Electro-Catalysis Solutions

BASi

Reach Your Potential

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INTRODUCTION - ELECTROCATALYSIS

Electrocatalysis is termed as a catalytic process that applies to normal oxidation and reduction reactions when their typical transfer of electrons is fastened using electrocatalysts to lower the activation energy of the reactions. With the global demand for energy growing at an exponential rate the need for highly advanced energy conversion systems that are environmental friendly has increased as well. A few examples of such commercially viable research solutions include fuel-cells, dye-sensitized solar cells, metal-air / Li-CO_2 batteries, and photo-based water-splitting.

The main reactions involved in these "green" energy solutions are oxygen reduction reaction (ORR), oxygen evolution reaction (OER), hydrogen evolution reaction (HER), and CO_2 reduction reaction (CO_2RR). Each of the above reactions require a catalyst that can increase a chemical reaction rate without even being consumed in the process. When electrodes are modified with an electrocatalyst like platinum or equivalent, they promote the overall kinetics and reaction rate of such reactions directly on the surface of electrodes itself. Because electrons are always transferred from one chemical species to another during all electrochemical reactions, such "modified" electrode surface also allow a desired control over the electrochemical transformations to occur by lowering the voltage / energy required to carry out these transformations. A highly sophisticated material characterization process is required to analyze the overall efficiency of such an electro catalysis surface.

Stability, selectivity and efficiency are three factors that can be utilized to evaluate the efficiency of "electrocatalysts". For an applied voltage, it is possible to quantify each of these factors by calculating the quantity of current density generated along with the reaction rate and stability of the catalyst layer. This is where highly accurate potentiostat / galvanostat systems equipped with advanced electrochemical set-ups and accessories are required. Since 1975, BASi Research Products has been a global provider of instruments, cells and accessories that are tailor-made for scientists and researchers in electrocatalysis at universities, national labs and industrial Research & Development centers.

Our BASi Research Products and PalmSens Instruments are equipped with advanced features for electrocatalysis. Some of them include a 1 MHz EIS measurement capacity, plug-n-play RDE measurements, default IR compensation mode, bi-potentiostat configuration, high sampling rate and upto 3fA measured current resolution. As a part of complete solution initiative, we also offer our customers with a wide range of fully equipped electrochemical cell kits that can be customized as per the user requirement for a wide variety of applications in hydrogen generation, metal-air batteries, water-splitting, electrolysis, photo-based electrocatalysis, DSSC / Perovskite solar cells, OLE'D's, electrochromism, enzymatic catalysis, semiconductor FET based electrocatalysis, spectro-electrochemistry and more. This brochure summarizes each of these advanced research solutions developed.

EF-1031: EPSILON ECLIPSE™

The Epsilon EClipse™ is a fully loaded Bi-potentiostat / galvanostat tailor-made for wide variety of measurements in electrocatalysis research. Built-in modules for electrocatalysis applications are:

- Low current resolution (3 fA)
- High Sampling Rate (50 KHz)
- Built-in current integrator
- Bi-potentiostat module
- IR-Compensation option

APPLICATIONS:

- Oxygen Reduction Reaction Analysis
- Hydrogen / Oxygen Evolution
- Carbon Dioxide Reduction Reaction
- Conducting Polymer Films
- Self-assembled nanolayer electrocatalysis
- Photo-based Water-splitting

PALMSENS4 + EIS OPTION

The PalmSens4 is a fully loaded, expandable, and floating ground potentiostat / galvanostat that is tailormade for advanced level electrocatalysis research with hybridized options for light, bluetooth and other features:

- Accurate EIS (1 MHz)
- Bluetooth Compatibility
- Low current resolution
- Multi-channel expandability
- Bi-potentiostat module
- IR-Compensation option

APPLICATIONS:

- ORR / HER / OER / CO_2RR
- Hydrodynamic EIS ORR / RRDE
- Field Effect Transistors (FET) analysis
- Enzymatic electrocatalysis SPE's
- Spectro-electrochemistry

C3 CELL STAND

The C-3 Cell Stand is a general purpose accessory for electroanalytical experiments. It provides a base to support the cell vial and a mounted cell top to hold the electrodes. The base also contains a magnetic stirrer and lines for inert gas purging. Stirring and gas are available by remote control with BASi PC-controlled potentiostats. The standard package contains all accessories needed to run basic electrochemistry experiments.

PART NUMBER:

> **EF-1085** C-3 Cell Stand

STANDARD PACKAGE:

> Glassy carbon working electrode
> Platinum working electrode
> Ag/AgCl reference electrodes (+ storage vial)
> Platinum auxiliary electrode
> PK-4 working electrode polishing kit
> Standard cell vials
> Low-volume cell vials
> Teflon Coated Stir bar
> Cell lead clips
> Gas line tubing

FEATURES:

> Faraday cage for low current measurements
> Dual gas lines for purge and blanket
> Cell lead connects directly to all BASi potentiostats (other potentiostats require modification of the cell lead)
> Optional water-jacketed cell vial

ACCESSORIES:

> **MF-1208** Glass cell vial for Voltametry 5-15mL 12/pk
> **MW-2980** C-3 Cell Stand Accesories Kit

RDE-2 CELL STAND

The BASi RDE-2 is a rotator system for both fixed rotation rate and hydrodynamic modulation rotating disk electrochemical experiments. Rotation rates from 50 to 10,000 RPM are available with better than 1% accuracy. The rotator unit is manually raised and lowered, and can be inverted for spin-coating. Rotation functions can be controlled remotely using a BASi PC-controlled potentiostat, or manually. Wide range of working electrodes in various size and shapes possible.

PART NUMBER:

> **EF-1100** RDE-2 Rotating Disk Electrode Cell Stand

STANDARD PACKAGE:

> Cell stand with gas purge capabilities
> Glassy carbon working electrode
> Ag/AgCl reference electrodes (+ storage vial)
> Platinum wire auxiliary electrode
> PK-4 working electrode polishing kit

FEATURES:

> Compatible with BASi stationary voltammetry electrodes
> Standard addition port
> Easy and rapid exchange of electrodes
> Low-noise electrode contact
> Excellent rotation speed accuracy, acceleration and deceleration

APPLICATIONS:

> Koutecky-Levich Analysis
> Diffusion Co-efficienct
> Reaction kinetics
> Electron-transfer mechanism
> Hydrodynamic EIS study

FULLY LOADED HYDRODYNAMIC EIS PACKAGE

BASIC ELECTROCHEMICAL CELLS

This cell is designed to conduct standard three electrode based electrochemistry analysis with options for purge, stir and a secondary compartment for counter electrodes.

PART NUMBERS:

> **MF-1054** Jacketed Three Electrode Electrochemical Cell
> **MF-1051** Standard Three Electrode Cell

FEATURES:

> Option for disc or ITO type working electrode
> Separate chamber for counter electrode
> Purge option available

APPLICATIONS:

> Electrochemical mechanisms
> Redox-state studies
> Reaction kinetics
> Electron-transfer studies
> Surface Coverage Analysis

LOW VOLUME ELECTROCHEMICAL CELL

This cell is designed to conduct extremely nano scale electrocatalysis measurements on micro-leter volumes, single droplets and monolayers.

PART NUMBERS:

> **MF-2141** Standard Low Volume Cell Kit
> **MF-2145** Standard Jacketed Low Volume Cell Kit

FEATURES:

> Option for disc or ITO type working electrode
> Separate chamber for counter electrode
> Purge option available

APPLICATIONS:

> Single Drop Electro-Catalysis
> Self-assembled mono layers
> Electrode interface studies
> Electron-transfer studies
> Surface Coverage Analysis

ELECTROCHEMICAL H-CELL

This cell is deigned to conduct standard dual compartment based electrochemistry analysis with options for purge, thermal control and detachable membrane assembly.

PART NUMBERS:

> **IP-HC50** Standard H-Cell Kit
> **MF-2024** Working Electrode Holder (Alligator clip)

FEATURES:

> Disc or ITO type working electrode
> Separate chamber for counter electrode
> Available in 25-1000 ml Volume
> Option for thermal control available

APPLICATIONS:

> Hydrogen / Oxygen Evolution
> Carbon Dioxide Reduction
> Membrane Research
> Redox-flow batteries
> Hydrogen Permeation studies in corrosion

BULK ELECTROLYSIS CELL

This cell is designed for complete electrolysis of a species in solution, as required controlled potential coulometry. Ideal for small-scale electrosynthesis (mg quantities).

PART NUMBERS:

> **MF-1056** Bulk Electrolysis Cell Kit
> **NM-D001** Platinum Gauze (90/10 Platinum) Outer Electrode
> **NM-D002** Platinum Gauze (90/10 Platinum/Iridium Alloy) Inner Electrode

FEATURES:

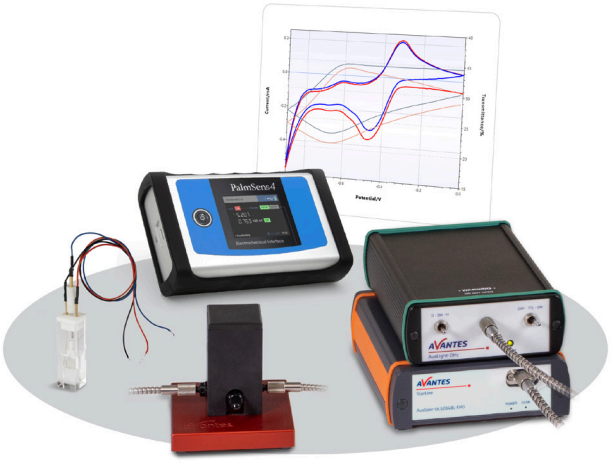
> Large surface area working electrode (reticulated vitreous carbon)
> Chamber for isolating auxiliary electrode
> Optional platinum gauze electrode
> Optional water-jacketed vial

APPLICATIONS:

> Bulk electrolysis
> Electrochemical Synthesis
> Electron Transfer Kinetics

SPECTRO-ELECTROCHEMISTRY KIT

This is a customized kit made for our PalmSens customers wanting to expand their electrochemical research with spectroscopy analysis. This kit will allow users to conduct fully synchronous and in-situ measurements for electrochemistry along with UV-Vis Spectroscopy in the wavelength range of 200-1100 nm.



PART NUMBERS:

> **MF-SPEC-ECKIT** Fully Equipped Spectro-Electrochemist
> **EF-1350** Spectroelectrochemical Cell with Platinum Minigrid, 1mm pathlength
> **EF-1351** Spectroelectrochemical Cell with Gold Minigrid, 1mm pathlength
> **EF-1362** Spectroelectrochemical Cell with Platinum Minigrid, 0.5mm pathlength
> **EF-1363** Spectroelectrochemical Cell with Gold Minigrid, 0.5mm pathlength

FEATURES:

> Monitor in real time the chromic changes a reduction/oxidation reaction including reaction and/or final product(s) by spectroscopic means
> Platinum and Gold mini grid electrodes are available (purchased separately)
> Uses standard BASi reference electrodes

APPLICATIONS:

> Photo-based organic dye evaluation for DSSC
> Half-life studies of a redox reaction
> Electro-chromic material and their kinetics
> Investigation of optical sensors
> Electro-chemie luminescence research

KIT INCLUDES:

> Thin-layer quartz cuvette (1mm pathlength)
> Platinum or gold minigrid working electrode
> Platinum wire auxiliary electrode
> Teflon® cap
> Chemically inert plastic purge tube

ADDITIONAL ELECTRODES NOT INCLUDED:

> **MF-2052** Ag/AgCl (long, glass tip)
> **MW-2030** Ag/AgCl (short, ceramic tip)
> **MF-2062** Ag/Ag+ Non-Aqueous Reference Electrode

PHOTO-ELECTROCHEMICAL CELL KIT

This cell is designed to conduct light-based electrocatalysis research on DSSC solar cells, electrochromic materials and organic light emitting diodes.

PART NUMBERS:

> **IP-PECUWC50** Photo-EC Cell Kit with Lid
> **MF-2024** Working Electrode Holder (Alligator clip)

FEATURES:

> Disc or ITO type working electrode
> Available in 25-1000 ml Volume
> Option for thermal control available

APPLICATIONS:

> Photo / electrochromism
> Solar cell studies
> Artificial photosynthesis
> Light based water splitting
> Light activated catalysis

PHOTO-ELECTROCHEMICAL H-CELL

This cell is designed to conduct photo based electrochemistry research in dual compartments with options for purge, thermal control and detachable membrane assembly.

PART NUMBERS:

> **IP-PECHC50** Standard Photo-EC H-Cell Kit
> **MF-2024** Working Electrode Holder (Alligator clip)

FEATURES:

> Disc or ITO type working electrode
> Quartz window for light emission
> Available in 50-1000 ml Volume
> Option for thermal control

APPLICATIONS:

> Photo-based Water Splitting
> Electrochromism
> Electrochemical luminescence intensity
> Solar Cells
> Spectro-electrochemistry

PRICES:
www.BASinc.com/products/all

TERMS OF SALE:
www.BASinc.com/products/terms

LIMITED WARRANTY:
BASi instruments manufactured by the company carry a one-year limited warranty.
Full details at: www.BASinc.com/products/terms

EXTENDED WARRANTY AND MAINTENANCE PROTECTION PLAN:
A Maintenance Protection Plan is available for a complete electrochemical or voltammetric analyzer, or individual electroanalytical instruments including potentiostats, cells, controllers, etc. This extends the one year warranty that normally applies to these instruments. The cost of this plan is most advantageous when purchased with a new instrument. Instruments which are out of warranty must be inspected by BASi, for at least the cost of the estimate fee, prior to being registered for an extended warranty.

TO PLACE AN ORDER:
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