Nanomaterial Photocatalytic Hydrogen Production System

HydroTech-X1000

The **HydroTech-X1000** is an all-in-one, modular research platform designed for advanced **hydrogen production**, **nanomaterial development**, and **photoelectrochemical (PEC) characterization**.

This system integrates materials synthesis, photoreactor illumination, electrochemical performance evaluation, and hydrogen generation diagnostics into a single unified instrument.

The HydroTech-X1000 is optimized for **metal oxide nanomaterials**, **photocatalysis**, and **PEC water splitting** applications, offering complete control over synthesis conditions, light exposure, and electrochemical behavior.

System includes

1. Ultrasonic Nanomaterial Processing Module

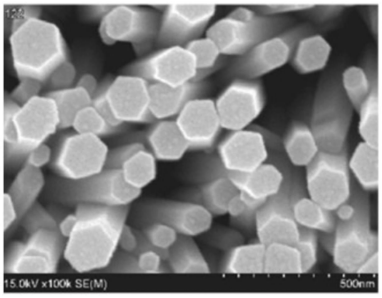
- High-power ultrasonic sonicator
- Enables nanoparticle dispersion, exfoliation, nanocomposite formation
- Adjustable amplitude and pulsed operation

System should have the following specificaitons
1. The sonicator must automatically control power according to its resonance point.
2. The sonicator must homogenize with electromagnetic waves.
3. The total operating time must be 99 hours.
4. It must have an operating time indicator.
5. It must have an On/Off Pulse Timer. The timer must be set from 1 second to 99 minutes.
6. The probe amplitude must be adjusted with an automatic amplitude adjuster.
7. It must have overload/overtemperature protection.
8. The sonicator must emit a wave at a frequency of 22.7 kHz.
9. The probe diameter must be 6 mm.
10. The sonicator power must be 150 W.
11. The sonicator must move the probe with a micropositioner between -Z and +Z.
12. The sonicator size must be 1 cm.
13. Power regulation must be between 0-100% in 5% steps.
14. The device's modes must be pulse and continuous.
15. Timing function: LCD display, adjustable from 1s to 99h.
16. Probe material: Titanium alloy, TI-6AL-4V
17. Probe length: 120mm
18. Processing capacity: 2ml-150ml
23. Lifting table material: Stainless steel and 100×100mm.
24. Ambient Temperature: 0 - 40°C
25. Energy converter temperature: 0 - 105°C.
26. CE certification is required, and the CE certification must be submitted upon delivery.
27. The device must be a domestic product and have an industrial registry certificate.
28. ISO9001:2015 certification

2. Nanomaterial Production System

- Hydrothermal/solvothermal reactor
- Temperature range: 25–250 °C
- Pressure-resistant chamber for controlled nanomaterial synthesis

- Ideal for metal oxide nanoparticle production



System should have the following specificaitons

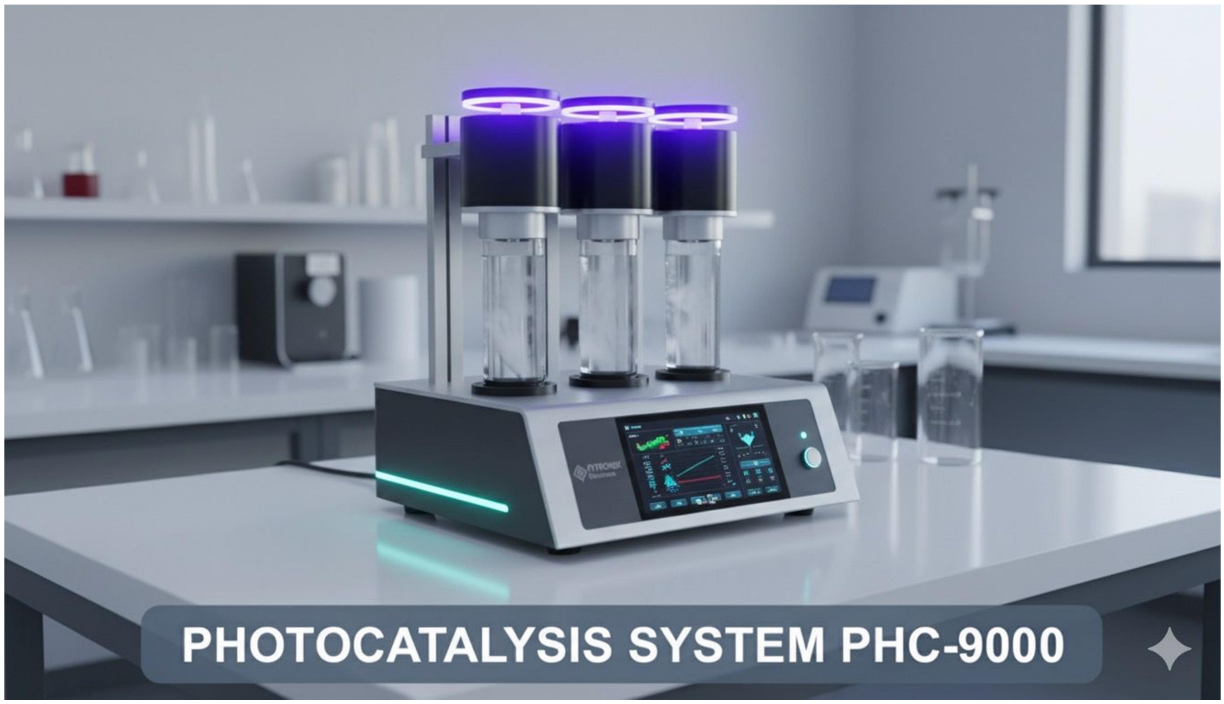
1. System must be made of stainless steel.
2. The system must have a 7-inch touchscreen.
3. The system must consist of a touchscreen-controlled temperature control unit and a high-pressure unit.
4. The maximum temperature must be 250°C.
5. The reactor volume must be 500 ml.
6. The temperature must be controlled with a digital temperature controller.
7. The system must be capable of single-step and multi-step heating.
In a single heating process, the Start temperature, Stop temperature, and heating rate must be entered on the touchscreen.
In a multi-heating process, the device must be able to be set to at least 5 different temperatures simultaneously.
The device must have a start/stop button on the screen.
8. It must be capable of producing with 5-step reaction temperatures and reaction times.
9. The device must automatically shut down when the system completes production.
10. The device must automatically change its internal pressure. The device must be able to automatically adjust its internal pressure to 5 different pressures.
11. The device must produce based on the reaction temperature and be able to automatically adjust the reaction temperature.
12. The device must be capable of producing powdered and activated carbon materials.
13. The device must be capable of film coating based on production conditions.
14. The device must produce coating based on the heating rate. The device must have a heating rate that can be adjusted to the desired value on the device screen.
15. A total of three sample holders must be included with the device.
16. The device must have a green FKM Viton temperature seal, and 10 FKM high-temperature seals must be included with the system.
17. The system pressure must also be externally controllable.
18. The pressure gauge must be digital. Internal pressure must be measured in psi, bar, MPa, and kg/cm2.
19. An industrial registration certificate must be present.
20. The device must have a capacity report.

21. The device must be able to read up to 25 MPa. The maximum operating pressure of the device must be 250 bar. 22. The device must have ISO 9001:2015 and CE certificates.

3. LED Solar Simulator

- Three outputs for photocatalytic applicaitons
- Outputs:
- UV range: 320- 365 nm
- Visible range: 400- 700 nm
- Sun spectrum range: 400-1100 nm
- Full-spectrum LED illumination
- AM 1.5G calibrated solar output
- System automaticaly control spectrum to match AM1.5
- Illumination Area: 40 mm
- Adjustable intensity: 0.1–2 Sun


FYTRONIX®
FYTRONIX® Original FULL AUTOMATIC SOLAR SIMULATOR



Housing is designed according to specifications

4. Quartz Reaction Cell / PEC Cell

- Optical-grade quartz chamber
- Compatible with photocatalytic suspension experiments
- PEC cell with three-electrode configuration
- Suitable for thin-film coated electrodes (FTO, ITO)

5. Electrode Kit

- **FTO conductive glass electrodes**
- **ITO electrodes**
- **Platinum wire counter-electrode**
- All electrodes designed for PEC and electrochemical water splitting.

6. Precision Magnetic Stirring System

- Integrated magnetic stirrer
- Variable speed control

- Ensures homogeneous catalyst dispersion inside the reaction cell

7. Advanced Cyclic Voltammetry (CV) Analyzer

- Integrated potentiostat
- Voltage range: −8.5.0 V to +8.5.0 V
- Scan rate: 1–50 mV/s
- Evaluates redox behavior and catalytic activity
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7.1 Electrochemical Impedance Spectroscopy (EIS) M

- Frequency range: 150 μHz – 1 MHz
- Capable of Nyquist, Bode, and Mott-Schottky analysis
- Measures charge-transport properties
- Essential for PEC hydrogen production analysis
- System simultaneously measure , Z|, |Y|, θ, Rp, Rs G, X, B, Cp, Cs, Lp, Ls, D (tanδ) parameters as a function of frequency
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- System includes
- 1 Cyclic voltammetry
- 1 EIS analyzer
- 1 Dummy cell for CV measurements
- 1 Dummy cell for EIS measurements give two Cole –Cole plots
- Required Connectors
- Software

Key Features

- Fully integrated photocatalytic + electrochemical system
- Enables hydrogen evolution studies under controlled illumination
- Supports both powder photocatalysts and thin-film electrodes
- Real-time monitoring of current, voltage, impedance, and light intensity
- Modular design allows future expansion (GC gas analysis, temperature control, etc.)

Application Areas

- Photocatalytic hydrogen evolution
- Photoelectrochemical (PEC) water splitting
- Metal oxide semiconductor research
- Nanomaterial synthesis and characterization
- Renewable energy materials development
- Catalytic reaction mechanism studies

Technical Advantages

- One device replaces 8 separate laboratory instruments
- Reduces lab footprint and complexity
- Improves experiment consistency and reproducibility

- Ideal for university research labs, renewable energy centers, and R&D units

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HydroTech-X1000 Integrated Photocatalytic Hydrogen Production & Electrochemical Analysis System combines:

- Ultrasonic Sonicator
- Nanomaterial Production System
- LED Solar Simulator
- Quartz / PEC Reaction Cell
- Electrode Kit (FTO, ITO, Pt)
- Magnetic Stirrer
- Cyclic Voltammetry
- Electrochemical Impedance Spectroscopy

into one powerful, unified hydrogen production research platform.