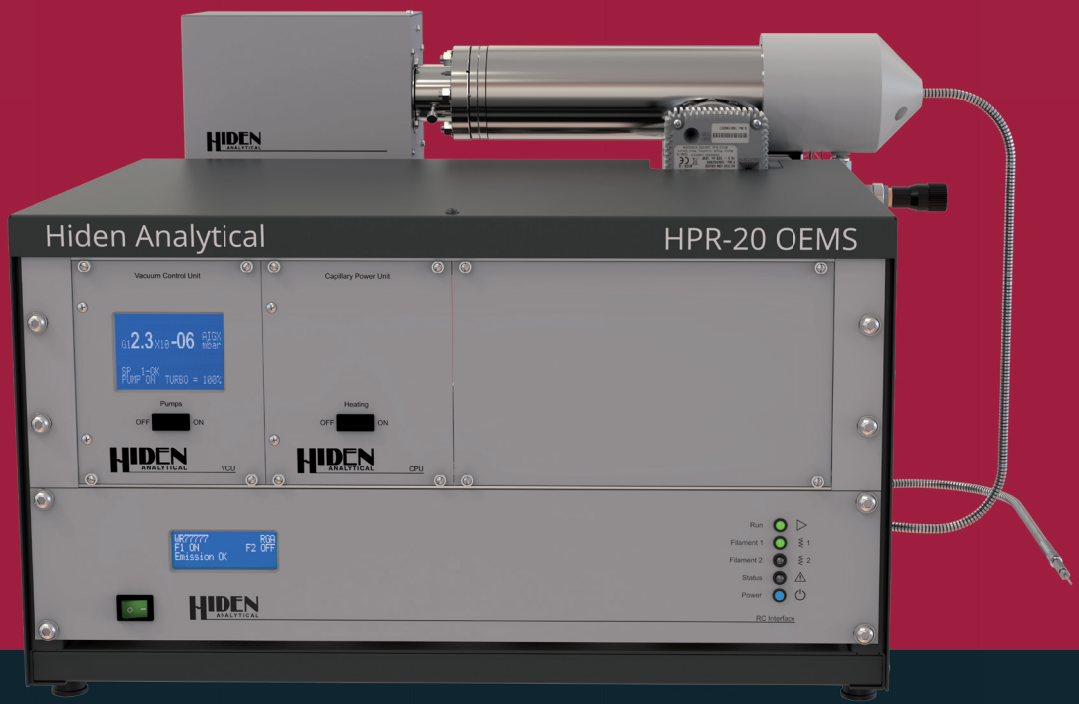
HIDEN ANALYTICAL



HPR-20 OEMS

Online Electrochemical Gas Analyser

Online Electrochemical Mass Spectrometry

Online Electrochemical Mass Spectrometry (OEMS) is a technique for quantifying gaseous and volatile products from electrochemical reactions.

The HPR-20 OEMS provides a range of gas analysis solutions for direct connection to electrochemical cells.

Applications:

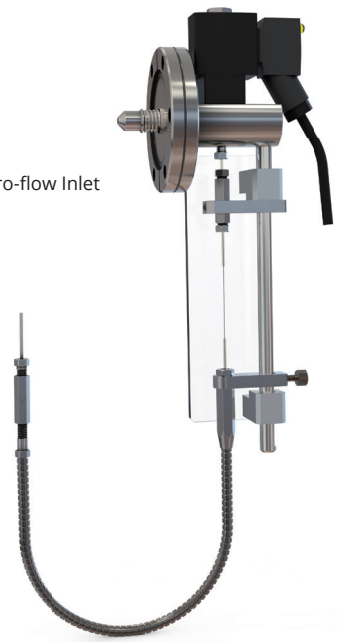
- Lithium Ion Battery Development
- Fuel Cell Research
- Cathode Studies
- Electrochemical Analysis Techniques
- Energy Storage Research
- Alternative Battery Development
- Nitrogen Reduction
- Electrocatalyst Studies
- CO_2 Reduction
- Green Hydrogen
- Oxygen Reduction Reaction

Key Features

- Multiple gas and vapour analysis: 0 – 300 amu mass range option
- Multiple options of gas sample flow rate: 12 µl/min – 16 ml/min
- Continuous sampling heated capillary inlet. Heating dependent on selected flow rate
- Real time, multispecies analysis: detection from 100 ppb – 100%
- Response times as fast as 300 ms
- Fast data acquisition: up to 1000 measurements per second
- Soft ionisation for reduced spectral fragmentation and simplified data interpretation
- Broad range of sampling accessories
- Custom designed interfaces available to suit a wide range of OEMS applications

System Configurations & Options

ITEM	DESCRIPTION	PARTCODE
SYSTEM	HPR-20 OEMS bench-top gas analysis system, including the Ultra-Low Flow (ULF) QIC heated capillary sampling inlet for continuous sampling at low flows. Hiden HAL 201 RC mass spectrometer with Dual Faraday/Channeltron Electron Multiplier. Mass range 200 amu. Includes external scroll pump. QGA 2 & MASsoft Professional included as standard.	**305126**
OPTIONS & ACCESSORIES	Extended mass range. 300 amu mass range (in place of standard 200 amu mass range).	**305021**
	Corrosion resistant upgrade.	**303604**
	Mobile Cart System.	**303715**
	Potentiostat Integration: Cables available for connection to most Potentiostats, allowing trigger start and real time integration of Potential and Current into Hiden software	**270220-22 & 270230**
	EL-Cell PAT cell gas.	**303448**
	Quick Coupling Kit for EL-Cell ECC DEMS cell.	**303444**
GAS INLET OPTIONS	QIC heated flexible capillary inlet, for evolved gas studies with sample flow rates specified from 0.8 ml/min.	**303562**
	Micro-flow capillary inlet, with sample flow rate 12 or 25 µl/min, unheated.	**303452/303456**



QIC Micro-flow Inlet

Ultra-Low Flow (ULF) QIC Heated Capillary Inlet

Example Data

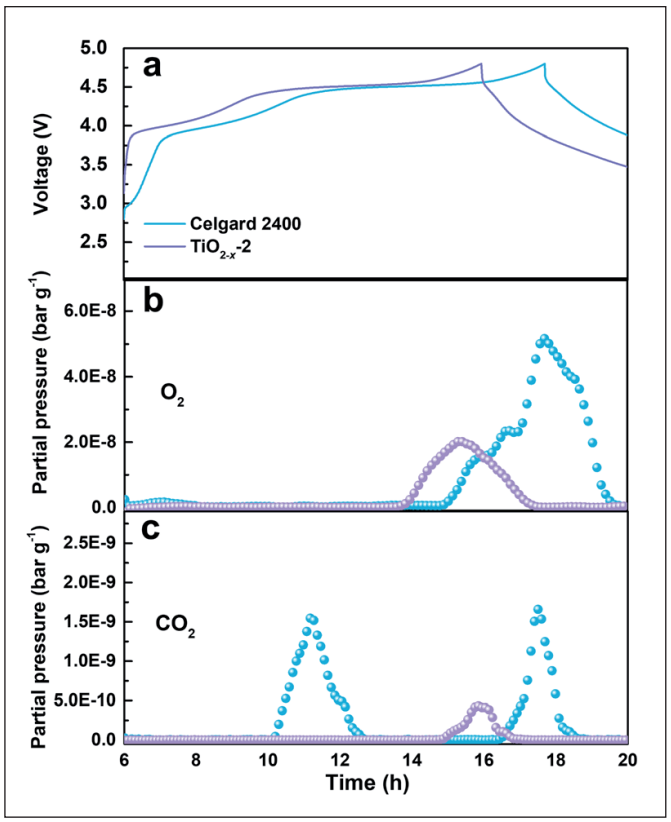


Figure 1. (a) First cycle voltage profiles tested in commercial ECC-DEMS cell at 0.1C with Celgard 2400 separator sample and TiO_{2-x}-coated separator sample in the voltage range of 2–4.8 V and the corresponding (b) O_2 and (c) CO_2 evolution by DEMS analysis.

Reference: RSC Advances (2023) 13, 16850-16859

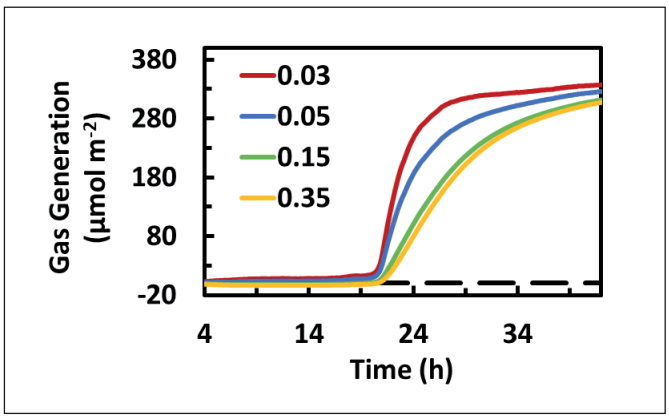


Figure 2. In-situ OEMS data plotted with gas generation from closed-cell measurements of a lithium | LNO half-cell.

Reference: Small Methods (2023) 7, 6, 2201438

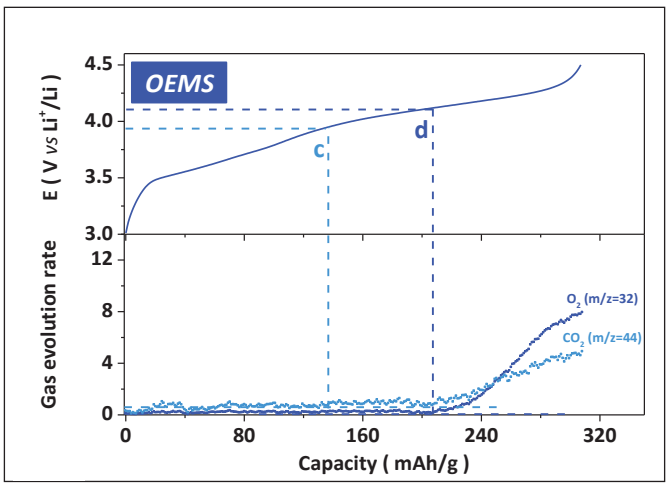


Figure 3. Potential (top panel) and gas evolution rate (bottom panel) as a function of capacity for $Li_2Ru_{0.75}Ti_{0.25}O_3$ measured by OEMS.

Reference: Journal of The Electrochemical Society (2018) 165, A3326

Snapshot OEMS Spectra

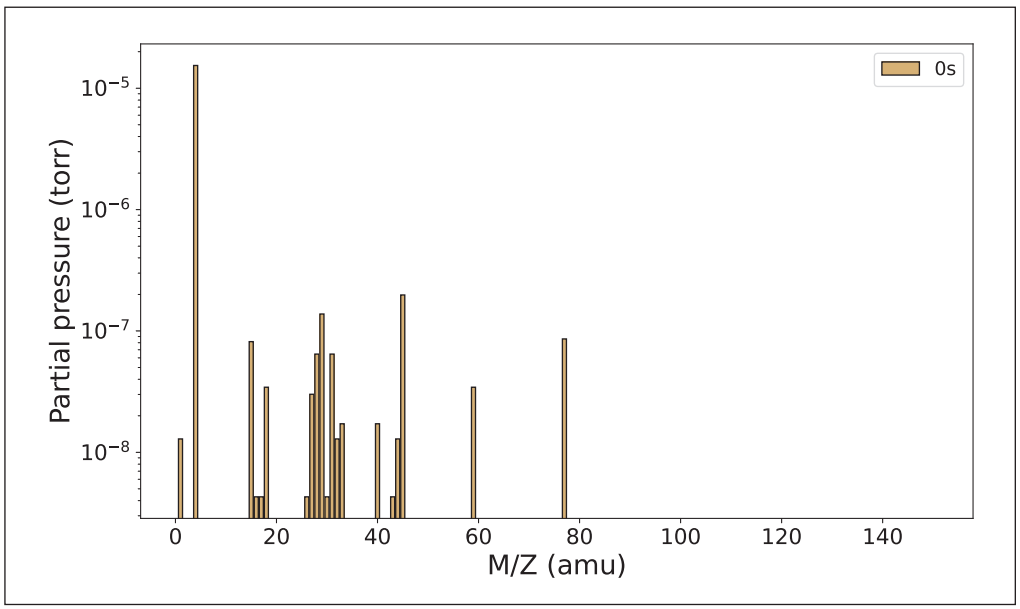


Figure 4. Snapshot OEMS spectrum taken at the beginning of a potentiostatic experiment.

Reference: Journal of the American Chemical Society (2023) 145, 22, 12181–12192

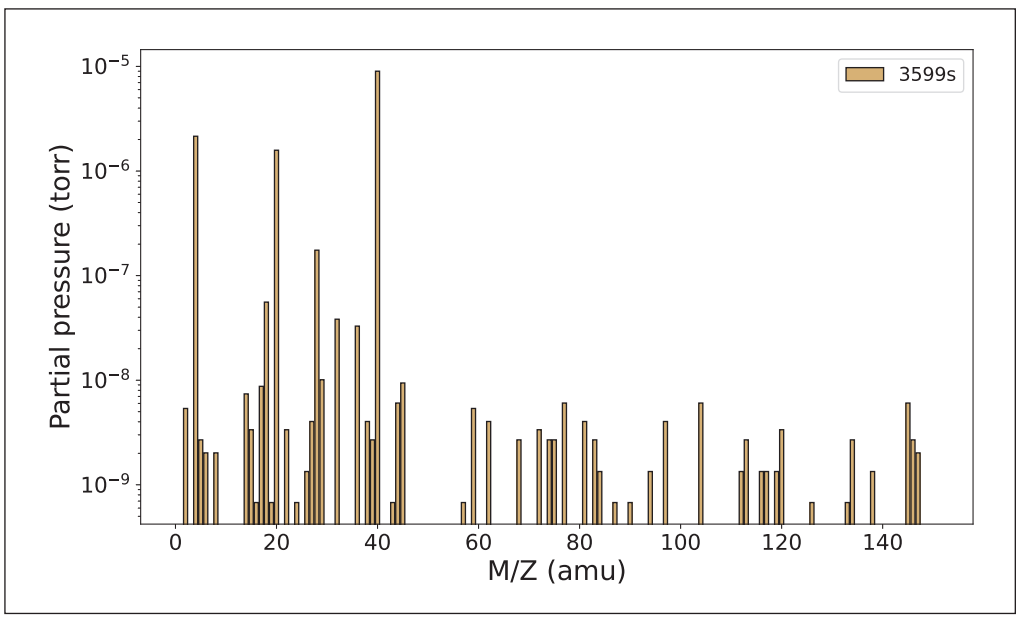
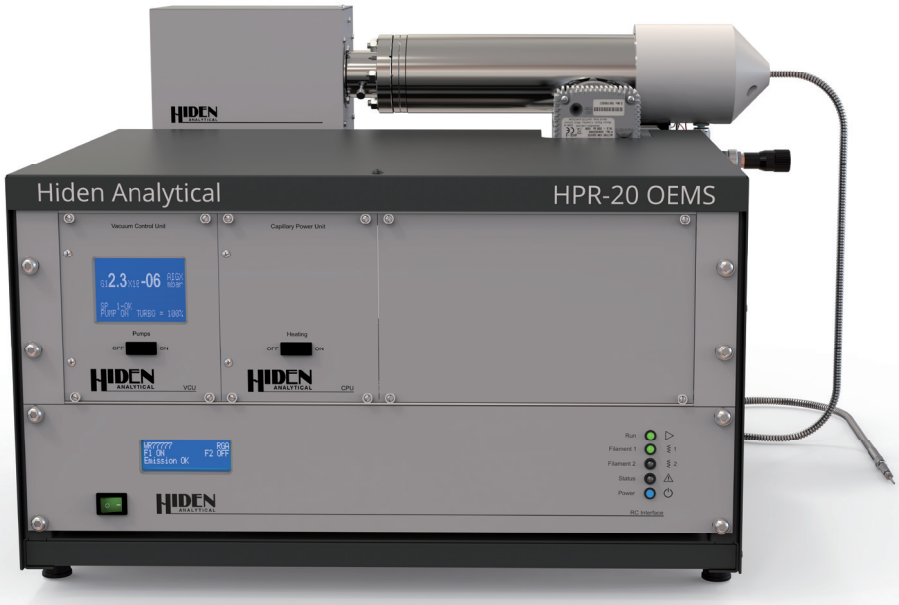


Figure 5. Snapshot OEMS spectrum taken one hour into a potentiostatic experiment.

Reference: Journal of the American Chemical Society (2023) 145, 22, 12181–12192

Technical Data



HPR-20 OEMS

Mass ranges, amu:	1-200 / 1-300 amu
Sensitivity:	100% to 100 ppb subject to spectral interference
Speed:	Up to 1000 measurements/second
Response time:	Min. 300 ms (dependant on flow rate)
Software:	MASsoft Professional
	QGA 2
	Windows compatible
Interface:	Ethernet/USB/Serial (RS-232) connections
Detector:	Dual Faraday/Channeltron Electron Multiplier
Analogue input:	2x standard (Potential & Current), 8x (optional)
Analogue output:	8x (optional)
Digital input:	8x
Digital output:	8x, 24 V
External control:	TTL, OPC
Dimensions (L x W x H):	495 x 535 x 394 mm
Weight:	Typically 33 kg and external scroll pump 26 kg
Power requirement:	110/220/240 V AC, 50/60 Hz, 1.2 kVA

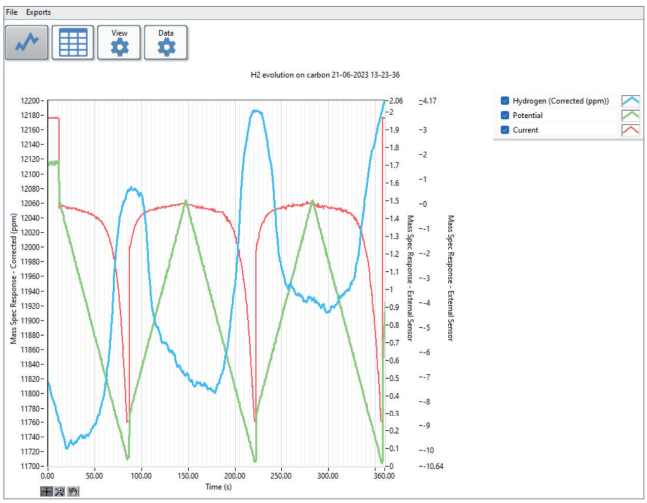
Software

QGA 2 Software

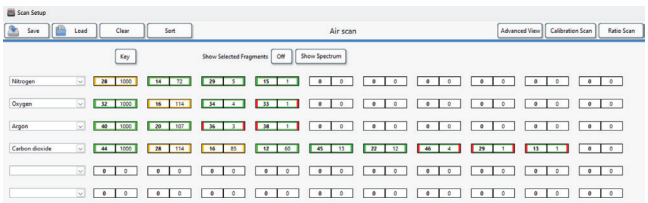
An application specific software package for quantitative gas and vapour analysis providing real-time continuous analysis of up to 32 species with concentrations measured in the range 0.1 ppm to 100%.

Key Features

- Quantitative analysis of up to 32 gases
- Automatic peak selection using built-in library
- Simple calibration with background correction
- Automatic subtraction of spectral overlaps
- 10 peak spectral library and simple fragment ratio update tool
- Automatic triggering of analysis from an external input
- X-axis can display time or an external input, e.g. Current, Potential
- External output via OPC or Analogue outputs
- Output data as percentage or ppm values



QGA 2 MID Trace



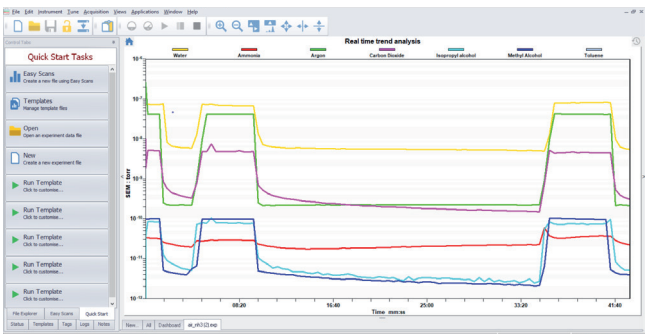
QGA 2 Set-up

MASsoft Professional Software

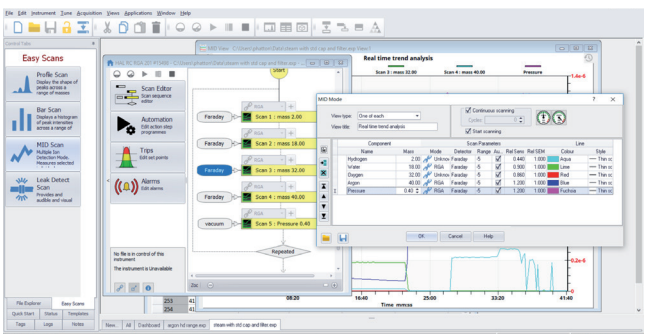
A multi-level software package allowing both simple control of mass spectrometer parameters and complex manipulation of data plus control of external devices.

Key Features

- Bar and multiple ion detection (MID) modes
- Ionisation energy control for soft ionisation of complex mixtures
- Export data to NIST MS database for analysis of unknowns
- Export to external data analysis software, e.g. Excel, Origin
- Control of external devices e.g. MFCs, gas switching/sampling
- Control valves and furnace PID values
- Scan templates for fast setup of scans
- User selected alarm facilities



MASsoft Professional MID Trace



MASsoft Professional Scan Tree

Hiden**APPLICATIONS**

Hiden's quadrupole mass spectrometer systems address a broad application range in:

GAS ANALYSIS

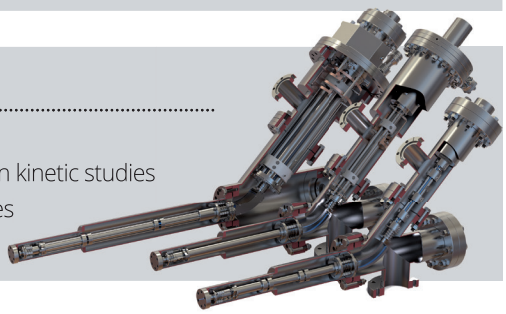
- dynamic measurement of reaction gas streams
- catalysis and thermal analysis
- molecular beam studies
- dissolved species probes
- fermentation, environmental and ecological studies

SURFACE ANALYSIS

- UHV TPD/TDS
- ToF qSIMS and SIMS analysers
- end point detection in ion beam etch
- elemental imaging – 3D mapping

PLASMA DIAGNOSTICS

- plasma source characterisation
- etch and deposition process reaction kinetic studies
- analysis of neutral and radical species



VACUUM ANALYSIS

- partial pressure measurement and control of process gases
- reactive sputter process control
- vacuum diagnostics
- vacuum coating process monitoring

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