ElectraSyn 2.0

by IKA

EN

THE FULL POTENTIAL OF ELECTROSYNTHESIS | ElectraSyn 2.0

The perfect workflow

/// Electrosynthesis simplified and accelerated with ElectraSyn 2.0

ElectroSyn 2.0 is the smart solution for all oxidation / reduction reactions in the laboratory. This compact and environmentally-friendly laboratory device is absolutely indispensable where electrons need to flow, at the interface of electrochemistry and synthetic organic chemistry.

The ElectraSyn 2.0 has been developed in collaboration with Phil S. Baran, the renowned professor at the Scripps Research Institute in La Jolla, California. It paves the way for mass use of sustainable, environmentally-friendly redox reactions.

Personalized application advice

You can get your own impression of the efficiency and effectiveness of our ElectraSyn 2.0 electrosynthesis device in the IKA Application Center. Our experts will show you the application and will present the packages on offer together with the extended range of accessories.

Worldwide service

To opt for ElectraSyn 2.0 is also to opt for the excellent IKA technical service in your region. Our team is available worldwide for your service and application needs. The availability of replacement parts is guaranteed for 10 years.

Any questions?
Our service team is at your personal disposal:

00 8000 4524357 (00 8000 IKAHELP)

10 years warranty*

CE

*2+8 years after registering at www.ika.com/register, wearing parts excluded

reddot award 2018
winner

3 devices in one

/// Determine the voltammetry, apply the power, mix the substances

The variable all-in-one system ElectraSyn 2.0 allows you to develop new electrochemical reactions and transformations on a laboratory scale. ElectraSyn 2.0 permits sustainable, cost-effective synthesis as it represents three devices in one:

Analytical device
ElectraSyn 2.0 gives an easy approach of cyclic voltammetry test for synthetic chemists. The result will help customers understand the electrochemical properties of the tested sample.

Potentiostat
ElectraSyn 2.0 provides constant voltage and constant current reaction mode for electrolysis. The novel device also provides assist mode, an unique reaction mode accessible to electrochemistry beginners.

Magnetic stirrer
The tried and tested IKA stirring technology also forms part of the ElectraSyn 2.0. In just a few seconds, a stirring attachment converts the electrosynthesis device to a powerful magnetic stirrer for stirring volumes up to 100 ml.

The most important features

ElectraSyn 2.0 offers a wide variety of functions for the development of new electrochemical reactions and transformations on a laboratory scale. Working with ElectraSyn 2.0 is convenient and safe for both the experienced user and the novice.

IKA Menu Guide

The user-friendly, intuitive IKA Menu Guide directs the user through the experiment. A single rotary knob suffices to find your way easily through the settings.

Cyclic voltammetry (CV)

Both analytical measurements and preparatory experiments can be carried out using one and the same unit.

USB data transfer

USB flash drive exports CV result as CSV file which can be opened in Excel.

Smart Assist

The Smart Assist mode provides support if the world of electrochemical reactions are uncharted territory for you. It provides an analysis before execution and continues to provide communication during the reaction.

Alnico magnetic technology

Alnico magnetic technology ensures high levels of magnetic coupling. This prevents sedimentation during the experiment.

Apple App Store

Google Play Store

ElectraSyn 2.0 app

The ElectraSyn 2.0 app allows users to connect their mobile devices (cell phone and tablet) to ElectraSyn 2.0 through WiFi. With the help of the app, users can monitor their real time reaction information within an effective range, send CV data and reaction data through email, view and download further experiments from the IKA Knowledge Base crowdsourcing platform, make online orders and watch tutorial videos of ElectraSyn 2.0. The app is available in the Apple App Store and on Google Play.

Modularity

Several accessories are extending the functionality of ElectraSyn 2.0. The Carousel attachment transforms ElectraSyn 2.0 from a single reactor to a six-reactor screening system. It is perfectly suitable to monitor, optimize, and scale up experiments. The GOGO Module allows flexible vial placement, such as placing the reaction vial in a cryo-bath. With Pro-Divide users can trigger divided cell reactions whereas Pro-Seal vacuum allows the application of vacuum as low as 50 mbar to attain better reaction system sealing. IKA e-Hive provides a platform for early stage reaction discovery.

ElectraSyn 2.0 lifts the old tried and tested principle of electrochemistry to a completely new level: Oxidation / reduction reactions can be carried out simply, quickly, and safely in a single compact device.

FASTER
The ElectraSyn 2.0 works intelligently and automatically and thus operates considerably more quickly than conventional processes.

EASY TO OPERATE
A new equipment concept, in combination with the tried and tested IKA Menu Guide, also makes this complex equipment simple to handle.

REPRODUCIBLE
The ElectraSyn 2.0 means that electrochemical reactions are finally carried out in a standardized manner and are thus reliably reproducible. This finally facilitates mass productive use of electrochemistry.

ENVIRONMENTALLY-FRIENDLY
The standard use of electricity to move the electrons means that large volumes of solvents, and thus chemical waste, can be saved. This is both environmentally-friendly and sustainable.

SIMPLER

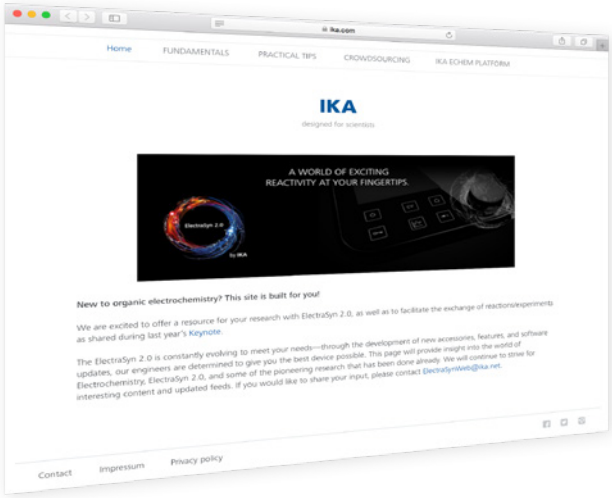
Electrosynthesis with ElectraSyn 2.0 is simple and tidy. It is no bigger than a conventional magnetic stirrer, and a small space on the laboratory bench is adequate for it.

RUGGEDNESS

The ElectraSyn 2.0 user interface is resistant to chemicals. The incorporated glass is characterized by scratch-resistance and extreme ruggedness.

FAST RESPONSE DISPLAY

The display is designed for perfect legibility: It is large, well-lit and mounted in hardened glass.



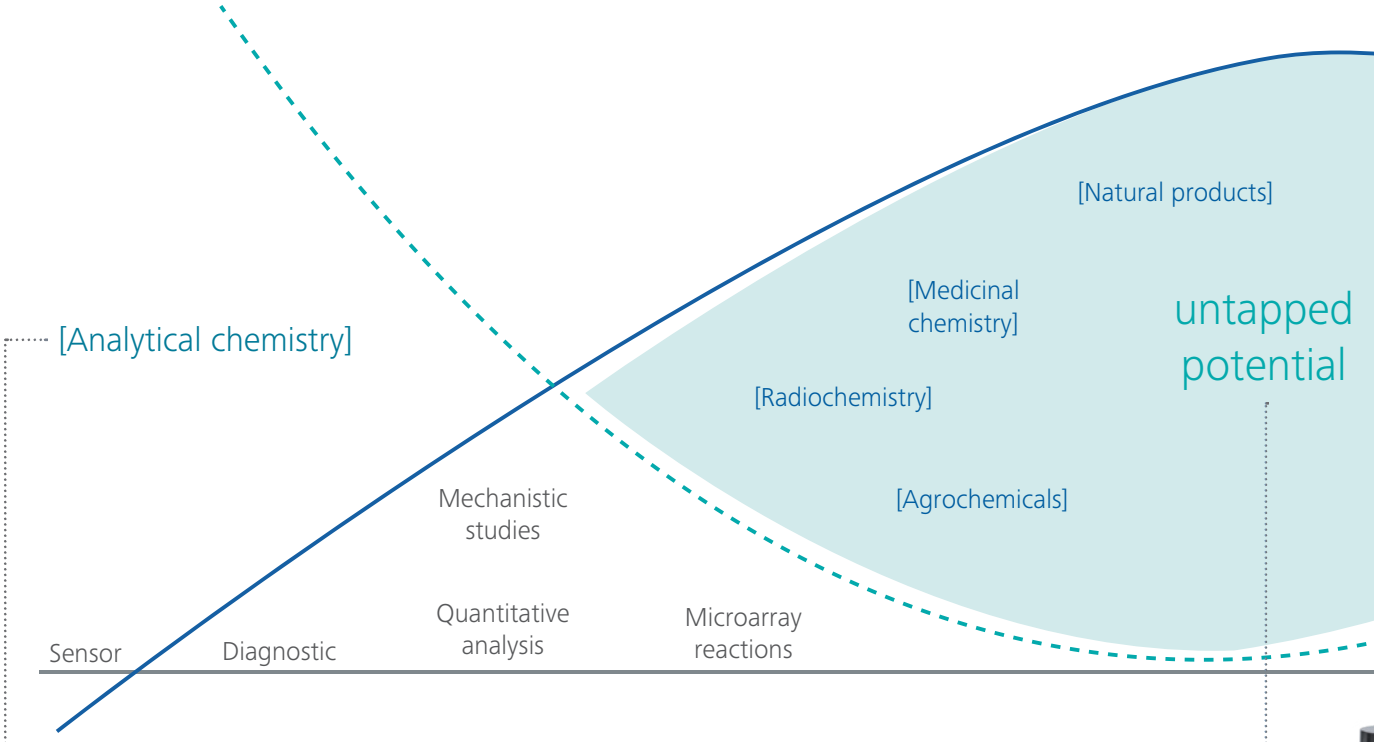
IKA Knowledge Base

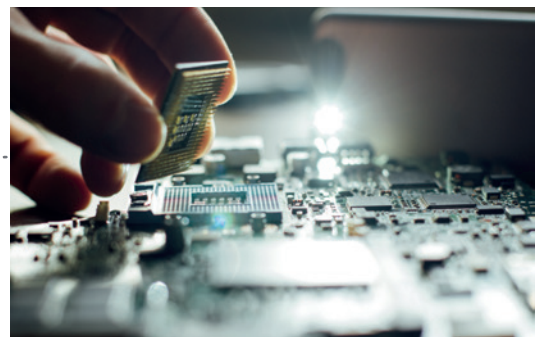
Comprehensive fundamental expertise in electrochemistry, lots of tips and a crowdsourcing platform are made available by the IKA Knowledge Base for ElectraSyn 2.0. Participate in the test rigs from other scientists and share your own experiences with your colleagues.

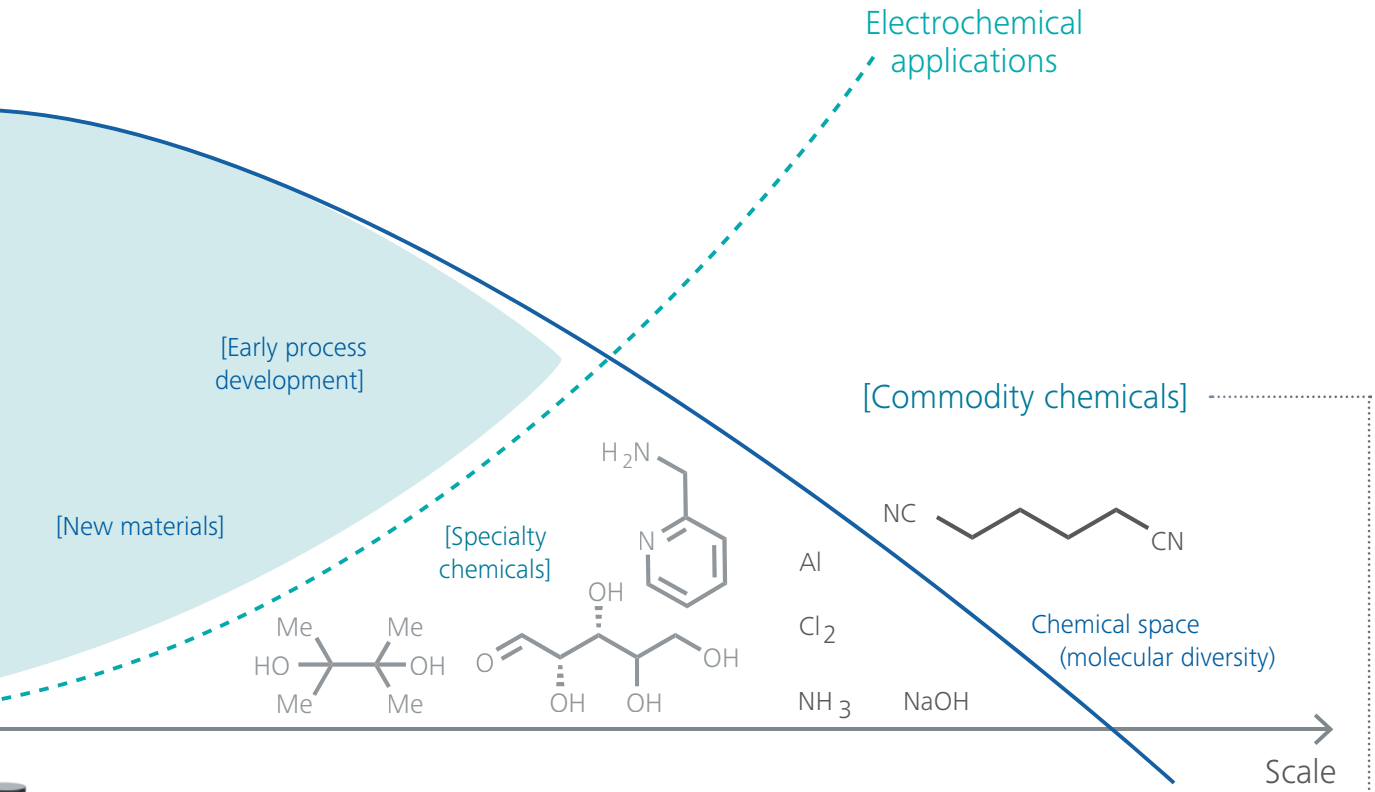
Acquire and share knowledge right now at:
www.ika.com/electrasyn

Endless potential

ElectraSyn 2.0 brings two sections of chemistry together that so far have had little to do with each other: electrochemistry and synthetic organic chemistry. The ElectraSyn 2.0 is thus the perfect complement for a large number of users between the analysis laboratory and large-scale chemistry. Whether it be process development, medical chemistry, radiochemistry, agrochemistry or substance and material research – this miracle device offers enormous potential for simpler, faster, environmentally-friendly working:






Electrochemical
applications
[Early process
development]
[New materials]
[Specialty
chemicals]
[Commodity chemicals]
Chemical space
(molecular diversity)
Scale
Al
Cl 2
NH 3
NaOH
NC
CN
H 2N
N
OH
Me
HO
O

ElectraSyn 2.0 Package
Ident. No. 0020008980

› ElectraSyn 2.0 base unit
+ vial holder
+ single vial, 10 ml, complete
+ 2 electrodes (graphite)
+ stir plate (aluminum)
+ stir bar

Ready-To-Go package

ElectraSyn 2.0 pro Package
Ident. No. 0040003261

› ElectraSyn 2.0 base unit
+ vial holder
+ single vial, 10 ml, complete
+ 2 electrodes (graphite)
+ stir plate (aluminum)
+ stir bar
+ set of CV electrodes:
 + CV glassy carbon
 + CV platinum
 + reference electrode Ag | AgCl

Technical data

TECHNICAL DATA	
Nominal voltage (input)	48 VCD
Max. current (input)	1,500 mA
Max. input power	40 W
Voltage output	30 / 10 V
Current output	100 mA
EC-Motor rating output	9 W
Speed range	50 – 400 – 1,500 rpm
Setting accuracy speed	10 rpm
Stirring quantity max. per stirring position (H_2O)	100 ml
Stirring bar length	10 mm
Operation elements	Capacitive touch / Turning knob
Speed control	Turning knob
Display	TFT
Analog output	no
RS 232 interface	no
USB interface	yes
IP rating	IP 40
Permissible ambient temperature	+5 °C – +40 °C
Permissible relative humidity	80 %
Dimensions incl. single-vial Adapter (W × H × D)	130 × 150 × 250 mm
Weight	1.4 kg

POWER SUPPLY	
Input	100 – 240 VAC 1.5 A 50 – 60 Hz
Output	48 VCD 39,84 W LPS (limited power source)
Protection class	II (double insulated)

Carousel complete

GOGO Module

e-Hive

Graphite electrode inner

Copper electrode outer

ACCESSORIES

Carousel, e-Hive, GOGO Module, Pro-Divide or Calibration cap – all these attachments and a great variety of different electrodes pave the way for standardization and reproducibility of electrochemical experiments in your lab.

Product	Description	Ident. No.
ATTACHMENTS		
Carousel	Attachment for multi measurements	0020017512
Carousel complete	Attachment for multi measurements, incl. glass vials	0040005427
e-Hive	Screening platform with a maximum of 24 reactions	0040004945
GOGO Module	Universal extension for ElectraSyn 2.0	0040006052
Pro-Seal	Vial cap for gas exchange	0040007151
Pro-Divide	Reaction cell for divided electrochemistry	0040006482
Calibration cap	Calibration cap for ElectraSyn 2.0	0040007388
ELECTRODES FOR E-HIVE		
Copper electrode inner	Anode copper (24 pcs.)	0040007427
Graphite electrode inner	Anode graphite (24 pcs.)	0040007430
Stainless electrode inner	Anode stainless steel (24 pcs.)	0040007429
Copper electrode outer	Cathode copper (24 pcs.)	0040007436
Graphite electrode outer	Cathode graphite (24 pcs.)	0040007438
Stainless electrode outer	Cathode stainless steel (24 pcs.)	0040007443

Glass vial 5 ml

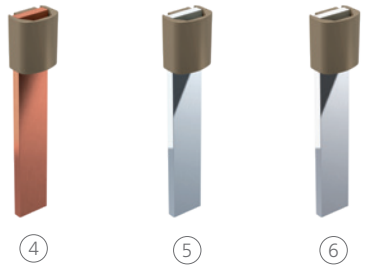
Glass vial
complete 10 ml

ElectraSyn 2.0 Complete Starter Kit

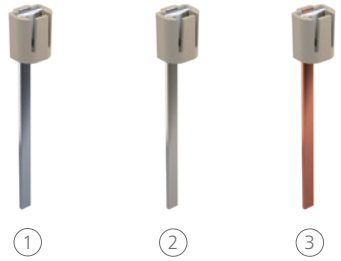
Microvial 1 ml

ElectraSyn 2.0 Micro Starter Kit complete

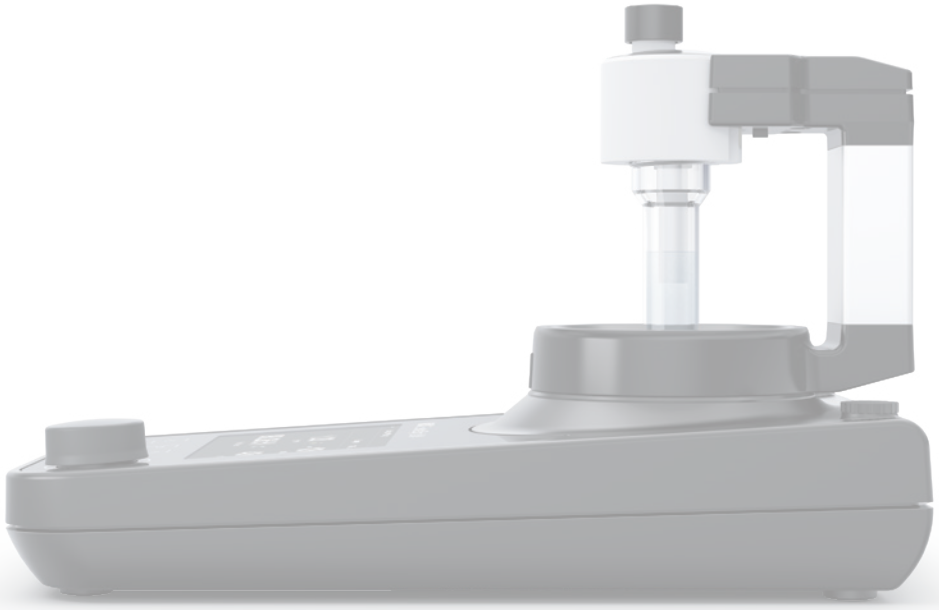
Product	Description	Ident. No.
VIALS / ELECTRODES		
Glass vial complete 5 ml	Glass vial 5 ml incl. lid, glass and magnetic bar	0040003171
Glass vial complete 10 ml	Glass vial 10 ml incl. lid, glass and magnetic bar	0040003170
Glass vial complete 20 ml	Glass vial 20 ml incl. lid, glass and magnetic bar	0040003168
Glass vials 5 ml	Glass vial 5 ml, set of 10	0040003327
Glass vials 10 ml	Glass vial 10 ml, set of 10	0040003325
Glass vials 20 ml	Glass vial 20 ml, set of 10	0040003324
ElectraSyn 2.0 Electrode Starter Kit	Kit of 9 electrodes, set of 12 (glassy carbon, set of 2 only)	0020017204
ElectraSyn 2.0 Complete Vial Kit	Kit of 5 ml, 10 ml and 20 ml vials complete, 10 spare vials of each volume	0010003810
ElectraSyn 2.0 vials only	Kit of 10 x 5 ml, 10 x 10 ml, 10 x 20 ml vials	0010003811
ElectraSyn 2.0 Complete Starter Kit	Kit of 5 ml, 10 ml, 20 ml vials complete; 10 spare vials of each volume; 9 electrodes, set of 12 (glassy carbon, set of 2 only)	0040004013
Electrode CV Package	Kit of electrodes (CV glassy carbon, CV platinum, reference electrode)	0040002864
MICROVIALS / MICROELECTRODES		
Microvial 1 ml	Glass vial 1 ml incl. lid, glass and magnetic bar	0040003294
Microvial 2 ml	Glass vial 2 ml incl. lid, glass and magnetic bar	0040003295
Micro glass vials 1 ml	Glass vial 1 ml, set of 10	0020017207
Micro glass vials 2 ml	Glass vial 2 ml, set of 10	0020017206
ElectraSyn 2.0 Micro electrode Starter Kit	Kit of 8 electrodes, set of 12 (glassy carbon, set of 2 only)	0040004016
ElectraSyn 2.0 microvials only	Kit 10 x 1 ml, 10 x 2 ml vials	0040004103
ElectraSyn 2.0 Microvial Kit complete	Kit of 1 ml and 2 ml vials complete, 10 spare vials of each volume	0040004014
ElectraSyn 2.0 Micro Starter Kit complete	Kit of 1 ml and 2 ml vials complete; 10 spare vials of each volume; 8 electrodes, set of 12 (glassy carbon, set of 2 only)	0040004015



	Product	Ident. No.
	ELECTRODES	
1	Electrode graphite (12 pcs.)	0040002858
2	Electrode glassy carbon (2 pcs.)	0040002842
	Electrode lead bronze (2 pcs.)	0020016076
	Electrode lead (12 pcs.)	0040002843
	Electrode tungsten (2 pcs.)	0040002845
3	Electrode niobium (2 pcs.)	0040002846
4	Electrode copper (12 pcs.)	0040002847
	Electrode magnesium (12 pcs.)	0040002848
	Electrode titanium (12 pcs.)	0040002849
	Electrode zinc (12 pcs.)	0040002850
	Electrode stainless steel (12 pcs.)	0040002851
5	Electrode platinum plated (2 pcs.)	0040002852
	Electrode platinum foil (2 pcs.)	0040005015
	Electrode platinum on ceramics (2 pcs.)	0040006753
	Electrode gold plated (2 pcs.)	0040002853
6	Electrode silver plated (2 pcs.)	0040002854
	Electrode aluminum (12 pcs.)	0040003174
	Electrode boron doped diamond (2 pcs.)	0040002856
	Electrode tin (12 pcs.)	0040002857
7	Electrode nickel (12 pcs.)	0040002859
8	Electrode RVC foam (12 pcs.)	0040002860
	Electrode nickel foam (12 pcs.)	0040002861
	Electrode cobalt (2 pcs.)	0040003385
9	Electrode reference (1 pc.)	0040002865
	Electrode CV glassy carbon (1 pc.)	0040002863



	Product	Ident. No.
	MICROELECTRODES	
1	Microelectrode aluminum (12 pcs.)	0040004029
	Microelectrode boron-doped diamond (2 pcs.)	0040004036
2	Microelectrode cobalt (2 pcs.)	0040004039
3	Microelectrode copper (12 pcs.)	0040004027
4	Microelectrode glassy carbon (2 pcs.)	0040004022
5	Microelectrode gold (2 pcs.)	0040004034
	Microelectrode graphite SK-50 (12 pcs.)	0040004021
	Microelectrode lead (12 pcs.)	0040004028
6	Microelectrode lead bronze (12 pcs.)	0040004030
	Microelectrode magnesium (12 pcs.)	0040004025
	Microelectrode nickel (12 pcs.)	0040004023
7	Microelectrode nickel foam (12 pcs.)	0040004101
8	Microelectrode niobium (2 pcs.)	0040004032
	Microelectrode platinum (2 pcs.)	0040004038
	Microelectrode silver (2 pcs.)	0040004035
	Microelectrode stainless steel (12 pcs.)	0040004024
9	Microelectrode tin (12 pcs.)	0040004037
	Microelectrode titanium (12 pcs.)	0040004033
	Microelectrode tungsten (2 pcs.)	0040004031
	Microelectrode zinc (12 pcs.)	0040004026
	Microelectrode graphite V2100 (2 pcs.)	0040004040



Screening System Package
(8 cells)
Ident. No. 0040003642

Screening System Package
(6 cells)
Ident. No. 0040003631

Screening System

The Screening System is perfectly suited for constant current electrosynthesis in “multibatch” mode. The combination of both divided and undivided batch cells enables you to quickly carry out research on multiple electroconversions at the same time. In addition, you can combine the system with other equipment in the laboratory.

Scope of delivery

> Reaction block
> Electrolysis cells
> Power supply
> IKA Plate (RCT digital) including PT 1000 temperature sensor
> Cable set
> Screw drive
> Electrode graphite (16 pcs.)

TECHNICAL DATA	SCREENING SYSTEM PACKAGE (6 | 8 CELLS)
CONTINUOUSLY ADJUSTABLE POWER SUPPLY	
Voltage output	0 – 32 V (± 1 mV)
Supply voltage	115 or 230 V (50 Hz / 60 Hz)
MAGNETIC STIRRER	
Speed range	0 – 1500 rpm
REACTION CELLS	
Number of cells	6 or 8
Usable volume of undivided cell	8 ml
Usable volume of divided cell (per chamber)	8 ml
Material	PTFE
Divided cells	Yes (reaction block with 6 cells)
Temperature control	Yes (RT to 100 °C)

Scale up with ElectraSyn flow

ElectraSyn flow basic is a system for continuous flow electrosynthesis. The heart of this system is the electrosynthesis flow cell – in short, ElectraSyn flow. It consists of two half cells, each equipped with an electrode. By combining similar and dissimilar half cells / electrodes, ElectraSyn flow provides maximum flexibility for research in the field of electrosynthesis. It also enables the laboratory scale production of a variety of products using electrosynthesis.

ElectraSyn flow basic
Ident No.: 0020014266

ElectraSyn flow eco
Ident No.: 0020014267

Scope of delivery

1. Nine half cells with accessories
2. One nafion-membrane for cell splitting
3. R 104 stand with cell holder and H 44 boss head clamp
4. Power supply adapter with cords
5. Peristaltic pump with tubing
6. Practical carrying / storage case for small components

CONTINUOUSLY ADJUSTABLE POWER SUPPLY	
Voltage	0 – 35 V (± 6 mV)
Current	0 – 1 A (± 50 µA)
Mains voltage	100, 115 or 230 V (50 Hz / 60Hz)

PERISTALTIC PUMP	
Flow rate per tube	0.01 – 0.61 ml/min
Overall flow rate	0.02 – 1.22 ml/min
Inner tubing diameter	0.25 mm
Mains voltage	100 – 230 V (50 Hz / 60 Hz)

FAQ

Why electrochemistry?

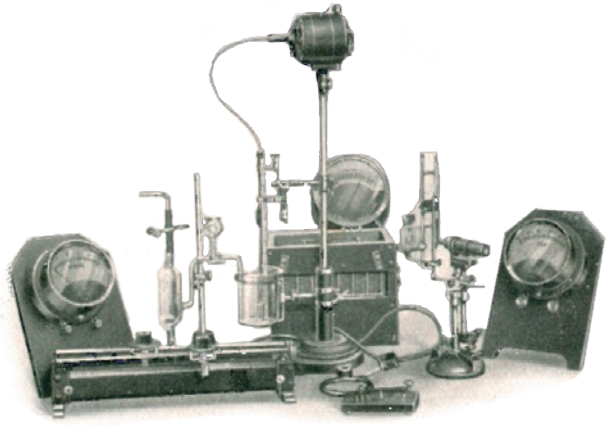
Electrochemistry can trigger reactivity that will be inaccessible otherwise; electrochemistry is sustainable and environmental friendly by allowing less expensive and less toxic reagents; electrochemistry contributes to safety by avoiding dangerous operating procedures.

Why ElectraSyn 2.0?

ElectraSyn 2.0 is a three-in-one device with a featured Smart Assist mode for beginners. Compared to traditional equipment setup, ElectraSyn 2.0 is cheaper and takes up smaller space – the device is as big as a stir plate. Experiments on ElectraSyn 2.0 are very simple, in comparison with traditional setup which requires time consuming connections and wirings. ElectraSyn 2.0 also provides standardized reaction vials and electrode dimension, which guarantees reaction reproducibility. In general, ElectraSyn 2.0 offers great accessibility for both experienced users and beginners.

Which is the right electrode for me?

For undivided cell, if the desired reaction is oxidation, use the combination of non-sacrificial anode and cathode on whose surface it is easier to observe hydrogen revolution than organic compound reduction; if the desired reaction is reduction, use the combination of sacrificial anode and cathode on whose surface it is easier to observe organic compound reduction than hydrogen revolution.



The Beginnings: Apparatus for electrolysis with stirring standmotors and regulating starters for the rotating electrodes (electrochemical method)

Basics

Electrochemistry deals with both chemical transformations that generate electricity, and chemical transformations that are induced by electricity. In the span of two hundred years, it evolved from a few obscure and eccentric laboratory phenomena into a highly sophisticated and comprehensive scientific discipline, with applications that permeate all corners of society. Today, batteries of all sizes – from the delicate hand watch to the powerful Tesla automobile – stem from electrochemistry. Corrosion prevention of metal objects, from a tiny galvanized nail to thousands of miles of underground gas pipelines, is based on fundamental principles of electrochemistry. Powerful sensors such as the glucose meter used by tens of millions everyday are developed from the basic understanding of the correlation between glucose oxidation and the magnitude of its corresponding electrical signal. Scores of commodity chemicals, including aluminum and PVC, are manufactured at an industrial scale every year using electrochemical processes. Beyond practical applications, electrochemistry plays a pivotal role in the search for new materials, more sustainable energy sources, and novel strategies for environment cleanup

Divided vs. Undivided Cells

In an undivided electrochemical cell, the cathode and anode are housed in the same chamber. This setup is easy to carry out, as no elaborate glassware / reactor is needed. In addition, the distance between the two electrodes can be easily adjusted, and ionic species can move freely between the electrodes. An example of an electrochemical reaction in a simple undivided cell is water electrolysis in a regular cup with two pencil leads as electrodes. This is something that can be done outside the confines of a laboratory environment. IKA's supply of standardized vials, electrodes, and their easy assembly makes it extremely convenient for a chemist to quickly evaluate effect of different electrodes on a specific reaction.

In a divided electrochemical cell, the cathode and anode are kept in different chambers, separated by an ion-permeable membrane or salt bridge. This, of course, requires that special membrane or salt bridge and a reaction vessel of complicated design. Another consideration when using a divided cell is that the resistance is typically high due to the separation of electrodes, which may lead to a slower reaction. However, a divided cell allows the possibility of maintaining different chemical environments around the two electrodes, thereby bringing out fine-tuned reactivity inaccessible via an undivided cell. In the case of water electrolysis, the divided cell furnishes hydrogen and oxygen gases in the cathode and anode chambers, respectively. This makes it possible to deliver hydrogen and oxygen as pure products in the divided cell, as opposed to a mixture of hydrogen and oxygen in an undivided cell.

Constant Current vs. Constant Voltage

An electrochemical reaction can be executed at a constant cell current (galvanostatic) or a constant voltage (potentiostatic). In a constant current reaction, it is easy to calculate the total charge consumption. The disadvantage of the constant current reaction is that the voltage profile of the reaction is often overlooked. The potential that the reaction starts at and the way it changes throughout the course of the reaction are factors critical to the outcome of the reaction. As the redox active species deplete in the course of a constant current reaction, the potential increases. If unattended, this can lead to undesired redox processes and become detrimental to the reaction. If the reaction is executed with the total amount of charge (e.g., 2 Faradays per mole), it is possible for the potential profile to stay within an acceptable range in the course of the reaction. However, if a reaction is run continuously (e.g., for 16 hours), it is especially important in this case to pay attention to the potential and make sure it stays within an acceptable range.

In a constant voltage reaction, the reaction is typically executed with a constant cell voltage which is set by the redox potential of the intended transformation. If there is no prior knowledge about the redox system, cyclic voltammetry studies are often required to set a potential value for the reaction. Constant voltage reactions are less prone to runaway side reactions. The magnitude of the current flow depends on the overall resistance of an electrochemical cell – a high resistance cell will lead to low current and a slow reaction. Ensuring the current and the reaction rate stay within an acceptable range becomes a point of interest for constant voltage reactions.

Overall, the potential range of a constant current reaction must be carefully monitored and controlled to avoid unintended redox processes that may be detrimental to the reaction. Similarly, the current of a constant voltage reaction must remain at a sufficient level to achieve an acceptable rate of reaction. In both cases, the cell resistance can be adjusted, via electrolyte concentration, solvent, cell configuration, electrode surface area, etc., to achieve the control of voltage or current respectively.

Find more information on: **www.ika.com/electrasyn**

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