CO_2 Reduction
Electrolyzer Cells & Workstations

Research hardware for catalyst screening, membrane studies and system development. Select a divided flow cell, a titanium zero-gap electrolyzer or an integrated CO_2RR workstation, with configurations built around your experiment.

CF SERIES / GAS DIFFUSION FLOW CELL (3 ELECTRODE CONFIGURATION)

Quartz window options


CF-A

Transparent PMMA

Observe the flow field, bubbles and electrolyte through the clear body.


CF-T

PTFE body

Dedicated gas, liquid and electrode ports in an opaque PTFE body.


CF-K

PEEK body

Alternative body material in the modular divided-cell family.

Gas diffusion

CO_2 is fed to the rear face of the catalyst-coated GDE.

Divided liquid circuits

Independent anolyte and catholyte circulation across a membrane.

Research access

Reference and counter-electrode ports for three-electrode studies.

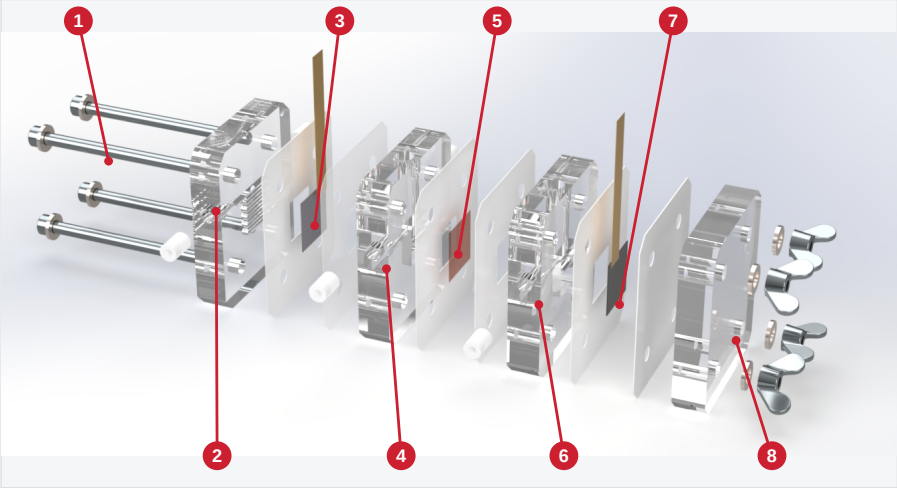
CONFIGURATION RANGE

PARAMETER	CONFIGURATION
Working dimensions	1 × 1; 2 × 2; 3 × 3; 5 × 5; 10 × 10 cm
Geometric active area	1, 4, 9, 25 or 100 cm², respectively
Chamber volume	1.5-250 mL per liquid chamber; configuration dependent
Flow-channel options	Serpentine / parallel / interdigitated / customized
Electrical interfaces	Gold-plated Cu collectors; Ag/AgCl reference and Pt spring counter-electrode options

Configure your own cell. Choose body, active area, chamber volume, flow pattern, membrane and fittings. Model code: **CF-[body]-[area in cm²]**; **CF-T-25** identifies a PTFE cell with a 5 × 5 cm working area. Wetted materials and seals are matched to the selected chemistry.

Built for controlled CO_2RR experiments

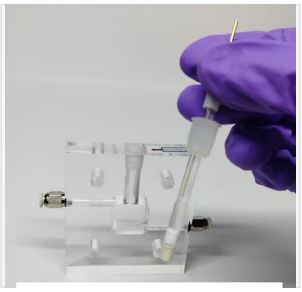
CELL CONSTRUCTION



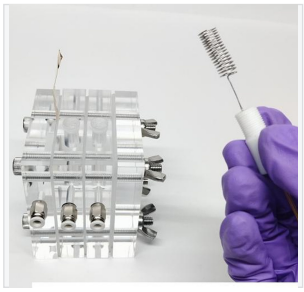
Representative PMMA assembly. White sealing layers sit between interfaces; seal material, thickness and compression are matched to the configuration.

1. **Tie bolts**
   Clamp the complete assembly.
2. **Gas flow-field plate**
   Feeds the rear face of the GDE.
3. **Cathode + collector**
   GDE at the working-electrode side.
4. **Catholyte chamber**
   Liquid inlet and return.
5. **Ion-exchange membrane**
   Separates the liquid circuits.
6. **Anolyte chamber**
   Independent liquid circulation.
7. **Anode + collector**
   Opposing electrode interface.
8. **End plate + wing nuts**
   Closes the compression stack.

ELECTRODE FITTING



Ag/AgCl reference
Fitted through the dedicated catholyte-side port.



Pt spring counter
Fitted through the anolyte-side port.

Three-electrode configuration
Working lead to the cathode collector; reference lead to Ag/AgCl; counter lead to the Pt spring. The selected counter electrode carries the anodic current.

FLOW CELL UNDER TEST



PMMA flow cell connected to dual electrolyte loops and a potentiostat / galvanostat.

1. **Flow cell**
2. **Potentiostat / galvanostat**
3. **Circulation pumps**
4. **Catholyte reservoir**
5. **Anolyte reservoir**

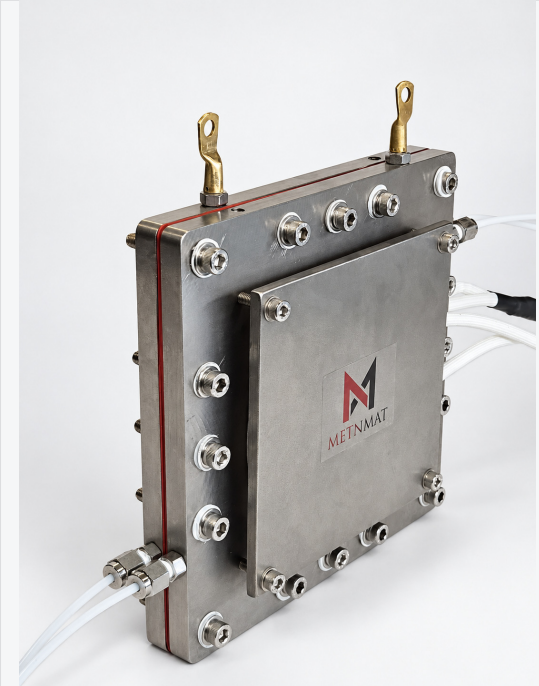
CONFIGURE THE TEST PACKAGE

Cell & accessories: body assembly, collectors, seals, fasteners and fittings; electrode set, pumps and reservoirs to suit the selected package.
Analysis: optional inline GC for gases; liquid sampling for NMR/HPLC. Catalyst-coated GDEs, membranes, analytical instruments and gas supply are specified separately.

Zero-gap CO_2RR Titanium electrolyzers

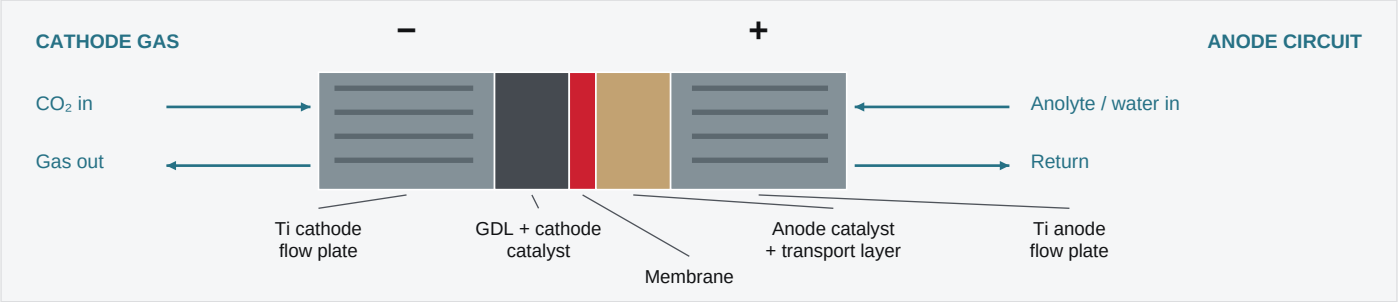
Machined titanium flow-field plates for membrane electrode assembly (MEA) research, from single cells to configured stacks. The cathode catalyst layer interfaces directly with the membrane in a zero-gap MEA.

PARAMETER	CONFIGURATION
Flow-field plates	Titanium
Active dimensions	1 × 1; 2 × 2; 3 × 3; 5 × 5; 10 × 10 cm
Active area	1 / 4 / 9 / 25 / 100 cm²
Architecture	Zero-gap, MEA compatible
Membrane options	AEM / PEM / CEM configurations
Scale-up option	Single cell or multi-cell stack

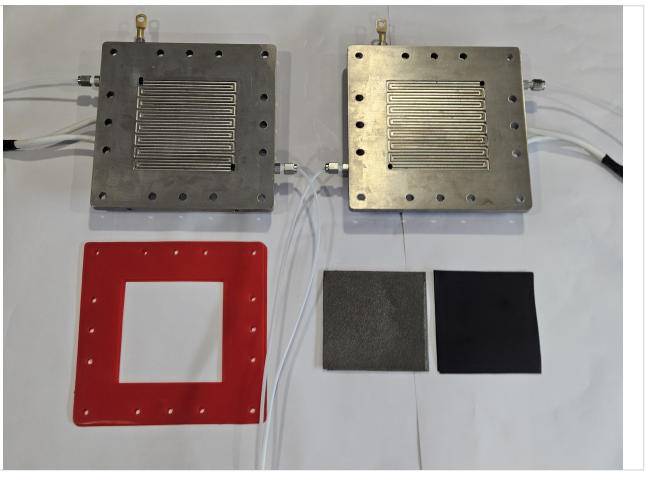


Assembled cell, shown with a studio-treated backdrop. Representative configuration.

MEA ARCHITECTURE



Functional section; not to scale. Peripheral gaskets and clamping hardware omitted.



Titanium flow fields & electrode media
Machined titanium plates with serpentine flow fields, a sealing frame and electrode media, shown before assembly.

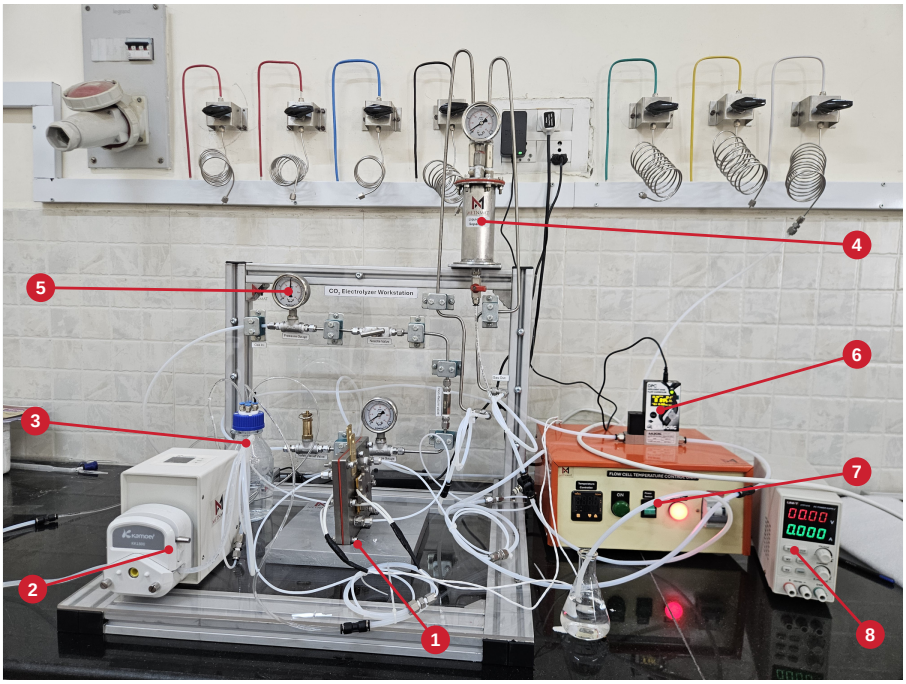
Membrane compatibility
AEM = anion-exchange; CEM = cation-exchange; PEM = proton-conducting CEM. Membrane, catalyst/ionomer, electrolyte, seals and compression are matched together. The CF chamber-volume range does not apply to the zero-gap cathode.

CZ-25: 5 × 5 cm cell. **CZ-25-S5**: example 5-cell stack code. Select cell count, area, membrane package, manifolds and electrical duty for a configured stack quotation.

CO_2RR workstations

COMPLETE TEST SYSTEMS / CONFIGURED AROUND YOUR CELL

CW-B benchtop system or **CW-A** PLC/HMI automation configuration. Integrate an CF flow cell, CZ zero-gap cell or engineered stack with gas, liquid, electrical and analytical equipment.



1. **Zero-gap cell** — Mounted test cell
2. **Peristaltic pump** — Liquid circulation
3. **Liquid vessel** — Connected fluid circuit
4. **Gas-liquid separator** — Phase separation
5. **Gauge & manifold** — Gas routing / indication
6. **Gas control module** — Digital controller
7. **Temperature unit** — Thermal control
8. **DC power supply** — Electrical drive

Actual METNMAT test installation. Photograph shows one equipment package; selected modules define the final supply.

WORKSTATION OPTIONS & INTEGRATION

PARAMETER	CONFIGURATION
Gas & liquid handling	Mass-flow control, optional humidification, circulation pumps, reservoirs, gas-liquid separation and temperature regulation.
PLC & automation	PLC/HMI, recipes, setpoint sequences, alarms and interlocks; I/O and sensors selected for the process.
Data logging	Time-stamped voltage, current, temperature, flow and pressure from connected instruments / fitted sensors; PC export.
Precision power supply	Constant-current / constant-voltage operation; voltage, current, resolution and remote-sense options selected for cell or stack duty.
Existing potentiostat	Integration with your potentiostat / electrochemical workstation, subject to electrical limits, electrode mode and supported interfaces.
Inline GC option	Conditioned gas outlet with GC sampling / bypass; sampling valves, communication and analytical method configured to the analyzer.

Measurement & operation: Gas-phase Faradaic efficiency requires calibrated analysis, outlet gas flow and charge. Pressure, temperature, wetted materials and power ratings are specified for the configuration. Ventilate and route exhaust for gases that may include CO_2, CO and H_2.

Build around your research workflow

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REQUEST QUOTE

From research ideas to working hardware

A configurable hardware platform for electrochemical research, supported by product fabrication, channel machining and application-specific system integration.



Real cells. Multiple configurations.
PMMA and PTFE assemblies with pumps, reservoirs and an electrochemical workstation.



Serpentine channel machining
CNC processing of the flow-field plate. Channel pattern and geometry can be specified for your research design.

Design inputs to discuss
Channel dimensions, active area, port layout, materials and assembly interfaces.

WHY CO_2RR RESEARCH MATTERS

CO_2 electroreduction explores electricity-driven routes to chemical feedstocks such as CO, formate and methanol. It connects carbon utilization with renewable-power pathways and enables systematic study of catalysts, membranes and reactor designs.

Research priorities
Product selectivity and energy efficiency
Mass transport and electrode stability
Reproducible scale-up from cell to system

Research context: U.S. DOE CO_2RUe

METNMAT IN PEER-REVIEWED RESEARCH

Insertion of Indium on Bismuth Sulfide Nanorod Embedded on Graphitic Carbon Nitride for Enhanced Selectivity Toward Formate in Electrochemical CO_2 Reduction

Mukherjee, Mahapatra & Ruidas
ACS Applied Nano Materials (2025)
doi: 10.1021/acsanm.5c04002

Flow-cell fabrication: Section 2.1 credits METNMAT with fabricating the authors' cell and supplying carbon-paper GDL.

Optimizing Cu Doping on Indium Sulfide Supported on Graphitic Carbon Nitride for Enhanced Selectivity toward C1 Products in Electrochemical CO_2 Reduction

Mukherjee et al.
ACS Applied Energy Materials (2026)
doi: 10.1021/acsaem.6c00909

Cells & systems: METNMAT provided gas diffusion flow cells and systems for CO_2RR electrochemical reactions.

Supply details reflect the papers' acknowledgments and METNMAT's confirmation. Results are specific to each study.

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LET'S DISCUSS YOUR DESIGN