

PRODUCT MANUAL

产品手册

➤ PRODUCTS

PRODUCTS 产品介绍

Standard Joule Heating Device 焦耳加热装置标准版

High-Throughput Joule Heating Device 高通量焦耳加热装置

High-Throughput Fully Automated Joule Heating Device
高通量全自动焦耳加热装置

TECHNOLOGY AND R&D 技术与研发

Core Technology 核心技术

Technology Partners 技术合作伙伴

TYPICAL CASE 典型案例

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Technological Achievements 技术应用成果

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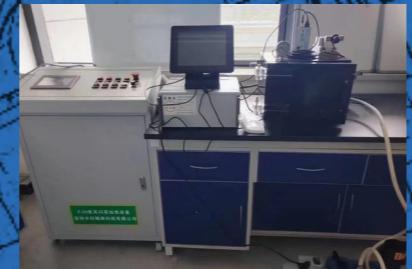
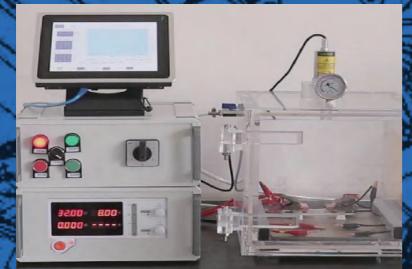
RESEARCH
EXCELLENCE



PRODUCTS

► 产品介绍

STANDARD JOULE HEATING DEVICE 焦耳加热装置标准版



HTS焦耳超快 加热装置

HIGH-TEMPERATURE SHOCK
JOULE HEATING DEVICE

01

HTL焦耳高温 长时加热装置

HIGH-TEMPERATURE LONG-
TIME JOULE HEATING DEVICE

02

FJH焦耳闪蒸 加热装置

FLASH JOULE HEATING
DEVICE

03



HTS焦耳超快 加热装置

HIGH-TEMPERATURE SHOCK
JOULE HEATING DEVICE

设备简介 PRODUCT OVERVIEW

By integrating fast heating with pressure control technology, this device achieves ultra-fast heating within 0 to 10 seconds, producing ultra-fast thermal shock effects. It enables the observation of changes in the material's structure and properties under conditions of extreme temperature variations and intense thermal shock, enabling the ultra-fast synthesis of small molecule nanomaterials.

设备参数 PRODUCT PARAMETERS

Temperature Range:	100-3000°C
Power:	1800W
Electrical Specifications:	220V, 18KW (customizable)
Overall Dimensions:	100×60×60 cm
Sample Diameter:	40mm/30mm/20mm/10mm
Sample Thickness:	Up to 10mm
Temperature Range:	Sample Platform up to 3000°C
Vacuum level:	6×10^-2 Pa
Chamber Operating Mode:	Vacuum, Ambient Inert Gas/Nitrogen Cycle (optional) /Ammonia Cycle (optional) Protection
High-Temperature Sintering Platform:	Copper, Quartz Tube
Temperature Probe:	Infrared Non-Contact, Accuracy ±1% Full Scale
Electrode Material:	Copper
Operating Method:	Touchscreen Operation
Gas Line Specifications:	1 Inlet, 1 Exhaust, 1 Vacuum
Pulse Parameters:	100 pulses/ms
Heating Rate:	Over 20000°C/s

设备优势 ADVANTAGES

- Ultra-fast sintering speed (seconds)
- Sintering time (minutes)
- Strong bonding force, ensuring more secure powder bonding;
- Intelligent temperature range selection(100-3000 segmented measurement)
- Capable of testing 2-4 samples at once
- Sintering Methods: Contact, Thermal Radiation, Sandwich

应用场景 APPLICATIONS

- Carbon materials
- Ceramic materials
- Battery electrodes, solid-state electrolytes, catalytic materials
- Two-dimensional materials, high-entropy materials, MOFs, 3D printing materials
- Metals and composite materials, etc.

样品状态 SAMPLE STATE

- Films
- Powders
- Bulk materials

HTL焦耳高温长时加热装置

HIGH-TEMPERATURE LONG-TIME JOULE HEATING DEVICE

设备简介 PRODUCT OVERVIEW

This device is equipped with a stainless steel vacuum chamber and a chiller, enabling sustained high-temperature operation. Its advantages include simple operation: simply specify the heating and cooling durations, target temperature, and holding time. The device can automatically execute the preset program, featuring six independently controlled temperature zones and adjustable current control stages for precise heating.



FJH焦耳闪蒸加热装置

FLASH JOULE HEATING DEVICE

设备简介 PRODUCT OVERVIEW

The Flash Joule Heating Device utilizes the principle of instantaneous Joule heating impact. With an intelligent control system, it applies current directly to the sample material, allowing for an ultra-fast temperature rise to over 3500K in milliseconds, achieving an ultra-fast thermal shock effect.

设备优势 ADVANTAGES

- Ultra-fast sintering speed(seconds)
- Long sintering time (hours)
- Intelligent temperature range selection(100-3000C segmented measurement)
- Multiple sample testing (sample slot capacity can be expanded and customized)
- Precise temperature control, within 1°C of the target temperature

应用场景 APPLICATION SCENARIO

- Carbon materials
- Ceramic materials
- Battery electrodes, solid-state electrolytes catalytic materials
- Two-dimensional materials, high-entropy materials, MOFs, 3D printing materials
- Metals and composite materials, etc.

样品状态 SAMPLE STATE

- Films
- Powders
- Bulk materials

设备参数 PRODUCT PARAMETERS

Temperature Range:	100-3000°C
Temperature Measurement Accuracy:	±5%
Temperature Measurement Repeatability:	±3%
Chamber Dimensions:	25*25*25cm
AC Power Supply:	14V800A (customizable)
Power Supply Voltage:	380V-50Hz
Power Consumption:	12KWA
Multi-Functional Controller:	Power Indicator, Operation Indicator, Power Control, Electrode Temperature Detection
Touchscreen Computer:	Real-Time Temperature, Voltage, and Current Display; Remote Control; Data Reading and Storage
Remote Control Method:	Working Time/Maximum Temperature/Segmented Control/Programmed Ramp Heating and Cooling
Data Acquisition Interval:	50ms Real-Time Temperature Acquisition
Vacuum Pressure Gauge:	-0.1 - 0 MPa
Vacuum Pump:	Dual-Stage Rotary Vane Pump; Ultimate Pressure: 6×10 ⁻² Pa; Rotation Speed: 1400 rpm
Gas Flow Path:	Pre-Installed Gas Inlet/Outlet Pipelines, Valves, and Connectors
High-Temperature Sintering Stage (Materials):	Red Copper and Graphite
Sintering Duration:	Capable of High-Temperature Sintering for Hours; Equipped with Cooling System
Dimensions and Weight:	70cm (L) × 70cm (W) × 150cm (H); 240 kg

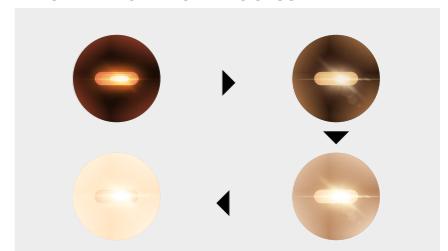
设备参数 PRODUCT PARAMETERS

Temperature Range:	2000K-8000K
Power:	1800W
Electrical Specifications:	220V, 18KW(customizable)
Overall Dimensions:	100*60*60cm
Sample Diameter:	40mm/30mm/20mm/10mm
Sample Thickness:	Up to 10mm
Data Collection Frequency:	1-10kHz
Temperature Range:	Up to 8000K
Vacuum Level:	6×10 ⁻² Pa
Chamber Operating Mode:	Vacuum, Ambient Inert Gas/Nitrogen Cycle (optional)/Ammonia Cycle (optional)
Flash Sintering Fixtures:	Copper, Quartz Tube
Temperature Probe:	Infrared Non-Contact, Accuracy ±1% FS
Electrode Material:	Copper
Operating Method:	Touchscreen Operation
Gas Line Specifications:	1 Inlet, 1 Exhaust, 1 Vacuum
Heating Rate:	Over 1000K/ms

设备优势 ADVANTAGES

- Ultra-fast sintering (milliseconds)
- Transient sintering time
- High-precision ultra-high temperature measurement (2000K-8000K)
- Fully automated sintering process without manual intervention, operating based on pre-configured parameters.

闪蒸过程 FLASH EVAPORATION PROCESS



样品状态 SAMPLE STATE

- Powders

HIGH-THROUGHPUT JOULE HEATING DEVICE

高通量焦耳加热装置

【#1适用场景 Applicable Scenarios】

High-throughput technology is an advanced method capable of processing large numbers of samples or data simultaneously, widely applied in scientific research, drug development, gene sequencing, and other fields. Our Joule heating high-throughput technology is suitable for the following scenarios:

Nanoparticle Synthesis: Such as metal alloys, oxides, sulfides, etc.

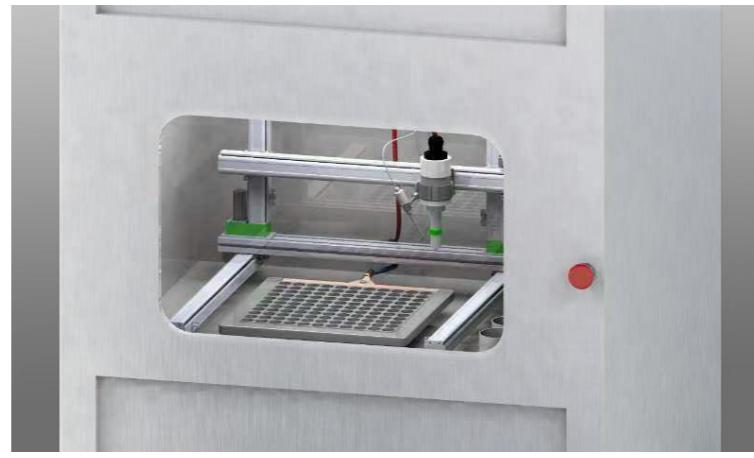
Carbon-Based Nanomaterials: Such as RGO (Reduced Graphene Oxide), CNF (Carbon Nanofibers), CNT (Carbon Nanotubes), biomass-derived carbon materials, etc.

Bulk/Temperature-Sensitive Materials: Such as ceramics, glass, plastics, etc.

Amorphous/Heterojunction Nanomaterials: For various scientific research applications.

Battery and Catalyst Applications: Including lithium/sodium batteries, CO reduction, water splitting, etc.

Smart Application Fields: Such as ultra-high-temperature heating, thermoelectric conversion, flexible electronic devices, etc.



【#2设备参数 PRODUCT PARAMETERS】

Temperature Measurement Range:	1000K-3000K(customizable)
Temperature Measurement Accuracy:	±5%
Power Supply Voltage:	380V-50Hz (customizable)
Overall Dimensions:	Customizable
Temperature Measurement Repeatability:	±3%
Multifunction Controller:	Power Indication, Operation Indication, Power Control, Electrode Temperature Detection
Data Acquisition Frequency:	1-10kHz
Temperature Range:Sample Platform:	Up to 3000K
Vacuum level:	-0.1-0.1MPa
Chamber Operating Mode:	Vacuum, Ambient Inert Gas/Nitrogen Cycle (optional)/Ammonia Cycle (optional) Protection
Flash Sintering Fixtures:	Copper, Quartz Tube, Graphite
Temperature Probe:	Infrared Non-Contact, Accuracy ±1% FS
Electrode Material:	Copper/Graphite
Operating Method:	Touchscreen Operation
Gas Line Specifications:	1 Inlet, 1 Exhaust, 1 Vacuum

【#3产品价值 PRODUCT VALUE】

Advantages of high-temperature material experimental devices supporting high-throughput capabilities:

1/ Enhanced Experimental Efficiency

Batch Processing: Simultaneously handle multiple samples shortening the experimental cycle.
Rapid Screening: Quickly identify high-quality materials under high-temperature conditions.

2/ Reduced Experimental Costs

Resource Savings: Reduce energy and raw material consumption per sample.
Increased Equipment Utilization: Efficiently complete more experimental tasks, improving economic benefits.

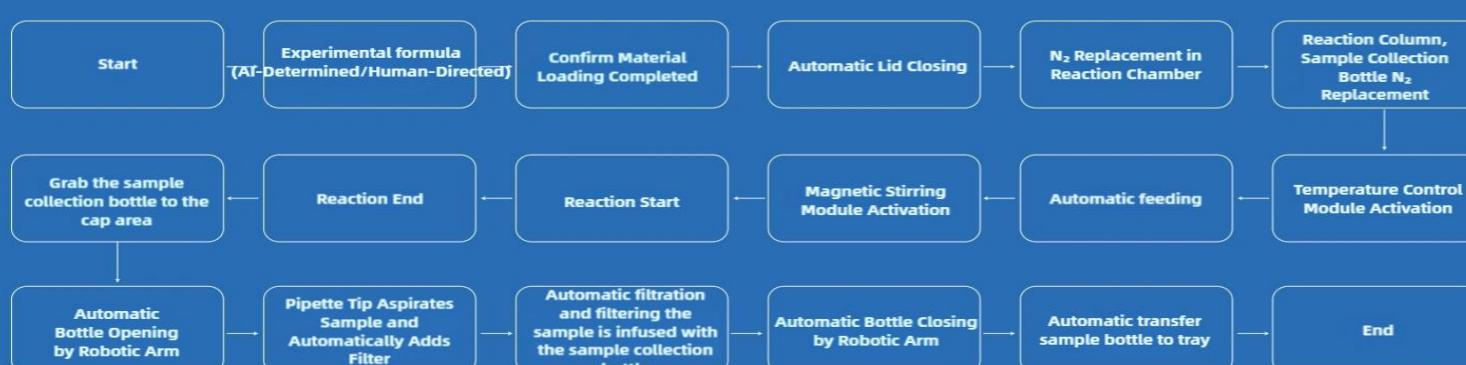
3/ Diverse Material Combinations

Prepare samples with various components and structures expanding material application areas and promoting industry development.



【#1应用场景 APPLICATIONS】

Suitable for all experimental environments requiring Joule heating for sample preparation, mass production, or long-term manual processing.



【#2设备参数 PRODUCT PARAMETERS】

Temperature Measurement Range:	1000K-3000K(customizable)
Temperature Measurement Accuracy:	±5%
Power Supply Voltage:	380V-50Hz (customizable)
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Electrode Material:	Copper/Graphite
Operating Method:	Touchscreen Operation
Gas Line Specifications:	1 Inlet, 1 Exhaust, 1 Vacuum

【#3产品价值 PRODUCT VALUE】

Advantages of high-temperature material experimental devices supporting high-throughput capabilities:

1/ Improved experimental efficiency and production capacity

Batch processing capability: Simultaneous processing of multiple samples significantly improves testing and analysis efficiency, shortening the experimental cycle.

Automated process: Full automation reduces manual intervention, avoids errors and delays, and can operate 24 hours a day, improving production capacity.

2/ Reduced experimental costs and human resource consumption

Resource conservation: Reduces energy and raw material consumption for individual samples, lowering experimental costs.

Reduced manpower: Automated operation reduces reliance on experimental personnel, allowing more time for result analysis and research.

3/ Improved data quality and experimental accuracy

Standardized operation: Full automation follows standardized procedures, reducing human error and improving data reliability and consistency.

Real-time monitoring and adjustment: Equipped with real-time monitoring and feedback mechanisms to adjust the experimental process in a timely manner and ensure the accuracy and precision of results.

4/ Enhanced experimental safety

Emergency handling: Equipped with emergency handling mechanisms to take prompt measures in abnormal situations, ensuring the safety of equipment and personnel.

Reduced safety hazards: Reduces direct contact between experimental personnel and high-temperature environments, lowering the risk of fire, explosion, and other safety hazards.

TECHNOLOGY AND R&D

➤ 技术与研发



CORE TECHNOLOGY 核心技术

Joule high-temperature heating technology, particularly flash Joule heating and rapid Joule heating, represents a significant innovation in the field of materials science. With its unparalleled heating speed and precise temperature control, this technology offers a new perspective for material preparation and performance research.

This technology is based on Joule's Law, utilizing the resistive heat generated by high current to rapidly elevate the temperature of materials within an extremely short timeframe, even capable of heating materials to ultra-high temperatures of 3000 – 4000°C within 1 second. Such an extreme temperature change offers unprecedented possibilities for material synthesis and processing. Joule high-temperature heating technology significantly outperforms conventional heating methods, such as muffle furnaces and tube furnaces, with a heating rate that far exceeds that of traditional heating devices.

焦耳高温加热技术的显著优势

SIGNIFICANT ADVANTAGES OF JOULE HIGH TEMPERATURE HEATING TECHNOLOGY

Ultrafast heating rate

Joule heating technology can achieve extremely fast heating rates, thereby reducing thermal damage and thermal stress to materials during the heating process.

High-precision temperature control

Joule heating technology offers high-precision temperature control, which is crucial for precisely managing the thermal treatment conditions during material synthesis processes.

Ultrafast heating rate

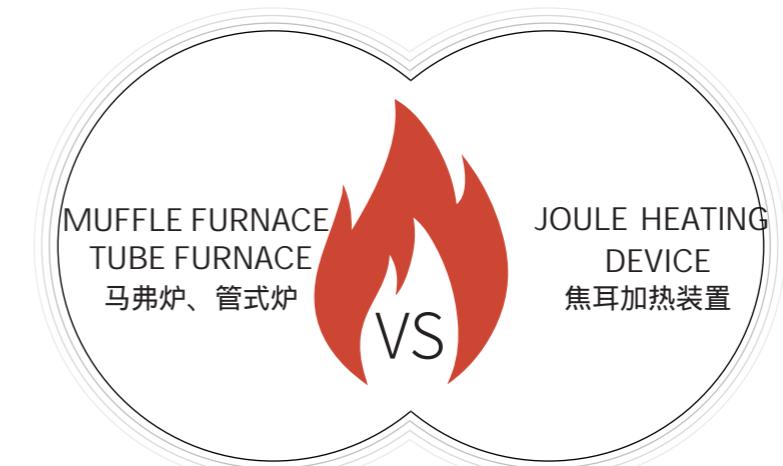
Due to the rapid heating rate, Joule heating technology exhibits minimal energy loss and achieves higher energy conversion efficiency.

Facilitating Non-Equilibrium Processes

Joule heating technology can achieve extremely fast heating rates, thereby reducing thermal damage and thermal stress to materials during the heating process.

Ultrafast heating rate

The high controllability of Joule heating technology ensures good experimental reproducibility, avoiding the reproducibility issues caused by imprecise temperature control or inconsistent heating rates in conventional heating methods.



Conventional high-temperature preparation methods

High-Temperature Shock Technology

Generally 1500 °C	Maximum temperature	3000°C
10 minutes-10 hours	Heating and cooling rates (3000°C/s)	1 second
Impurities and instability	Material properties	Ultrafine, uniform, and stable
High energy consumption and pollution	Energy consumption and environmental impact	Low energy consumption and reduced pollutant emissions
Limited application scope	Application scope	Suitable for most materials
Not scalable for large-scale operations	Synthetic efficiency	Scalable for large-scale operations
Time-consuming and labor-intensive	Experimental process	Time-efficient and labor-saving

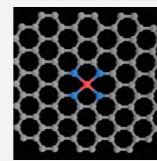
APPLIED RESEARCH OUTCOMES

技术应用成果

【#1材料研究 MATERIALS RESEARCH】

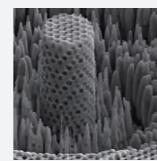
SINGLE ATOM 单原子

Flash-Thermal Shock Synthesis of Single Atoms in Ambient Air
 Ultrafast Joule heating synthesis of hierarchically porous graphene-based Co-N-C single-atom monoliths
 High temperature shockwave stabilized single atoms



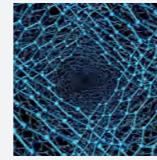
NANOMATERIALS 纳米材料

Ultrafast synthesis of Mo₂N with highly dispersed Ru for efficient alkaline hydrogen evolution
 Recent advances in Joule-heating synthesis of functional nanomaterials for photo and electrocatalysis



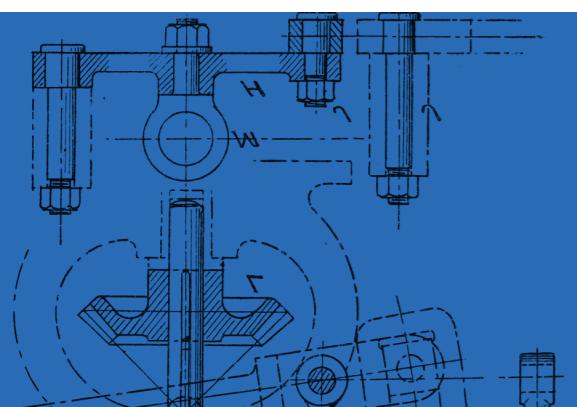
METALLIC GLASS NANOMATERIALS 金属玻璃纳米材料

Kinetically Controlled Synthesis of Metallic Glass Nanoparticles with Expanded Composition Space



HIGH-ENTROPY ALLOYS 高熵材料

Ultra-Small High-Entropy Alloy as Multi-Functional Catalyst for Ammonia Based Fuel Cells
 Scalable Synthesis of High Entropy Alloy Nanoparticles by Microwave Heating



【#2功能材料 FUNCTIONAL MATERIAL】

BATTERY CATHODE AND ANODE MATERIALS ANODE AND CATHODE MATERIALS FOR BATTERIES

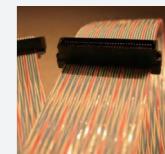
电池正负极材料

Ultrafast Dual-Shock Chemistry Synthesis of Ordered/Disordered Hybrid Carbon Anodes: High-Rate Performance of Li-ion Batteries
 A graphene-like hollow sphere anode for lithium-ion batteries
 Ultrarapid Nanomanufacturing of High-Quality Bimetallic Anode Library toward Stable Potassium-Ion Storage



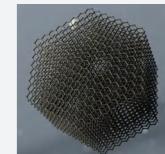
ENERGY STORAGE MATERIALS 储能材料

Enhancing electrochemical performance through swift functional group tuning of MXenes
 Rapid and Up-Scalable Flash Fabrication of Graphitic Carbon Nanocages for Robust Potassium Storage



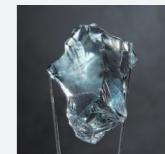
GRAPHENE 石墨烯

Gram-scale bottom-up flash graphene synthesis



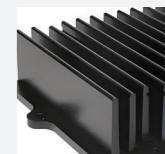
LIQUID METAL/DIAMOND 液态金属/金刚石

Growth of diamond in liquid metal at 1 atm pressure



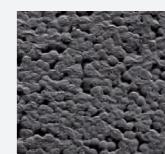
METAL OXIDE ANODES 金属氧化物阳极

In Situ Flash Synthesis of Ultra-High-Performance Metal Oxide Anode through Shunting Current-Based Electrothermal Shock



FUNCTIONAL FILMS 功能薄膜

Rapid Li compensation toward highly conductive solid state electrolyte film
 Joule heat enabled efficient In-situ regeneration of carbon nanotubes as model adsorbents

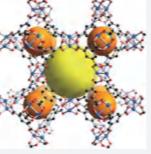
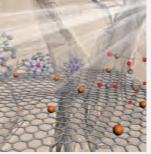
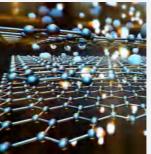


ELECTRODE MATERIALS 电极材料

Programmable Wet-Interfacial Joule Heating to Rapidly Synthesize Metastable Protohematite Photoanodes: Metal and Lattice Oxygen Dual Sites for Improving Water Oxidation



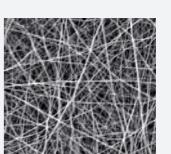
【#3催化与环保 CATALYSIS AND ENVIRONMENTAL PROTECTION】

CATALYSTS 催化剂	Asymmetric active sites originate from high-entropy metal selenides by joule heating to boost electrocatalytic water oxidation Ultrafast Joule heating synthesis of hierarchically porous graphene-based Co-N-C single-atom monoliths	
SYNTHESIS OF NANOMATERIALS AND PHOTO/ELECTROCATALYTIC APPLICATIONS 纳米材料合成及光/电催化应用	Recent advances in Joule-heating synthesis of functional nanomaterials for photo and electrocatalysis	
PHOTOCATALYTIC MATERIALS 光催化材料	ZnO:CuO Composites Obtained by Rapid Joule Heating for Photocatalysis	
ENVIRONMENTAL REMEDIATION 环境治理	Joule Heating Induced Reductive Iron – Magnesium Bimetallic Nanocomposite for Eminent Heavy Metal Removal Electrothermal mineralization of per- and polyfluoroalkyl substances for soil remediation	
WATER TREATMENT FUNCTIONAL MATERIALS 水处理功能材料	Mn doping improves in-situ H ₂ O ₂ generation and activation in electro-Fenton process by Fe/Mn@CC cathode using high-temperature shock technique Joule Heating-Induced Active MgO into Nano-Mg Composites for Boosted Oxidation and Antiviral Performance	
OIL-WATER SEPARATION FUNCTIONAL MATERIALS 油水分离功能材料	Joule Heating-Assisted Crude Oil Purification by a Poly(pyrrole)-Modified Microfibril Cellulose Membrane	
SOLID WASTE TREATMENT 固废处理	Nondestructive flash cathode recycling Recycling polyolefin plastic waste at short contact times via rapid joule heating Ultra-fast, low-cost, and green regeneration of graphite anode using flash joule heating method	

【#4陶瓷与超硬材料 CERAMICS AND SUPERHARD MATERIALS】

CERAMIC MATERIALS 陶瓷材料	Flash Joule Heating-Boro/Carbothermal Reduction (FJH-BCTR): An approach for the instantaneous synthesis of transition metal diborides Synthesizing Functional Ceramic Powders for Solid Oxide Cells in Minutes through Thermal Shock	
SUPERHARD MATERIALS AND PRODUCTS 超硬材料及制品	High-surface-area corundum nanoparticles by resistive hotspot-induced phase transformation	

【#5金属与表面工程 METAL AND SURFACE ENGINEERING】

MATERIALS SURFACE ENGINEERING 材料表面工程	Managing Interfacial Defects and Carriers by Synergistic Modulation of Functional Groups and Spatial Conformation for High-Performance Perovskite Photovoltaics based on Vacuum Flash Method.	
METAL SURFACE ENGINEERING AND COATING PROTECTION TECHNOLOGY 金属表面工程与涂层防护技术	Fe ₂ Al ₅ formation in the cold-sprayed Al coatings on steel by ultra-fast Joule heating	
ADVANCED MATERIALS JOINING TECHNOLOGY 先进材料连接技术	Ultrafast high-temperature joining of Ti ₃ SiC ₂ using FeCoCrNiCu high-entropy alloy via thermal shock Carbon Welding by Ultrafast Joule Heating	
3D PRINTING AND ADDITIVE MANUFACTURING TECHNOLOGY 3d打印与增材制造技术	Thermal Shock Synthesis of Nanocatalyst by 3D-Printed Miniaturized Reactors	



【#6复合材料与力学 COMPOSITES AND MECHANICS】

Contact Us

Email: researchcloud.xumi@gmail.com

METAL MATRIX COMPOSITES
金属基复合材料

Millisecond self-heating and quenching synthesis of Fe/carbon nanocomposite for superior reductive remediation



MATERIAL FATIGUE
AND FRACTURE
材料疲劳与断裂

Carbon nanotube films with ultrahigh thermal-shock and thermal-shock-fatigue resistance characterized by ultra-fast ascending shock testing

