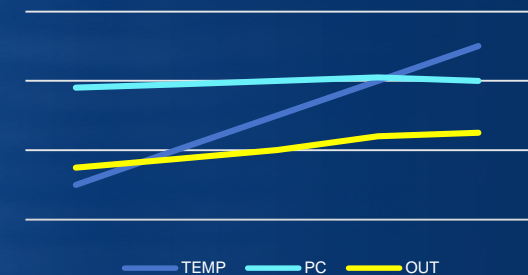
The Trina PV-Storage-Hydrogen Test Platform covers an area of approximately 1,000 square meters and primarily consists of equipment such as electrolyzers, gas-liquid separators, drying and purification frameworks, DC/DC power supplies, AC/DC power supplies, and auxiliary systems. It can perform functions such as testing the comprehensive performance of alkaline electrolyzers ranging from 2.5MW to 20MW. As the first photovoltaic storage and hydrogen integration test platform in China, it enables off-grid hydrogen production through photovoltaic systems and conducts research on the operational characteristics of water electrolysis hydrogen production systems under renewable energy power fluctuations.



The 10MW testing platform has been running for 400 hours

- ✓ Factory testing of the entire machine
- ✓ Control strategy optimization verification
- ✓ Volatility experiment

Test data of a thousand cubic meter alkali tank for a hydrogen ammonia alcohol project in China



© Global Cases: Supply reliable products and integrated solutions



Green Hydrogen Ammonia & Methanol Project, Liaoyuan, China



Model:

16sets 1000Nm³/h

Alkaline Electrolyzer

8 sets of 1000Nm³/h alkaline electrolyzers delivered, installation underway. Full installation and commissioning expected to complete in September.

© Global Cases: Supply reliable products and integrated solutions



A polysilicon manufacturing base
Yichang, China



Delivery Date: October 2023
Model: 1000Nm³/h Alkaline Electrolyzer
1000Nm³/h Gas-liquid Separation System
1000Nm³/h Purification and Drying System

Shaanxi Hydrogen Energy Industrial Park
Yulin, Chian



Delivery Date: December 2025
Model: 1000Nm³/h Alkaline Electrolyzer
1000Nm³/h Gas-liquid Separation System

Hydrogen production and refueling integrated station
Portugal, Europe



Delivery Date: December 2025
Model: 100Nm³/h Alkaline Electrolyzer
100Nm³/h Gas-liquid Separation & Purification
Drying System


Complete sets including power supply and auxiliary equipment




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THANKS!

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