ADVANCED MEASUREMENT INSTRUMENTS

Product Catalog of
Reactor System

Advanced Measurement Instruments

Advanced Measurement Instruments

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Application Directions:

01 Petrochemical Industry
02 Coal Chemical Industry
03 Fine Chemicals
04 Environmental Protection
05 CO_2 Adsorption & Capture
06 Hydrogenation Catalysis Systems
07 Adsorption Separation
08 Multichannel Capability
09 Flue Gas Denitrification Systems
10 Fixed-Bed Reactors
11 Fluidized-Bed Reactors
12 Trickle-Bed Reactors
13 Slurry-Phase (Autoclave) Reactors
14 Catalyst Evaluation Systems
15 Photocatalytic Reaction Systems
16 Electrochemical Reaction Systems

Reactor System

Introduction

The BenchCAT is built for researchers who need to process larger catalyst volumes or require custom reactor configurations. Typically designed as floor-standing systems or specialized setups, BenchCAT units are ideal for advanced catalysis studies, pilot-scale testing, or any application that goes beyond standard fixed-bed reactor capabilities.

By comparison, the μBenchCAT series consists of pre-engineered, benchtop systems that fit easily on a lab table or workbench. These compact units are optimized for fixed-bed catalytic experiments, with configurable options for gas and liquid feeds, as well as a wide range of temperature and pressure conditions. The μBenchCAT offers a space-efficient and cost-effective solution for routine testing and academic research.

Choose the BenchCAT when your research demands greater scale, flexibility, or custom design beyond what the μBenchCAT series offers. AMI will customize these instruments to meet your exact research needs today.

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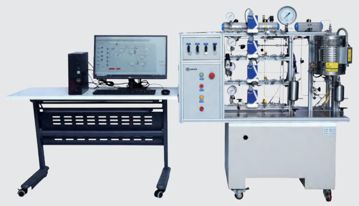
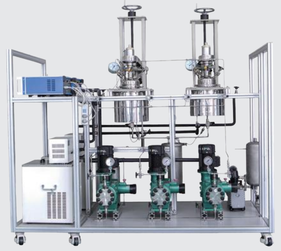
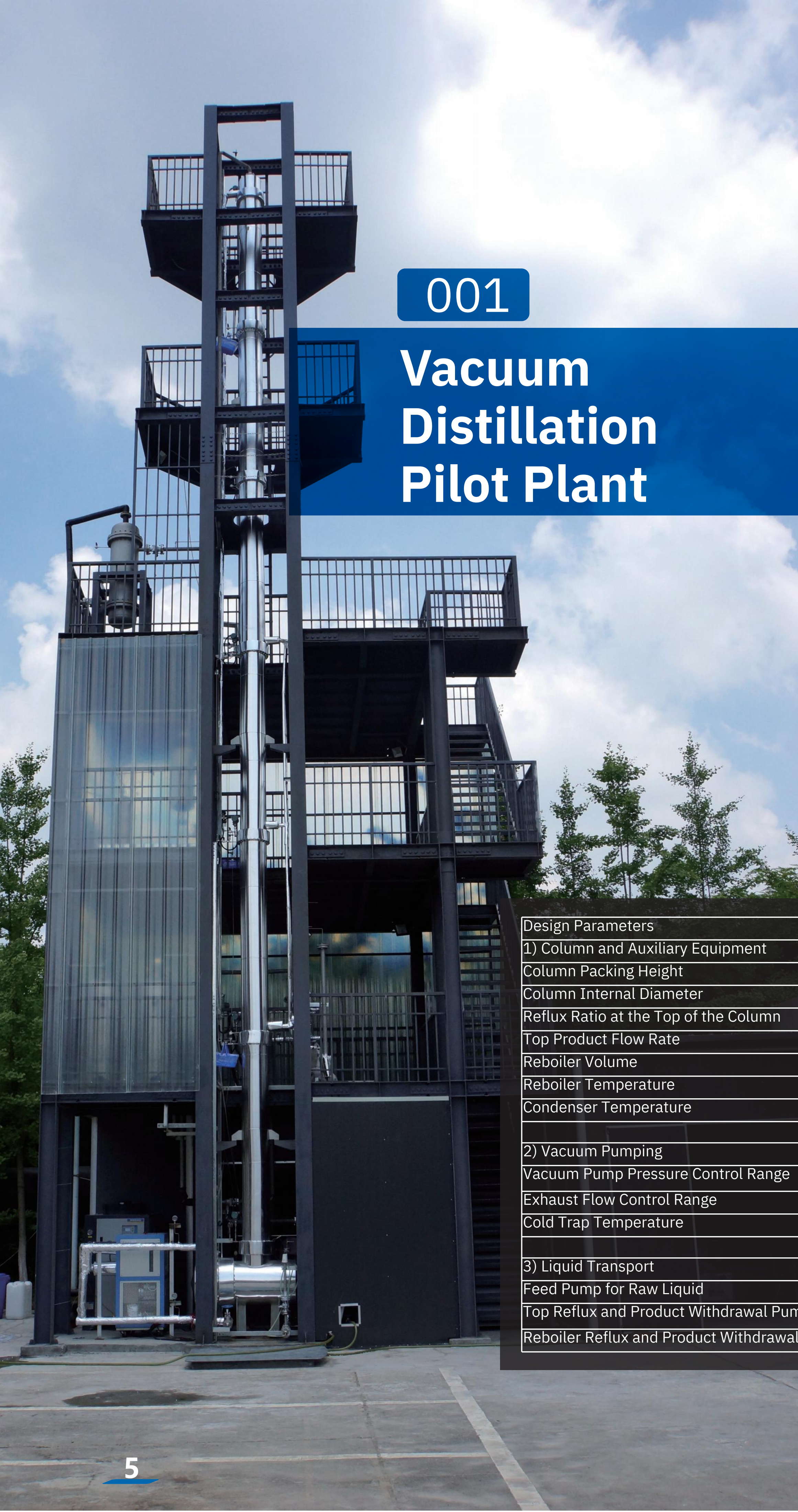






001

Vacuum Distillation Pilot Plant

A Vacuum Distillation Pilot Plant is a chemical device used for separating and purifying liquid mixtures, typically applied in petroleum refining and chemical processes. The principle of operation involves heating the mixture under reduced pressure to evaporate and separate different components, which are then condensed back into liquids. The device usually includes a heating furnace, distillation column, condenser, and collection tanks, along with a reboiler. Vacuum distillation pilot plants are used to separate various fractions in petroleum or to purify and separate chemicals in chemical production.

★Customizable tower parameters such as reflux ratio at the tower top, draw-off volume at the tower top, and volume of the reboiler.

★Vacuum gas circulation through a Venturi ejector, recycling from the tower top to the reboiler.

★Continuous feed and draw-off functions at the tower bottom and tower top can be achieved.

Design Parameters		
1) Column and Auxiliary Equipment		
Column Packing Height	12 m	
Column Internal Diameter	0.261 m	
Reflux Ratio at the Top of the Column	25 ~ 35	
Top Product Flow Rate	0 ~ 1.0L/h	
Reboiler Volume	30 L	
Reboiler Temperature	40 ~ 100 ° C	±0.5° C
Condenser Temperature	40 ~ 100 ° C	±0.5° C
2) Vacuum Pumping		
Vacuum Pump Pressure Control Range	10-100 KPa	±1% F.S
Exhaust Flow Control Range	6000 L/h	±1 % F.S
Cold Trap Temperature	-10° C ~ 0° C	±1.0° C
3) Liquid Transport		
Feed Pump for Raw Liquid	0 ~ 2.0 L/h	±1 % F.S
Top Reflux and Product Withdrawal Pump	0 ~ 40.0 L/h	±1% F.S
Reboiler Reflux and Product Withdrawal Pump	0 ~ 1.0 L/h	±1% F.S

002

Heavy Oil Hydrocracking Catalyst Evaluation Reactor

The reactor is used to evaluate the performance and effectiveness of hydrocracking catalysts for heavy petroleum fractions. In this device, heavy petroleum fractions typically come into contact with the catalyst and react under high temperature and pressure conditions to convert the heavy fractions into lighter products, such as fuel oil or paraffin. The system generally includes a gas supply system, liquid supply system, preheating reaction system, condensation separation system, and backpressure system. By evaluating the catalyst performance, the petroleum processing technology can be improved, enhancing product quality and yield.

Design Parameters:

Catalyst Loading	100 mL
2 Inlet Gas Streams, 1 Inlet Liquid Stream	
Design Reaction Pressure	10.0 MPa
Design Reaction Temperature	500° C

003

Microchannel Isothermal Bench-Scale Reactor

The reactor is used for conducting chemical reactions at a microscale, typically employed in the research and development of new catalytic reactions or chemical synthesis processes. Its technical features include:

★Microscale: Small channels and reaction chambers, which help better control reaction conditions, reduce reaction volume, and improve reaction efficiency.

★Isothermal Performance: Capable of providing strict isothermal conditions, ensuring temperature stability, which is crucial for studying reaction kinetics.

★High Throughput: Allows for high-throughput screening of multiple reactions, enabling rapid evaluation of products under different reaction conditions.

★Fine Control: Provides more precise control over reaction conditions, such as temperature, pressure, and flow rate, to achieve higher reaction selectivity and product purity.

★Waste Reduction: Due to the small-scale reactions, less waste is generated, making it more environmentally friendly.

Design Parameters

H2 Gas Flow Rate	0 ~ 1000 m1/min	±1% F.S
CO Gas Flow Rate	0 ~ 500 m1/min	±1% F.S
CO2 Gas Flow Rate	0 ~ 500 m1/min	±1% F.S
CH4 Gas Flow Rate	0 ~ 1000 m1/min	±1% F.S
N2 Gas Flow Rate	0 ~ 100 m1/min	±1% F.S
Liquid Feed Flow Rate	0 ~ 5 m1/min	±1% F.S
Reaction Pressure	≤3.0 MPa	±1% F.S
Reaction Temperature	≤350° C	±1° C

004

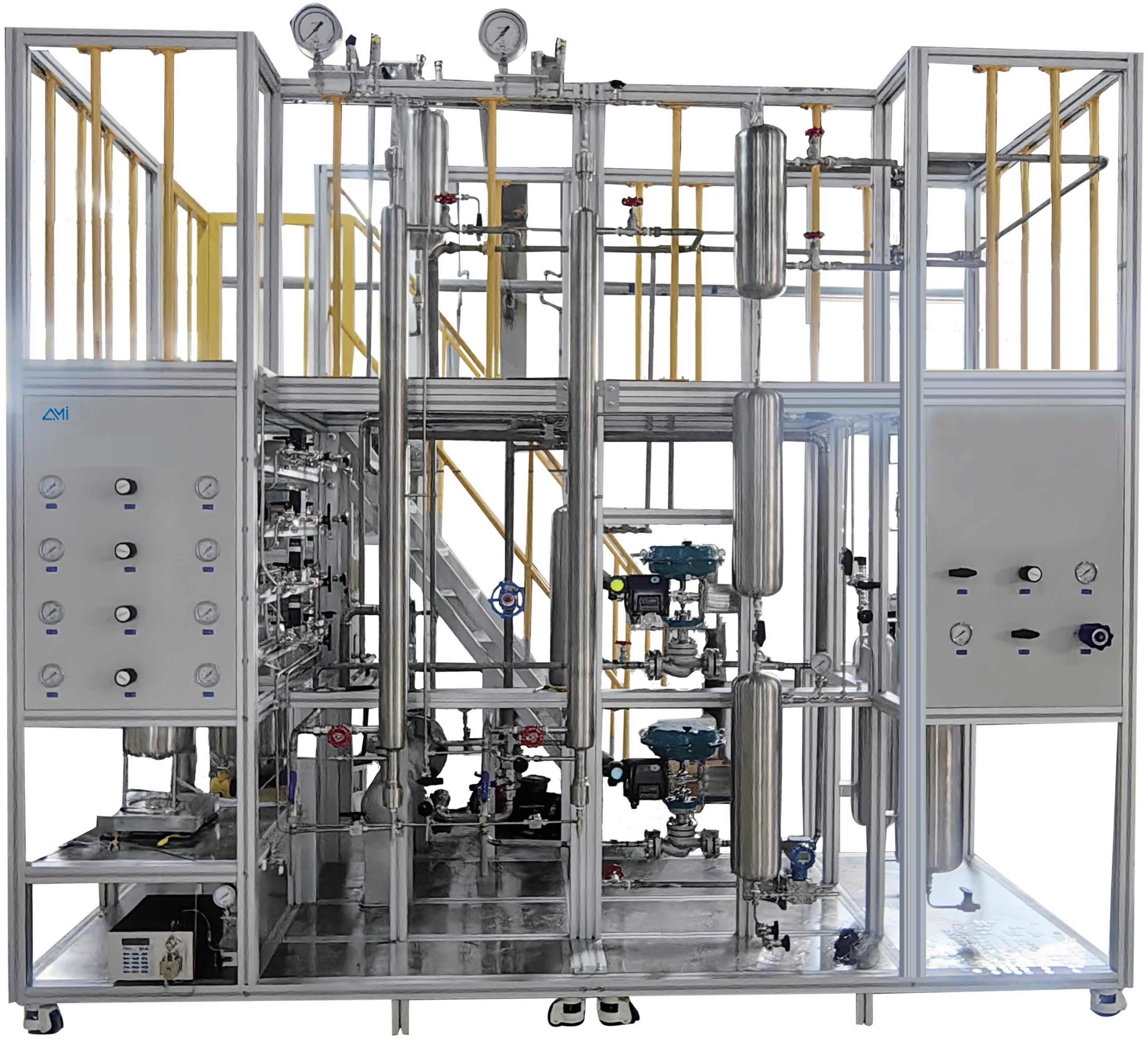
Hydroformylation Reactor

It is used for the chemical reaction between formic acid and hydrogen gas to produce acetone and water. The process typically occurs under high pressure and at an appropriate temperature. Acetone is an important chemical intermediate used in the synthesis of various chemicals and materials. The device includes a reactor, hydrogen supply system, heating and cooling systems, and product separation units. The hydroformylation reaction device plays an important role in chemical synthesis.

Design Parameters:

Design Temperature	200° C
Design Pressure	≤10 MPa
Inlet Flow Rate	160 L/min
Inlet Liquid Flow Rate	20 ml/min
Catalyst Loading Amount	1-5 L
Control Method	PLC
Other Features	Hydrothermal Circulation

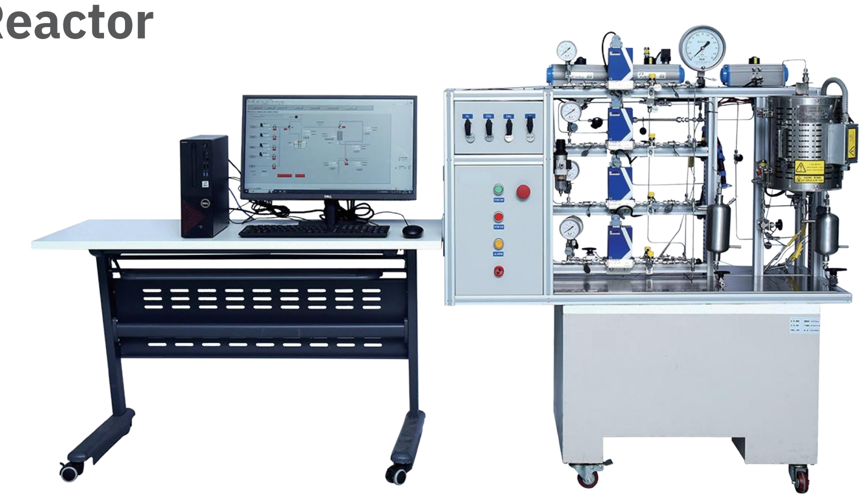
Technical Advantages:
By heating the water inside the high-pressure water jacket, the reaction temperature is controlled. This method efficiently and accurately achieves precise control of the reaction temperature. The structure is designed to withstand high pressure, with reserved expansion space, real-time pressure monitoring, and safety valve protection, ensuring both safety and stability during operation.



005

Methane Combustion Reactor

The methane combustion reaction apparatus is designed to simulate and study the combustion process of methane in the presence of oxygen. The system includes methane and oxygen supply systems, reaction systems, online detection systems, and control systems.



Design Parameters:

Catalyst bed height	10 ~ 20 mm	
Operating pressure	Atmospheric pressure	
Design pressure	0.1 MPa	
Operating temperature	1000° C	Accuracy: ±0.1° C
Design temperature	1100° C	Accuracy: ±0.1° C
Sampling temperature	100 ~ 200° C	
Reactor	Independent temperature control	
Mixing type	Static mixer	SV Type
Reactor	Tubular	Quartz material
Condensate Tank	Circulating Refrigeration	Jacket cooling
MS Sampling Methods	Full Component Sampling	Continuous control
GC Sampling Methods	Gas Phase Sampling	Continuous control
Equipment Framework	Aluminum Alloy	Vertical with pulley
Control Method	PLC+LabVIEW	Security Protection

006

Fischer-Tropsch Synthesis Reaction Product Online Gas Chromatography Analysis System

The Fischer-Tropsch synthesis reaction system uses synthesis gas (a mixture of carbon monoxide and hydrogen) as raw material, and through a catalyst and suitable conditions, synthesizes liquid hydrocarbons or hydrocarbon compounds. This process is a key component of gas liquefaction technology, and is typically used to produce synthetic lubricating oils and synthetic fuels from coal, natural gas, or biomass. Fischer-Tropsch synthesis has received intermittent attention as a source of low-sulfur diesel fuel, addressing issues related to the supply or cost of petroleum-based hydrocarbons.

Functional Features:

1.Catalyst Loading Capacity:
Capable of accommodating 5–10 ml of catalyst for Fischer-Tropsch synthesis experiments.
2.Automatic Temperature Control:
Equipped with advanced temperature control systems to maintain precise reaction temperatures.3.Automatic Flow Control:
Features automated flow control mechanisms to ensure stable and accurate feed rates.
4.Programmable Temperature Ramping:
Supports programmed temperature profiles for precise control of reaction temperature ramps.
5.Dual Independent Sampling and Analysis:
Enables simultaneous, interference-free automatic sampling and analysis with dual independent systems.
6.Aesthetic and Robust Design:
Designed with an aesthetically pleasing appearance, high stability, and strong resistance to interference.

007

Coal-based Polycarbonate Polymer Synthesis

Polycarbonate is a high molecular weight polymer containing carbonate groups in its molecular chain. Depending on the structure of the ester groups, polycarbonates can be categorized into several types, including aliphatic, aromatic, and aliphatic-aromatic polycarbonates.

Hardware Configuration

Magnetic stirrer and stirring motor (adjustable from 0 to 500 r/min) | Drain port | Separate inlet and outlet for circulating liquid Feed system for raw materials (including: 2 gas feed lines and 1 liquid feed line; gas feed flow range 0-500 ml/min, liquid feed 0-40 ml/min) with gas feed control accuracy of ±0.5% | Automated control system | Constant temperature water bath/oil bath

Main Functions

Starting from the carbon dioxide released in coal chemical processes, the polymer is subjected to pyrolysis after activation and copolymerization. This approach is used to study the molecular chain segment structure, thereby further guiding the screening of catalysts. Additionally, it involves the detection of adsorbent performance in the adsorption of carbon dioxide, as well as the exploration, research, and optimization of process conditions during adsorption and desorption.

The equipment can also be used to evaluate the performance of catalysts and explore, research, and optimize process conditions during the activation and transformation of collected gases.

Furthermore, it enables the evaluation of various catalysts required for the polymerization of polycarbonate-based high-molecular-weight materials. These include zinc carboxylate catalysts, metal porphyrin catalysts, β-diketiminate metal complexes, rare-earth coordination catalysts, bimetallic cyanide catalysts, SalenMX complexes, and supported catalysts. The equipment can also be used to explore, research, and optimize the process conditions suitable for each type of catalyst, as well as to analyze the products.

008

100g MTO Fixed Fluidized Bed

It is primarily used to evaluate the performance of catalysts in the MTO process, to improve MTO catalysts, and to enhance the selectivity and yield of olefins. The unit consists of a reactor, catalyst supply system, fluidized bed system, and product analysis module. Its technical features include controllable reaction temperature and pressure, an efficient fluidized bed system, and the capability for real-time monitoring and analysis of products.

Design Parameters:

Catalyst Loading	100 mL
Catalyst loading	50 g~100 g
N2 gas flow rate	0~ 2 L/min
Air gas flow rate	0 ~4 L/min
Reserved gas flow rate	0 ~2 L/min
Liquid Feed Rate	5 ~ 250 g/h
Design Pressure	≤ 6 MPa
Design Reaction Temperature	850° C
Design Preheating Temperature	350° C

010

Fischer-Tropsch Fixed-Bed

The Fischer-Tropsch synthesis (also known as F-T synthesis) is a process that converts synthesis gas (a mixture of carbon monoxide and hydrogen) into liquid hydrocarbons or other carbon-containing compounds under appropriate conditions in the presence of a catalyst.

Technical Features: The entire pipeline for post-reaction materials is equipped with heating and insulation. The backpressure valve and six-way sampling valve are housed in an insulated valve box to ensure pressure control and sampling of the materials in their gaseous phase.

009

Methanation Dual-Channel Parallel Reactor

The reactor is used to evaluate the performance of catalysts in the methane conversion process.

Technical Features:

The device utilizes independent gas supply and discharge systems. The quartz reactor is heated under fully parallel temperature conditions. To ensure uniform temperature distribution, the reaction furnace has been specially designed and processed. The interior of the furnace is made with special materials and structures to guarantee consistent temperature across dual or multiple reaction channels.

011

Methanation High-Pressure Dual-Channel Parallel Reactor

The methanation reactions of CO and CO2 are volume-reducing reactions, and higher pressure promotes a more complete reaction.

Technical Features:

The high-pressure reactor and the dual-tube parallel reaction furnace are specially designed to ensure the matching of the reactor and parallel reaction furnace while maintaining parallel temperature conditions.

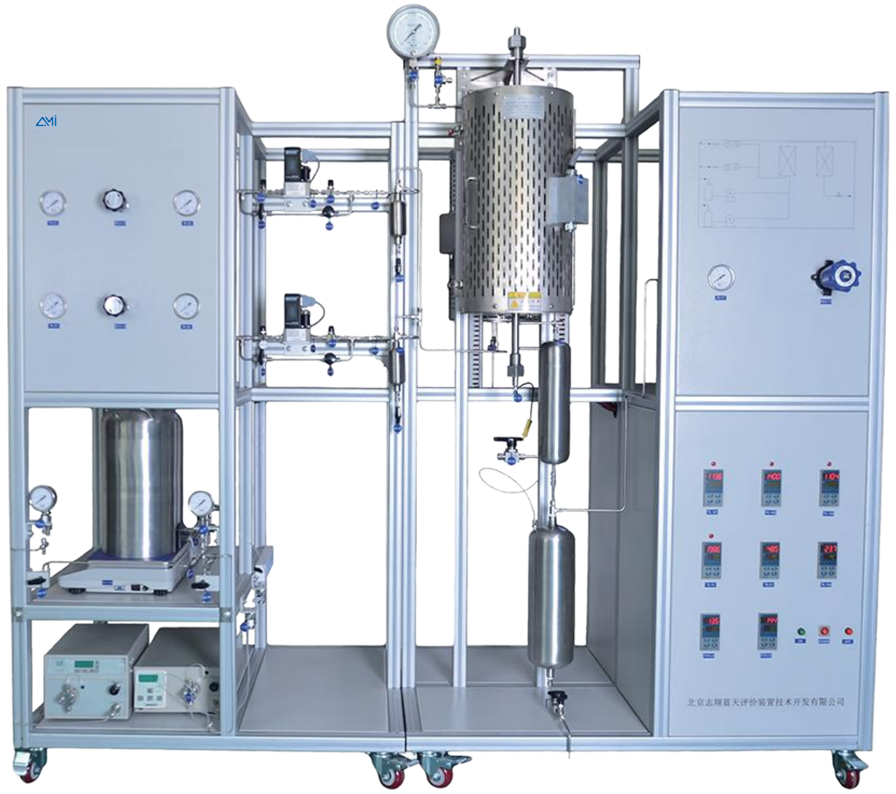
012

Alkylbenzene High-Pressure Fixed Bed Reactor

Alkylation is the process in which an alkyl group is transferred from one molecule to another, involving the introduction of alkyl groups (such as methyl, ethyl, etc.) into the compound molecules.

Technical Features:

The device adopts a modular design approach, including gas supply module, liquid supply module, preheating reaction module, condensation separation module, backpressure module, and control module. This design clearly displays the flow of the device and significantly improves its operability and maintainability.



013

Syngas to Methanol Reactor

The reactor is used to convert syngas (a mixture of carbon monoxide and hydrogen) into methanol through a chemical reaction. The syngas-to-methanol process is an important chemical engineering technology, as methanol can be used as a solvent, fuel, or an intermediate for other chemicals. During the setup process, it is important to control reaction conditions such as temperature and pressure to improve yield and selectivity. A more efficient reactor design ensures the continuity and stability of the reaction.

014

Synthetic Rubber Kettle-Type Continuous Reactor

The reactor is specifically designed for the synthesis of rubber, typically using a kettle-type continuous reaction process to ensure high-quality and high-yield continuous rubber production. It is widely used in the rubber industry for scientific research experiments related to rubber products, such as tires, seals, and other rubber goods.

Design Parameters:

Reactor Volume	5 L	
Catalyst Feed Flow Rate	0-100 ml/min	±1 % FS
Hexane Feed Flow Rate	0-10 L/min	±1 % FS
Butadiene Feed Flow Rate	0-10 L/min	±1 % FS
Reaction Pressure	5 MPa	±1 % FS
Design Pressure	6.4 MPa	±1 % FS
Reaction Temperature	< 100° C	±1° C

015

Ammonolysis and Ammoniation Dual Parallel Fixed Bed Reactor

The reactoris used for the dissociation and ammoniation of ammonia. It employs a dual parallel fixed bed structure, which helps improve reaction efficiency and practicality. The ammonolysis reaction produces hydrogen gas, while the ammoniation reaction is used for synthesizing amine compounds, commonly found in fertilizer and chemical synthesis industries.

016

Microchannel Evaluation Device (Fine Chemicals Direction)

Microchannel technology is typically used for evaluating and optimizing chemical reactions at the microscale, making it suitable for the fine chemicals industry, such as drug synthesis, catalyst research, etc. It can be used for small-scale experiments and rapid optimization of reaction conditions.
High Efficiency: The small scale within the microchannel enhances mass transfer efficiency and reaction rates.
Precise Control: The microchannel system allows for precise control of reaction conditions, such as temperature, flow rate, and more.
Resource Savings: Due to small-scale operation, it reduces the consumption of reactants and the generation of waste.

This is a gas-solid phase reaction evaluation device with a catalyst loading of 500 mL. Its primary purpose is to evaluate the mesoscopic scale performance of catalysts for reactions such as methane reforming, syn-gas-to-chemical synthesis, and CO2-to-liquid fuels and chemicals.

017

VOC Reactor

The VOC (Volatile Organic Compound) reaction device is used for the treatment of volatile organic pollutants, typically applied in air pollution control. These devices generally include a gas treatment unit where VOCs are oxidized, degraded, or converted into harmless substances. The technical features of the device enable the efficient removal of VOCs using high-performance catalysts or oxidants.

·Design Parameters:
Catalyst Loading: 0.1~1.0g
VOC Gas Carrying Equipment: The VOC raw material is delivered to the reactor in the form of saturated vapor pressure.
VOC Carrying Capacity: 5%~10%
Inlet Gas-Liquid Phase: The raw materials can be heated using an air bath, ensuring integrated full-pipeline insulation to prevent any "cold spots" in the stainless steel pipelines and valves.
Post-Reaction: Full-component insulated chromatographic detection is conducted.

018

Industrial Flue Gas Recirculation System

The industrial flue gas recirculation system is designed to reintroduce exhaust gases into industrial processes to reduce emissions and improve resource utilization. This system typically includes the collection, purification, and treatment of exhaust gases, followed by their recovery and reinjection into the production process. The technical features include efficient purification and treatment technologies to ensure that the recycled exhaust gases meet quality standards. This system can be applied in various industrial sectors, including steel, cement, and chemical industries.

Design Parameters:
Adsorbent Loading: 5-10L
Gas Flow Rate: 30L/min
Recirculation Process with Booster Exhaust Gas Pump: Enhances the stability of the gas supply system.
Customizable Interface: Allows integration with other exhaust gas generating devices.

Kettle-type Structure Design

019

Denitration Catalyst Solid Waste Purification Experimental Device

The denitration catalyst solid waste purification experimental device is used for processing waste denitration catalysts to extract valuable substances or reduce environmental pollution from solid waste. This device typically includes a waste treatment unit where the catalyst solid waste is processed, separated, and purified. The technical features include efficient separation and purification technologies to minimize waste generation. This equipment is commonly used for the recycling of denitration catalysts or waste reduction treatments.
Design Parameters

Basket Filter	200 Mesh
Stirred Tank (R-101,R-201,R-301)	Volume: 10 L
Processing Temperature	RT ~ 100° C
Filter (V-201,V-301)	Volume: 10 L
Settling Tank (V-101,V-202)	Volume: 10 L
Recovery Tank (V-502)	Volume: 15 L

Gas Handling Capacity(VON)	50 Nm3/h
Space Velocity (SV)	600 h-1
Height (L)	0.868 m
Diameter (D)	0.35 m
Residence Time (t)	2.6668s
Adsorbent Porosity (e)	4/9
Fixed Bed Flow Velocity (u)	0.3255 m/s
Tower Pressure Drop (P)	2.137 kpa

020

Industrial Exhaust Odor Gas Adsorption Device

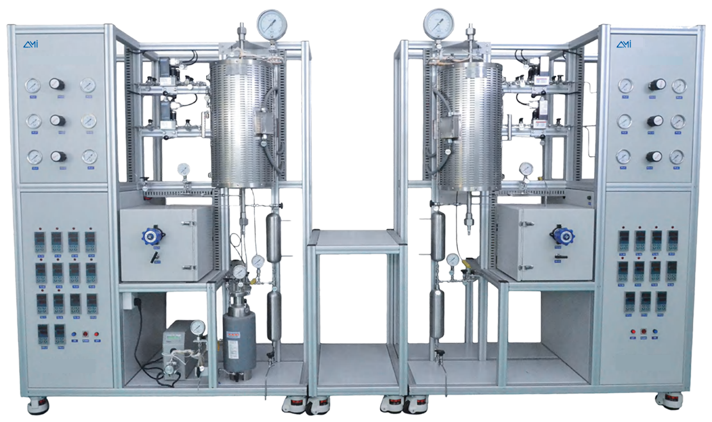
The industrial exhaust odor gas adsorption equipment is designed to remove odorous gases from industrial waste gases. It typically includes an adsorbent bed where the odor gases are adsorbed and neutralized.
The technical features include high-efficiency adsorbents and recirculation systems to eliminate odorous substances while ensuring the long-term stable operation of the equipment. This device is widely used in industries such as wastewater treatment, waste management, and pharmaceuticals.
Connect to online monitoring equipment to assess the purification and removal status, providing a basis for large-scale industrial exhaust gas emission reduction systems.

021 CO_2Gas Adsorption and Capture Reactor

022 CO_2 Adsorption and Desorption Reactor

This reactor is specifically designed for studying and experimenting with the CO_2adsorption process. It uses specific adsorbents (such as molecular sieves, activated carbon, etc.) to simulate the process of CO_2being adsorbed from the gas phase onto solid adsorbents. The technical features include real-time monitoring of CO_2concentration changes, control over the selectivity of the adsorbent, and the ability to perform multiple adsorption-desorption cycles to evaluate the regeneration performance of the adsorbent. It is primarily used in the research of carbon capture technologies, providing insights into CO_2 adsorption behavior under various conditions, evaluating the performance of adsorbents, and offering scientific data to address climate change and mitigate greenhouse gas emissions.

023 Multifunctional (Hydrogenation) Micro-Reactor Catalyst Evaluation Reactor



The reactor is required to achieve the following main objectives:

1.Capable of evaluating 5ml of catalyst.
2.Automatic temperature control functionality.
3.Automatic flow rate control functionality.
4.Programmable temperature ramping for reaction temperature.
5.Aesthetic design with a stable appearance, strong stability, and high resistance to interference.

This device is primarily used for studying and evaluating the performance of hydrogenation catalysts.

It includes a fixed bed reactor that can accommodate the catalyst and simulate industrial reaction conditions. The device provides precise control of temperature and pressure to mimic actual industrial catalytic hydrogenation reactions and can monitor the concentrations of reactants and products in real time. It is typically equipped with an efficient gas supply system to ensure the appropriate reaction atmosphere. The fixed bed structure makes it suitable for long-term operation and repeated catalyst evaluations.

024 Fixed Bed Hydrogenation Catalyst Evaluation Reactor

Catalyst Loading: 100ml
The reactor is designed for a complete heavy oil hydrogenation case, featuring a heating and insulation function from the raw material tank to the reactor inlet, ensuring the fluidity of the heavy oil. The 100ml catalyst loading capacity fully simulates industrial reactor conditions, and the experimental data provides industrial reference value.

025 Fixed Bed Hydrogenation Catalyst Evaluation Reactor

Catalyst Loading: 100ml
Process Features:
Increased Efficiency: Dual parallel reactions allow for experimental comparison of the
same catalyst within the same cycle.
Improved Selectivity: Simultaneous screening of multiple catalysts enhances experimental efficiency.
Labor Savings: One operator can manage two sets of reactions simultaneously.
Space Efficiency: The dual sets are integrated into the same frame, making the setup more compact.
Cost Savings: One control system operates both sets of devices, and a single gas supply system serves both sets of devices.

026 Fixed Bed Hydrogenation Catalyst Evaluation Reactor

Catalyst Loading: 1～6ml
High-Precision Constant Flow Pump: Enhances the accuracy of liquid feed.
Precision Pressure Gauges: Installed at the reactor inlet and outlet, providing clear pressure differential before and after the reaction.
Post-Reaction Secondary Cryogenic Separation: Allows for the complete collection of light component products.

027

CO_2 Hydrogenation Micro-Reactor Catalyst Evaluation Reactor

Technical Features: The device is equipped with real-time detectors for H_2, CO_2, and CO, which continuously monitor and provide alerts. In the event of a leak, the safety alarm system is triggered, automatically closing the inlet valve to ensure the safe operation of the device.

028

CO_2 Hydrogenation Micro-Reactor Catalyst Evaluation Reactor

Technical Features: Full-component backpressure control with valve box, temperature control range from RT to ≤320°C, allowing for convenient and flexible operation of products under atmospheric pressure.

029

CO_2 Hydrogenation Catalyst Evaluation Device (Touchscreen)

The device features a touchscreen interface, allowing users to intuitively and conveniently control experimental conditions and monitor the reaction process.

Technical Features:

Full-component backpressure after the reaction. It ensures stable reaction pressure while enabling pressure control, allowing subsequent process steps to be operated at atmospheric pressure. This design not only saves costs but also accommodates different process modes.

030

High-Pressure Hydrogenation Micro-Reactor Catalyst Evaluation Reactor

This desktop reactorfeatures a compact structure design that integrates the gas supply system, liquid feeding system, preheating system, reaction system, condensation separation system, and backpressure sampling system into one unit. It meets experimental needs while saving laboratory space, without compromising on ease of operation and maintenance.

031

300ml Liquid-Solid-Gas Adsorption Analysis Reactor

This reactor is designed for in-depth study of the adsorption and desorption processes between gas, liquid, and solid phases. With a 300ml capacity, it is suitable for small-scale experiments and is widely used in catalyst and adsorbent performance evaluation. The device's technical features include precise control of experimental conditions, seamless switching between liquid-solid and gas-solid adsorption/de-sorption processes, and highly flexible operation. By providing real-time monitoring and data analysis, researchers can gain a deeper understanding of the adsorption mechanisms, offering crucial data support for the design and application of new materials.

032

Gas Pressure Swing Adsorption and Desorption Reactor (Touchscreen)

Equipped with an advanced touchscreen interface, this device is designed to evaluate the adsorption and desorption behavior of gases under different pressure conditions. It simulates the performance of adsorbents in varying pressure environments for comprehensive adsorbent performance evaluation. The device also features high-precision data acquisition and real-time monitoring capabilities, providing researchers with a convenient and accurate experimental platform.

033

Three-Tube Series Adsorption Breakthrough Reactor

The reactor is designed to simulate the breakthrough behavior of multi-component gases in adsorbent materials. Its unique three-tube series structure allows for the simulation of multi-stage adsorption processes, making it widely applicable in the fields of gas separation and storage. The device offers adjustability for different pressure and temperature conditions to evaluate the adsorption performance of various components. This enables researchers to gain a more accurate understanding of the separation efficiency of complex gas mixtures, providing foundational data for the development of novel separation materials.

034

Membrane Separation Reactor

This specialized equipment is designed for studying the membrane separation process. Its functions include simulating the membrane separation process under experimental conditions to achieve selective separation of gases, liquids, or solutes. The device features a modular design, adjustable operating parameters, and a precise data acquisition and real-time monitoring system, ensuring a highly controllable experimental environment for accurately evaluating membrane separation performance. Its applications span across various fields, including gas separation, liquid purification, wastewater treatment, biomedical applications, and energy production, thus promoting the development and innovation of membrane separation technology.

035

Dual Set Series-Parallel Fixed Bed

The reactor systemconsists of two parallel reaction systems, allowing for both independent parallel operation and series operation. Each reaction system has two independent gas phase inlets and two independent liquid phase inlets, with preheating carried out by separate heaters before the reaction. The reaction process can be switched between series and parallel configurations according to experimental requirements, providing different process flow options for the experiment.

036

Four-Tube Parallel Reactor

To improve experimental efficiency and enable fast and simple catalyst screening, the device is designed with a four-tube parallel configuration, ensuring that four sets of catalysts can be tested within the same cycle. This configuration allows for experiments under identical conditions of temperature, pressure, and feed rate, while also accommodating different experimental parameters. This flexible and efficient design significantly enhances the experimental efficiency.

More independent channels have significant implications in catalyst research and industrial applications:

★Efficient Parallel Experimentation: Multiple independent channels allow for the simultaneous execution of multiple experiments, significantly improving experimental efficiency. This design enables the evaluation of several catalysts or different reaction conditions within the same timeframe, accelerating the research process.

★Multivariable Independent Control: Each channel independently controls parameters such as temperature,-pressure, and flow rate, enabling flexible adjustment of multiple variables. This helps gain deeper insights into the catalyst's performance under varying conditions, providing more accurate data for optimizing catalytic reaction conditions.

★Realistic Industrial Simulation: The multi-channel structure closely mimics the multi-channel operation mode found in real industrial reactions. This design helps translate experimental results more effectively into practical industrial applications, enhancing the applicability of the research.

★Flexibility and Versatility: Multi-channel catalyst evaluation devices typically feature a modular design, allowing for flexible configuration based on research needs. This versatility makes them suitable for various types of catalysts and reaction systems, broadening the scope of the research.

037

Three-Channel Catalyst Evaluation Reactor

The key design feature of the three-channel parallel evaluation device is that the three reaction tubes are heated within the same reaction furnace under high-pressure conditions, ensuring uniform catalyst temperature across all three tubes. This process is particularly suited for reactions that require strict temperature control and repetitive testing, greatly improving experimental efficiency.

038

Acetylene Hydrogenation Chlorination Reaction and Catalyst Stability Evaluation Reactor

The reactor is a multifunctional evaluation system capable of supporting various reaction modes. It features a 9-channel gas feed control system and has 2 independent liquid feeding systems to meet the gas intake requirements of different reactions. The reaction section is equipped with four different reactor configurations, enabling denitration reactions, photothermal reactions, electromagnetic reactions, and high-temperature reactions.

09 Flue Gas Denitration

039

SCR Desulfurization and Denitrification Reactor

040

SCR Desulfurization and Denitrification Reactor

041

SCR Desulfurization and Denitrification Reactor

Selective Catalytic Reduction (SCR) for denitration is a process in which ammonia, CO, or hydrocarbons are used as reducing agents to reduce NO in exhaust gases to N2 in the presence of a catalyst.

The SCR catalyst performance testing device simulates flue gas conditions or utilizes actual industrial flue gas conditions to analyze the flue gas parameters at the inlet and outlet of the flue gas reactor, allowing for the acquisition of various process characteristic indicators of the flue gas denitration catalyst.

The catalyst loading specifications can be divided into: powder type, honeycomb selective type (square/circular), corrugated plate type, and standard honeycomb single-tube type (which can be connected in series).

This device has important applications in environmental protection, air purification, and industrial waste gas treatment. By evaluating the performance of SCR catalysts, researchers can optimize catalyst formulations, improve the efficiency of exhaust gas treatment, and reduce harmful gas emissions, which plays a significant role in advancing environmental protection technologies and improving air quality. This evaluation device provides a reliable experimental platform for catalyst design and application, contributing to environmental protection and sustainable development.

09 Flue Gas Denitration

The SCR (Selective Catalytic Reduction) desulfurization and denitrification catalyst evaluation device is an experimental equipment used to assess the performance and effectiveness of catalysts. It is widely applied in the fields of environmental protection and industrial catalytic reaction research. This device is used to simulate and analyze the SCR reaction, where ammonia or urea is used as a reducing agent, and with the action of the catalyst, nitrogen oxides (NOx) are converted into harmless nitrogen and water vapor.

Device Features

1.Reaction Simulation: The device can simulate industrial SCR reactions under controlled conditions, including temperature, pressure, and gas composition, etc., to evaluate the performance and stability of the catalyst.
2.High - precision Control: It is equipped with a highly automated control system that can monitor and adjust reaction conditions in real - time, ensuring the consistency and accuracy of experiments.
3.Data Analysis: It is equipped with gas analysis instruments to monitor and record the gas components generated during the reaction, and evaluate key parameters such as NOx conversion rate and ammonia slip.
4.Catalyst Recovery: It allows the recycling and regeneration of the catalyst to test its durability and long - term stability.
5.Experimental Repeatability: The design aims to simulate real - world industrial conditions, ensuring the reliability of experimental results.

Application Scenarios

1.Optimizing Environmental Protection Control TechnologiesSCR denitrification is a key technology for reducing NOx emissions, especially applicable to industrial furnaces, power plant boilers and otherequipment during the combustion process. The catalyst evaluation device can be used to study the NOx removal efficiency of different catalysts.
2.Research, Development and Improvement of High - efficiency Catalysts The device can be used to evaluate the performance of different catalysts, aiming to develop more efficient and durable SCR catalysts and reduce the cost of catalysts.
3.Optimization of Engineering Applications Industrial production facilities can use this device to optimize the design and operating parameters of the SCR system, so as to improve the NOx removal efficiency and reduce the operating costs.

042

SCR Desulfurization and Denitrification Reactor

Catalyst loading	100 ml (32 x 32 x 96 mm)	
Space velocity range	4000 ~ 10000h-1	
N2 gas flow rate	0 ~ 15 NL/min	±1% FS
O2 gas flow rate	0 ~ 1 NL/min	±1% FS
SO2(5%)gas flow rate	0 ~ 400 ml/min	±1% FS
NO(5%)gas flow rate	0 ~ 400 ml/min	±1% FS
NH3(5%)gas flow rate	0 ~ 400 ml/min	±1% FS
H2O feed amount	0 ~ 5 ml/min	±1% FS
Reaction pressure Design pressure 1.0 MPa ±1% FS	micro positive pressure 1.0 Mpa	±1% FS
Reaction temperature	100 ~ 450° C	±1° C
Design reaction temperature	500° C	±1° C
Preheating temperature	350° C	±1° C
Design preheating temperature	400° C	±1° C

043

SCR Desulfurization and Denitrification Reactor

Catalyst loading	10 ~ 100 g	
Space velocity range	4000 ~ 8000 h-1	
N2 gas flow rate	0 ~ 3.0 NL/min	±1% FS
SO2/N2(gas flow rate)	0 ~ 120 ml/min	±1% FS
NO/N2(2%)gas flow rate	0 ~ 150 ml/min	±1% FS
NO2/N2(2%)gas flow rate	0 ~ 150 ml/min	±1% FS
CO2gas flow rate	0 ~ 200 ml/min Control accuracy : ±1% FS	±1% FS
O2gas flow rate	0 ~ 350 ml/min Control accuracy : ±1% FS	±1% FS
H2O feed amount	0 ~ 5 ml/min Control accuracy : ±1% FS	±1% FS
Reaction pressure	0 ~ 0.1 MPa	±1% FS
Design pressure	0 ~ 0.3 MPa	±1% FS
Reaction temperature	220 ~ 280° C	±1° C
Design reaction temperature	150 ~ 400° C	±1° C
Preheating temperature	0 ~ 200° C	±1° C
Design preheating temperature	300° C	±1° C

044

SCR Desulfurization and Denitrification

Catalyst loading	100 m1 25 x 25 x 160 mm	
Space velocity range	4000 ~ 8000 h-1	
N2 gas flow rate	0 ~15 NL/min	±1% FS
O2 gas flow rate	0 ~1 L/min	±1% FS
SO2(3%)gas flow rate	0 ~ 600 m1/min	±1% FS
NO (3%)gas flow rate	0 ~600 m1/min	±1% FS
NH3 (3%)gas flow rate	0 ~600 m1/min	±1% FS
H2O feed amount	0 ~5 m1/min	±1% FS
Reaction pressure	micro positive pressure	±1% FS
Design pressure	1.0 MPa	±1% FS
Reaction temperature	200 ~450° C	±1° C
Design reaction temperature	500° C	±1° C
Preheating temperature	≤350° C	±1° C
Design preheating temperature	400° C	±1° C

045

Fixed - Bed MicroReactor Evaluation Reactor

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Fixed - Bed MicroReactor Evaluation Reactor

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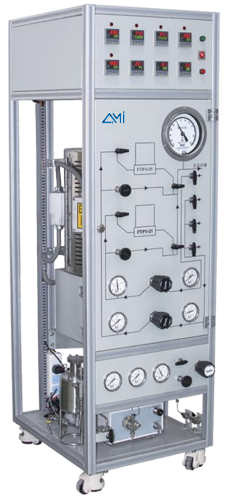
Fixed - Bed MicroReactor Evaluation Reactor

048

Fixed - Bed MicroReactor Evaluation Reactor



The catalyst evaluation reactor with a fixed - bed reactor and a compact design has the following advantages:

Simulating Real - world Conditions

The fixed - bed reactor can better simulate the actual industrial reaction conditions. In industry, catalysts usually carry out catalytic reactions while fixed on the reactor bed. This design makes the experimental results closer to the actual application scenarios, improving the reliability and reproducibility of the research.

Closer to Industrial Scale

The fixed - bed reactor is generally compact and occupies less space. This compact design makes the catalyst evaluation device easier to integrate into the actual production environment, reducing the equipment footprint and maintenance costs, and is more in line with the needs of industrial applications.

Efficient Mass Transfer and Reaction

The fixed - bed reactor helps improve mass transfer and reaction efficiency. The fixed - bed structure helps evenly distribute the reactants, optimizing the utilization of the catalyst. The compact design further enhances the heat and mass transfer effects, improving the overall performance of the reactor.

Adaptability to Multi - channel Operation

The compact design often comes with a multi - channel structure, enabling the catalyst evaluation device to conduct multiple sets of experiments simultaneously. This improves experimental efficiency and meets diverse research needs.

Cost - effectiveness

The compact design usually means a smaller equipment volume and less material usage, making it more cost - efficient in terms of manufacturing and maintenance.

049

Fluidized - bed Reactor

Simulation of Fluidized - bed Catalytic Reaction:

It can simulate the common fluidized - bed catalytic reaction conditions in industry, where the granular bed material is in a fluidized state under the action of gas flow. This design brings the experiment closer to actual industrial applications.

Better Mass Transfer and Reaction Performance:

The special structure of the fluidized bed enables the granular bed material to be efficiently mixed in the flowing gas, improving the mass - transfer efficiency and enhancing the contact between the catalyst and the reactants.

Study on the Kinetics of Fluidized - bed Catalysts:

This involves studying the kinetic behavior of catalysts in a dynamic fluidized bed. It is of great significance for understanding the stability, durability of the catalyst in actual reactions, as well as its response to different gas components.

Experimental Results Closer to Practical Applications:

The catalyst evaluation device can provide a more realistic dynamic of gas flow in the bed layer, making the experimental results closer to actual industrial applications, thus better guiding the design and application of industrial catalysts.

Catalyst Loading	100 ~150 g	
NH3 Gas Flow Rate	0 ~ 3000 m1/min	±1% FS
N2 Gas Flow Rate	0 ~ 1000 m1/min	±1% FS
Liquid Feed Rate	0 ~ 5 m1/min	±1% FS
Reaction Pressure	micro positive pressure	±1° C
Reaction Temperature	0 ~ 750° C	±1° C
Preheating Temperature	0 ~ 350° C	±1° C

The purpose of choosing a trickle - bed reactor for a liquid - phase catalytic catalyst evaluation device is to closely approximate the actual application scenarios.

In a trickle - bed reactor, by controlling the droplet falling rate and uniformity, the efficient distribution of the catalyst can be achieved, thereby maximizing the reaction efficiency to the greatest extent. Its design advantage lies in its adaptability to catalysts with a high specific surface area, including particles or nanoparticles, to give full play to their active sites. This type of reactor enables fine control of individual droplets, covering parameters such as the falling rate, size, and interval, providing researchers with greater freedom in experimental design.

Moreover, the trickle - bed reactor is conducive to in - depth study of the kinetic behavior of liquid - phase catalytic reactions, including aspects such as adsorption, desorption, and reaction rates. Through the trickle - bed reactor, researchers can gain a deep understanding of the mechanism of liquid - phase catalytic reactions, providing strong support for the design and application of catalysts.

050

2000ml Trickle - bed Reactor

Catalyst Loading	800 ml	
Air Gas Flow Rate	0 ~ 5 NL/min	±1% FS
N2 Gas Flow Rate	0 ~ 5 NL/min	±1% FS
Liquid Feed Rate	0 ~ 50 ml/min	±1% FS
Reaction Pressure	1 ~ 2 MPa	±1% FS
Reaction Temperature	80 ~ 100° C	±1° C

13 Stirred - tank (Slurry - bed)

The purposes and significance of using a tank (slurry - bed) reactor in the catalyst evaluation device are mainly reflected in the following aspects:

1.Simulating Slurry - State Reaction Conditions

The tank (slurry - bed) reactor is suitable for simulating slurry - state reaction conditions, where the liquid catalyst exists in a slurry form and comes into contact with the reactants. This design makes the device more closely resemble the actual application scenarios, especially for some reaction systems with high viscosity.

2.Improving Mass Transfer Efficiency

Through agitation or other stirring devices, the tank reactor can enhance the mass transfer effect between the liquid catalyst and the reactants. This is helpful for optimizing the reaction process and improving the catalytic efficiency.

3.Accommodating High - Viscosity CatalystsThe tank (slurry - bed) reactor is applicable for cases where high - viscosity catalysts are used, such as slurry - state catalysts or granular catalysts.

Because the stirring can effectively maintain the uniformity of the reaction system.

4.Flexibility in Experimental Operation and Control The tank reactor usually has a relatively large experimental volume, providing more flexible experimental design and operation space. At the same time, the device can be equipped with precise temperature, pressure, and stirring control systems, making the experimental operation more controllable.

5.Studying Complex Reaction Systems The tank (slurry - bed) reactor is suitable for studying some complex reaction systems, such as multiphase catalytic reactions and aqueous - phase catalytic reactions, providing an experimental platform for in - depth understanding of catalyst performance.

051

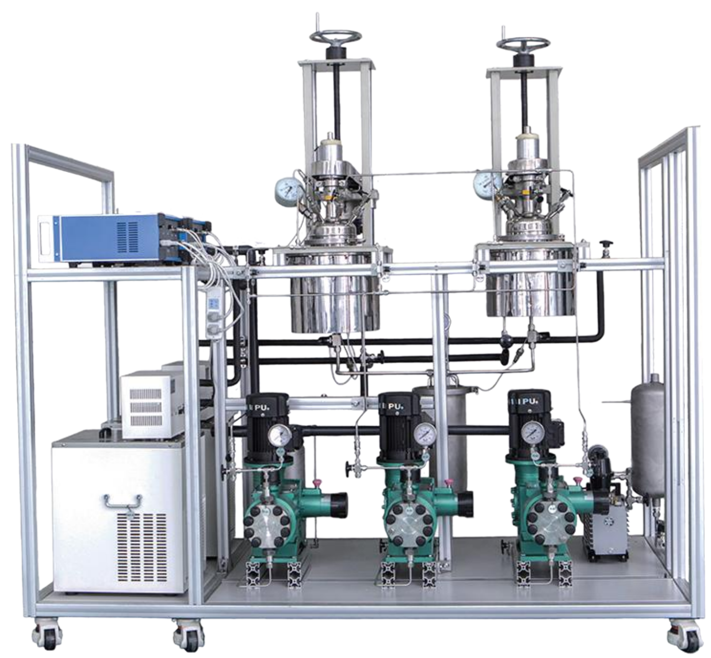
Gas - Liquid Multiphase Reaction Test Bench

052

Tank - Type Photocatalytic Reaction Device

053

Reaction Kettle



054

Methanol - Carrying 2ml Multifunctional Catalyst Evaluation Reactor

055

Multi - Channel Fixed - Bed Catalyst Evaluation Reactor

058

Fixed -Bed Micro - Reactor Evaluation Reactor

056

High - Pressure Catalyst Evaluation Device for Propylene Production from Propane Oxidation by CO_2

057

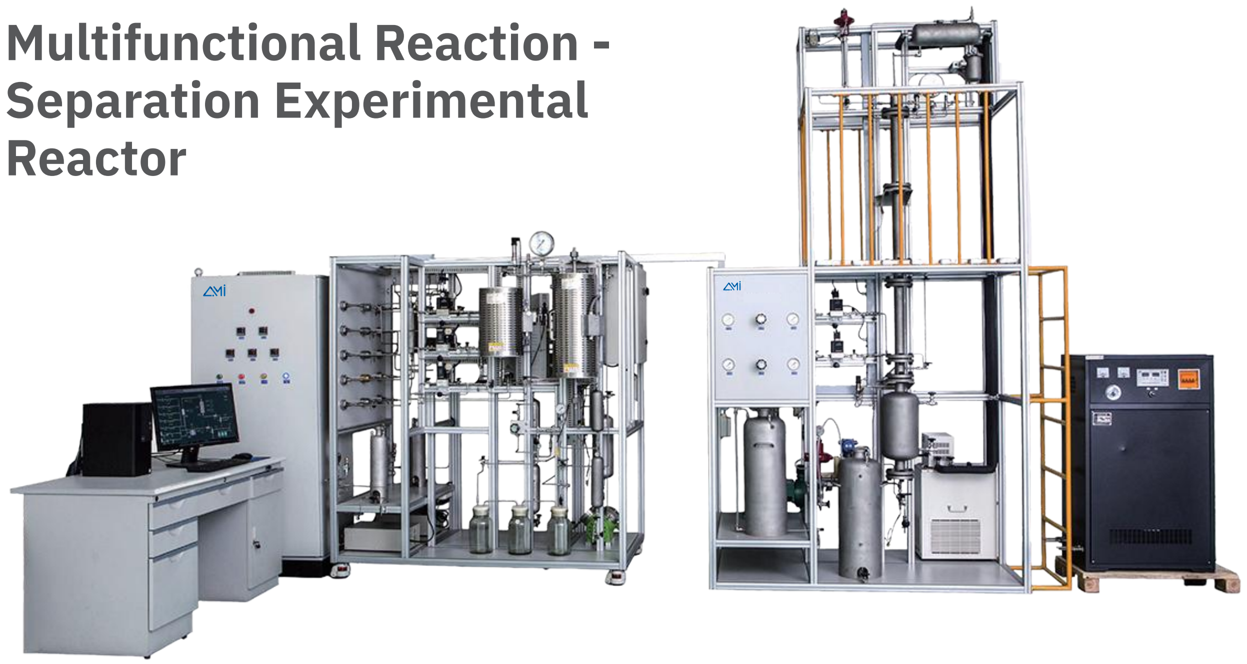
2000ml Trickle - Bed Catalyst Evaluation Reactor

059

Gas - Solid Phase Fixed -Bed Catalyst Evaluation Reactor

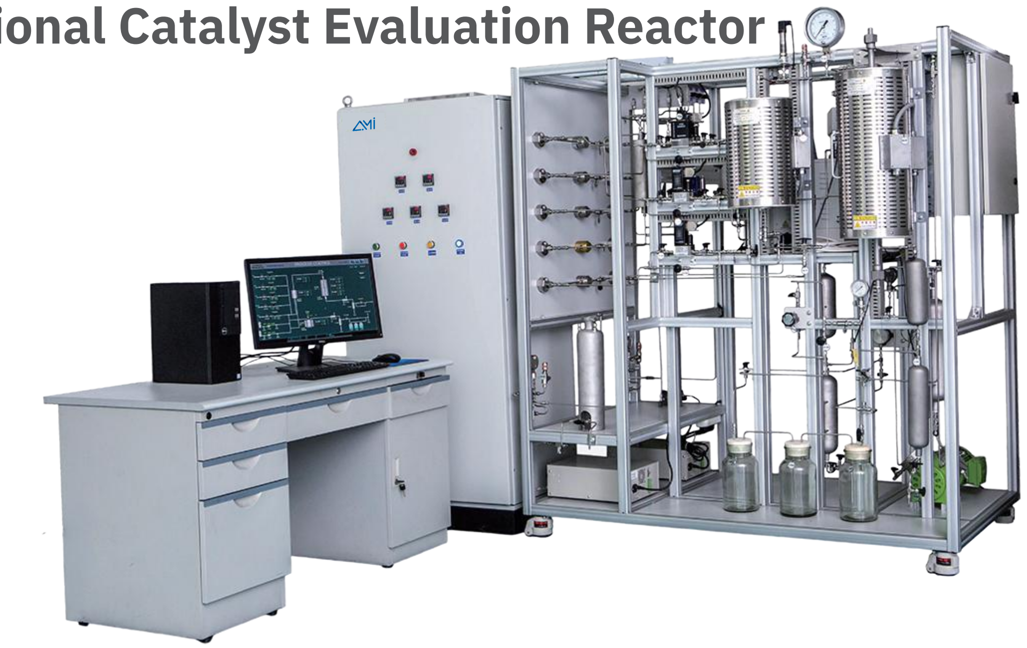
060

Multifunctional Reaction - Separation Experimental Reactor



063

Multifunctional Catalyst Evaluation Reactor



061

3ml Micro - Reactor Catalyst Evaluation Reactor

062

Multifunctional Fixed - Bed Catalyst Evaluation Reactor

064

Dual - Tube Multifunctional Catalyst Evaluation Reactor

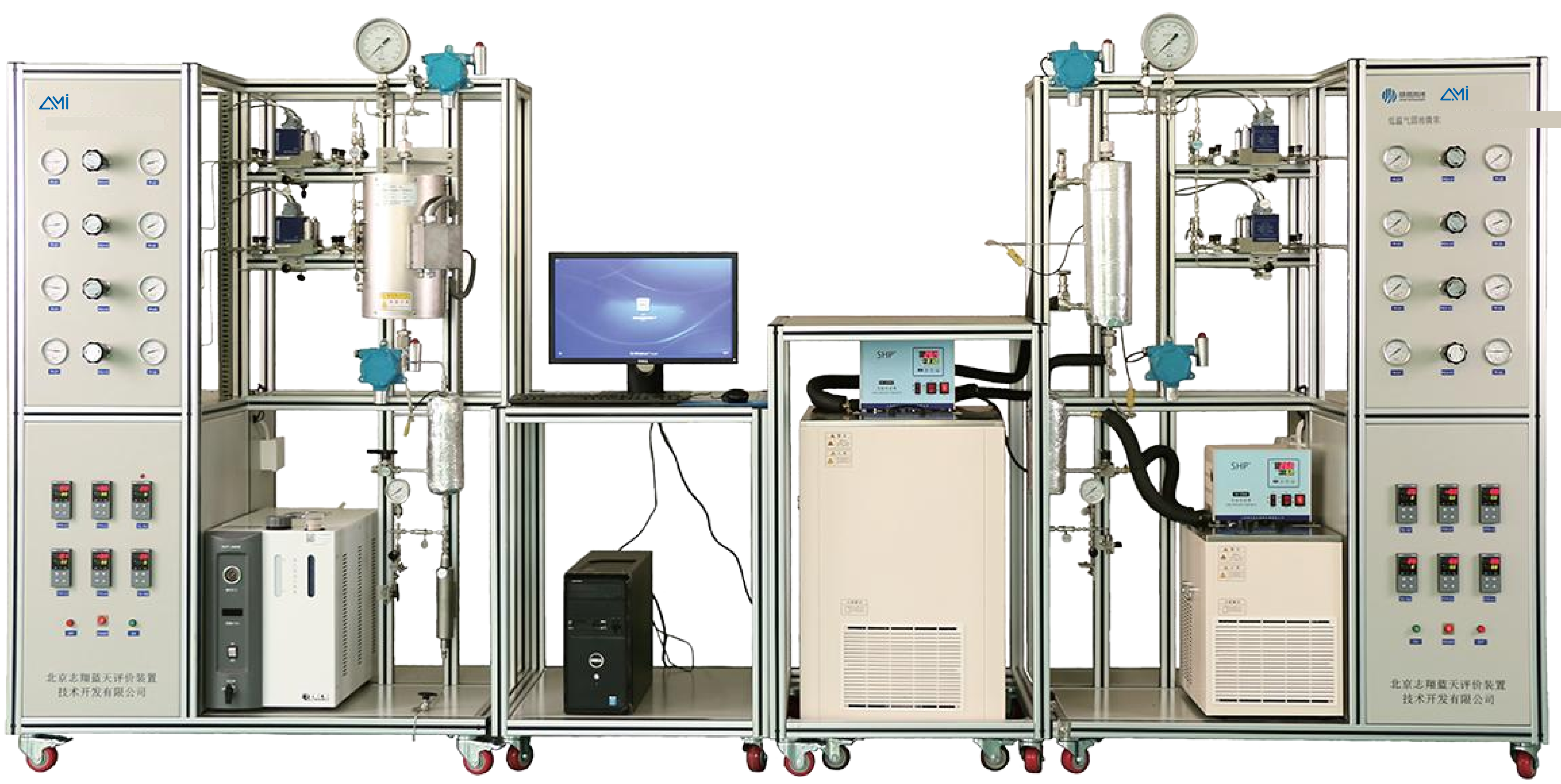
065

Methane - Steam - Carbon Dioxide Double Reforming

066

High - Low Temperature Multifunctional Catalyst Evaluation Reactor

Process Features: The dual - set symmetrical layout of A and B is aesthetically pleasing and practical. Detection equipment (chromatographs, infrared analyzers, mass spectrometers, etc.) can be placed in the middle position for shared testing. On the left side of this device is a high - temperature fixed - bed reactor, which can conduct catalyst evaluation tests under high temperature and high pressure. On the right side is a low - temperature fixed - bed reactor, capable of performing catalyst tests at a minimum temperature of - 80°C. This provides a wider reaction temperature range for laboratories.



067

Mini - Micro Reactor Catalyst Evaluation Reactor

Minimalist Design: Without affecting the reaction results, it saves experimental costs and laboratory space.

068

High - Low Pressure Fixed - Bed Reactor

To meet the high - precision reaction conditions under both high - pressure and low - pressure working conditions, the device adopts a structure with independent high - pressure and low - pressure sections, enabling reactions under the two pressure modes independently. The control system and chromatographic detection system are arranged in the middle, which can better shorten the sampling pipelines to meet the detection requirements of the dual - set setup.

The batch-type photocatalytic reaction device is an experimental apparatus used for studying photocatalytic reactions. Its main features include a batch reactor, a tubular reactor, and a batch reactor design with a large light source system, temperature and pressure control, and real-time monitoring systems. The reactor volume is suitable for small to medium-scale photocatalytic experiments. The light source system can provide light radiation of specific wavelengths and intensities, such as ultraviolet light, visible light, or infrared light, to simulate natural lighting conditions. The temperature and pressure control systems ensure that reactions occur under stable conditions, while the real-time monitoring system records key parameters such as temperature, pressure, and reactant concentration. This device can be applied in fields such as environmental purification, energy conversion, and organic synthesis.

The tubular reactor design is more suitable for the fixed-bed photocatalysis reaction mode and has a wider range of applications.

069

Photocatalytic Reactor

Catalyst Loading	1 ml	
Gas Path 1: Gas Flow Rate	0 ~100 m1/min	±1% FS
Gas Path 2: Gas Flow Rate	0 ~100 m1/min	±1% FS
Gas Path 3: Gas Flow Rate	0 ~100 m1/min	±1% FS
Reaction Pressure	≤3 MPa	±1% FS
Reaction Temperature	≤200° C	±1° C

070

ETC Electrolysis Water Treatment Reactor

In the design of circulating water systems, the ETC electrochemical water processor (electrolytic water processor) is adopted to replace the water softener and dosing device. The main consideration is that the electrolytic water processor utilizes the basic principles of electro chemistry, does not require the addition of chemical agents, and does not cause environmental pollution. This provides experimental data for large-scale cooling industrial applications.

071

SED Electrolysis Experimental Reactor

The SDE electrolysis experimental device is an experimental apparatus used for studying electrolytic reactions. Its name is derived from the abbreviation of "Splitting of Direct Electrolysis". The functions of this device mainly revolve around the electrolysis of water, with a focus on the process of directly electrolyzing water to produce hydrogen, emphasizing the decomposition of water into hydrogen and oxygen.

072

Low - temperature Plasma Experimental Reactor

The discharge principle of a plasma generator: The process of making a gas conductive by applying an external electric field or a high-frequency induced electric field is called gas discharge. Gas discharge is one of the important means of generating plasma. The electrons in partially ionized gas accelerated by the external electric field collide with neutral molecules, transferring the energy obtained from the electric field to the gas. Elastic collisions between electrons and neutral molecules increase the kinetic energy of the molecules, which is manifested as an increase in temperature; while inelastic collisions lead to excitation (electrons in molecules or atoms transition from low energy levels to high energy levels), dissociation (molecules break down into atoms), or ionization (outer electrons of molecules or atoms change from bound states to free electrons). The high-temperature gas transfers energy to the surrounding environment through conduction, convection, and radiation. Under steady-state conditions, the input energy and the lost energy in a given volume are equal.

An important method in electrochemical reactions, the device is equipped with positive and negative electrodes at the inlet and outlet of the reaction tube, and under the action of a low-temperature plasma generator, the catalyst inside the reaction tube undergoes highly efficient reactions under the effect of ionized high-temperature gas.