



At Cambridge Reactor Design, we believe in looking after our clients. By understanding how you work and the results you need, we develop original solutions aimed at saving you time, money and hassle!

Throughout the chemical industry, our global customers look to us to provide customised engineering and automation services. Our in-house capability to design and manufacture both instruments and components gives us unmatched flexibility to do just that - we relish the opportunity to tackle complex customer problems, providing creative, simple and, above all, practical solutions. The long-term relationships we have established with our client base are a measure of our success.

Today, over and above our bespoke service, we offer a number of 'off the shelf' products, designed and constructed to our usual exceptional standards. With this product range we hope many more of you can enjoy the benefits that come from saving time, money and hassle!

Chameleon Adaptable Reactor Technology

For your Continuous and Batch Chemistry Needs



Users of Continuous and Batch Processing now have an affordable Lab Scale, “off the shelf” system to fully investigate the best alternatives for their Chemistry.

Our Chameleon is a flexible, versatile reactor system that can readily adapt to your environment! If you are looking for a small volume, multi vessel system that can be used for either Batch or Continuous Chemistry, then look no further than the Chameleon Adaptable Reactor.

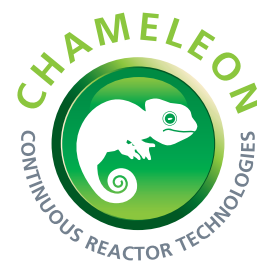
Overview

- Easily adapts to continuous or batch chemistry
- Suitable for liquid and gas-liquid chemistries
- Truly lab scale
- Excellent temperature and pressure capability
- Accommodates on-line analysis tools
- Compact and easy to install - suitable for every laboratory





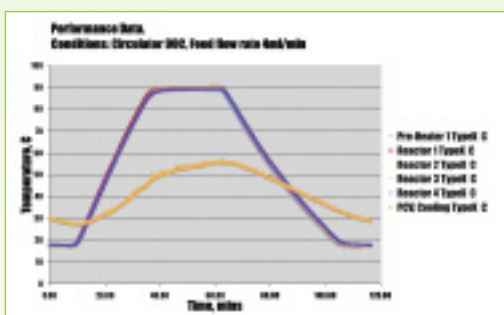
Chameleon Adaptable Reactor Technology



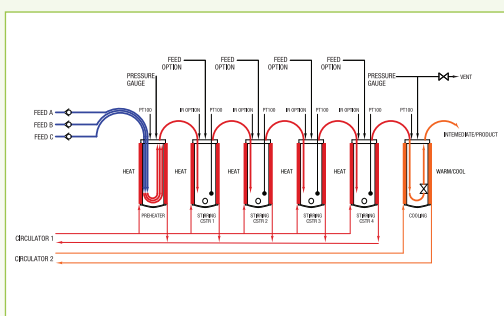
Continuous Mode



Batch Mode



Temperature Control



Chameleon Adaptable Reactor Technology



Continuous Mode

In continuous mode, up to 4 reactors can be connected in series offering the user a mixed reactor platform, a series of CSTRs (plug flow) for continuous processing. A Preheat Mixing Station allows reactants to be brought to the desired temperature. A Cooling and Pressure Control Station allows regulation of the upstream pressure and cooling prior to depressurization to avoid solvent boiling. The outlet stream can be collected as a final product or be used as an intermediate in a subsequent reaction.

Batch Mode

In batch mode, the user can charge and operate up to 4 reactors in parallel to build a database for comparing and optimizing operating conditions. For example, the user can design experiments to:

Optimize reactions – each reactor can be run with different operating conditions such as temperature and pressure making the Chameleon ideal for rapid reaction optimization.

Check reproducibility – the control of parameters allows you to run identical reactions to measure reproducibility.

Assess robustness - the Chameleon has the control and flexibility in operating parameters that you need for a statistically designed DoE approach.

Chameleon Adaptable Reactor Technology

Our Chameleon system offers a wide range of configurations. As well as switching between continuous and batch mode, you can easily change:

- The number of reactors and the reactor volume (5 - 20 ml).
- The temperature.
- The total pressure.
- The contacting patterns for various combinations of high and low concentrations of reactant.

Our systems may be manufactured with wetted parts in either 316-Stainless Steel or Hastelloy™ C276, so a range of reactions can be studied without fear of corrosion or contamination. There is opportunity to analyze the reaction using on-line analytical tools e.g. in-situ FTIR, for process understanding and control purposes.

No special facilities are required - the Chameleon footprint is small, suitable for installation in a standard fume cupboard with extraction, services and fail-safe power already in place.

If you would like to speak to a technical representative please call us on +44 (0) 1954 252522, e-mail sales@crduk.com, or alternatively you can visit www.crduk.com for further information.

Eagle Extraction "Robot Assistant"

Bringing Intelligent Vision to Liquid-Liquid Extraction



Chemists looking to gain increased process understanding of their downstream processing operations now have an eagle-eyed, robotic chemistry technician that can help them!

Our Eagle extraction robot assistant focuses on liquid-liquid extraction. By combining real-time machine vision with robotics, this workstation performs repetitive tasks 24/7, with high levels of precision and accuracy, recognises motion, takes video images - and does not talk back at or argue with management personnel!

Overview

- Delivers functionality to optimise liquid-liquid extraction
- Choice of aqueous solutions and organic solvents
- Performs pH adjustments
- Collects and prepares samples for analysis
- Automatic detection and processing of emulsions and difficult interfaces using our Eagle intelligent vision system
- Produces quality Distribution Ratio data
- User friendly software for easy operation.



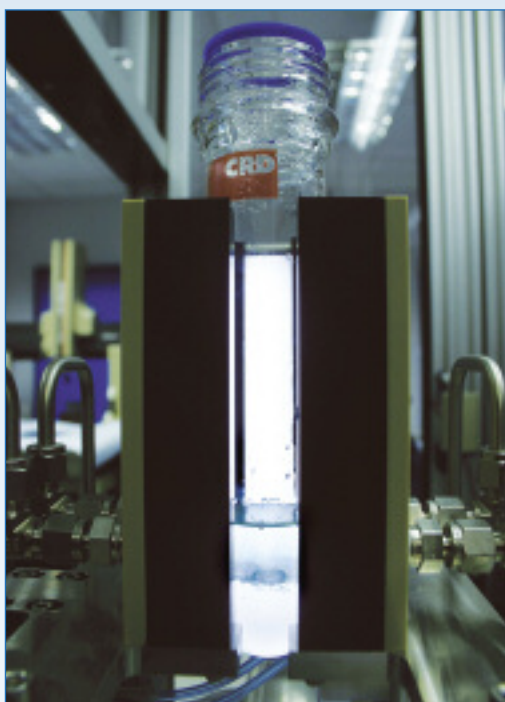
Eagle Extraction “Robot Assistant”



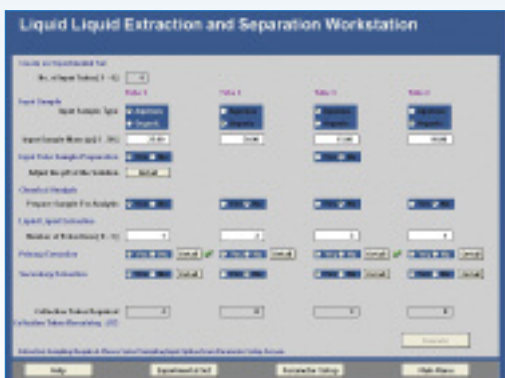
Robot in motion



Solvent dispensing station



Separation Station



Eagle Extraction Software

Introduction

Downstream processing operations, such as liquid-liquid extraction, provide an opportunity to effect purification and often lend themselves to process improvement. Choice of extraction media, pH and temperature used, quantity of solvents and number of washes/extractions are all areas that can be optimized. Such investigations are usually resource intensive, tedious and slow. Provided a fit for purpose lab process is available, extensive investigations are rarely carried out.

The Eagle extraction robot assistant offers process R&D groups both the capability and the capacity needed to fully investigate the parameters affecting liquid-liquid extraction processes.

Our Eagle can easily handle all your liquid-liquid extraction testing. As well as facilitating continuous process improvements, Eagle provides the information you need on quality, productivity, the environment and waste treatment costs, and delivers the process understanding demanded by Quality by Design.

What is it?

The Eagle is a fully automated, robotic chemistry technician designed to perform a range of extraction tasks, 24x7. It operates repeatedly and reliably to give the accuracy and precision you need, from dispensing the solvents through to separating the layers and preparing samples for analysis. Integration of the robotic actions with machine vision offers the end user flexibility with safety.

What does it do?

The Eagle carries out all the tests you need to determine solvent choice, aqueous media, quantity of solvents and number of washes required. Of course the contacting and disengagement parameters can also be investigated. In addition, the system can carry out precise pH adjustments, giving you the information you need to leverage the potential for purification during your extraction processes.

Machine vision is used in a variety of ways within the system. As well as capturing images of key procedures the data gathered is used for critical real-time decision making, whereby the next steps in the process are determined via automated feedback loops. This capability comes into its own in the separation step, enabling appropriate handling of all outcomes, from clean separation, through messy interfaces, to emulsions.

Conclusion

Our Eagle gives you the capability and capacity to gain insight into the parameters affecting your liquid-liquid extraction processes thus facilitating process improvement and delivering the process understanding you need.

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Zebrafish Corrosion Testing Platform

Fuel Cell Stacks – Optimizing the material
for bipolar plates.



If you agree that corrosion testing is a major bottleneck in the R&D process for fuel cell components and its an area crying out for improvement then the Zebrafish Corrosion Testing Platform is the system you've been looking for.

Our high throughput technology offers you an increase in the quantity and the quality of your corrosion data whilst decreasing the time, materials and manpower involved.

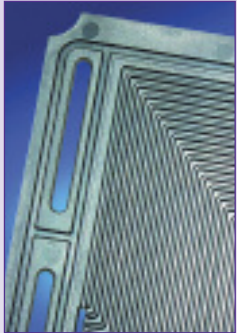
Overview

- Flow cells for electrochemical measurements
- Ideal for testing bipolar plates or tokens (PEM Fuel Cells)
- Performs standard tests eg. Polarisation resistance, cyclic voltammetry
- Modular construction, allowing multiple tests simultaneously
- Small volume, resource efficient design
- Easy to use and set up hardware – plates/tokens can be changed in seconds
- User friendly software for easy data collection and manipulation





Zebrafish Corrosion Testing Platform



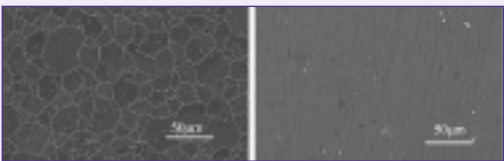
Bipolar plate



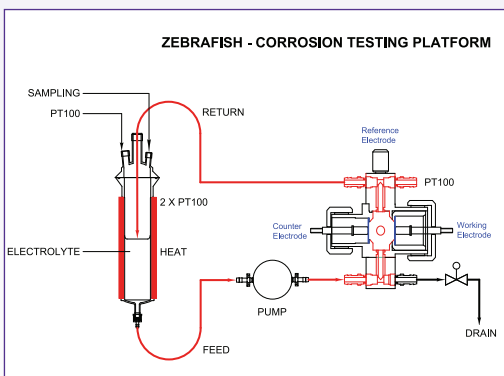
Test cell



Zebrafish - Corrosion Testing Platform



Corrosion of uncoated and coated plates



Introduction

Bipolar plates are essential for producing fuel cell stacks. They connect cells electrically in series, separate gases in adjacent cells and provide structural support for the stack. One of the keys to good performance is the stability of bipolar plates to the very corrosive environment inside a fuel cell (pH 2-3, temperatures 60-80C). Testing this stability is traditionally a time consuming, resource intensive step in characterizing the performance of fuel cells.

Corrosion testing need no longer be a bottleneck – the Zebrafish Corrosion Testing Platform will provide you with all the information you want!

Our multi-cell system addresses the bottlenecks inherent in corrosion testing. By applying high throughput technologies it is now possible to:

- carry out standardized tests,
- perform more tests at the same time,
- decrease the time per test
- dramatically reduce the quantity of corrosive fluid required.

What is it?

The Zebrafish is high-throughput equipment consisting of independently controlled test cells. A system can comprise of many tens of cells allowing simultaneous screening of samples under typical fuel cell conditions. All wetted parts are available in non-metallic materials suitable for use in aggressive environments. Easy to use software is integral to the

system so that you can collect your data and readily turn it into the information you need.

What does it do?

Our Platform sets the conditions for examining the impact of the electrochemistry on the test sample. At the click of a button, it will perform standard tests like polarisation resistance, cyclic voltammetry and constant potential experiments at user defined conditions of electrolyte, flow and temperature.

Users can sample the electrolyte for metal ion content and tests can be performed with any number of additives to evaluate accelerated degradation.

As well as yielding high-quality corrosion data a great deal faster than conventional test methods, the high-throughput approach provides a means to evaluate more complete parameter spaces than previously viable.

Conclusion

As an affordable, high throughput, lab scale system, the Zebrafish is an invaluable tool for every lab with a need for corrosion testing. It offers the capability to discover the best materials for bipolar plates in the shortest possible time.

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Rattlesnake Continuous Crystallisation Concept

Scaleable technology for your crystallisations



Our Rattlesnake is being developed to help you address the many challenges associated with your crystallisation processes.

Our novel design incorporates the control you would expect from continuous processing and effectively applies it to the parameters that influence crystallisation outcomes.

Details of the technology are under wraps for the time being as we are completing the patent application process, however we can give you an overview of the system features:

Overview

- Uniform mixing and precise temperature control over the entire reactor volume
- Multiple ports for monitoring and analysis
- Features to minimize encrustation
- Windows for process observation
- Lab and plant scale versions
- Easy to clean, with low volumes of waste solvent
- Material options e.g. Hastelloy C276

This fully funded concept is of high relevance across chemical industry and we are interested in meeting with companies from all fields who have an interest in crystallisation.





Rattlesnake Continuous Crystallisation Concept



Observation window



Sampling



Ultrasound



Isolation of solids by controlled crystallisation is key to ensuring pure and consistent product. Crystallisation requires control of supersaturation, nucleation, crystal growth and all the other parameters that influence particle size distribution.

Here at CRD we have worked hard to evaluate the many issues associated with these multiphase systems. Our novel Rattlesnake crystalliser extends existing system boundaries, offering innovation in a number of areas including temperature control, the use of ultrasound, pH control and product sampling.

We've also built in features such as windows for process observation and ports that give you the flexibility you want for monitoring and analysis.

We have working systems that are being extensively trialled and new results are being generated every week, building the evidence that this new technology is effective.

We can't reveal too much until the patent application is

complete, but if you'd like to talk to us in person we'd be happy to discuss what we can. In particular we are interested to hear from companies who would like to participate. We can offer experienced resource in this area - this may be of value if you are looking to facilitate a switch from batch to continuous production. Please contact us if want to discuss this option.

If you would like to speak to a technical representative please call us on +44 (0) 1954 252522, e-mail sales@crduk.com, or alternatively you can visit www.crduk.com for further information.

The Origin of the Species

Continued evolution makes CRD a breed apart



At CRD we have flourished over the last 20 years by evolving the company, allowing us to take advantage of the latest advances in technology and to deliver to changing customer demands.

Today's industries want to embrace continuous improvement to their existing methods, as well as look for step change. Companies that survive are those, like ours, that can deliver to this changing market, for example in the areas of miniaturisation, robotics and vision.

We recognise that every element of our work, small or large, is equally important – after all, little things often develop into great things! This attention to detail is one of the reasons we have been the preferred partners to academic institutions and companies across the chemistry sector, on a global basis.

Our in-house capability to design and manufacture what we need, from small components to complete systems gives us unmatched flexibility to tackle complex customer problems, providing creative, simple and, above all, practical solutions.

We have enabled new ventures to secure multi million pound funding, academic institutions to build state of the art laboratories and established companies to expand their knowledge base beyond the traditional boundaries.

Today, to complement our custom engineering and automation service, we offer a number of 'off the shelf' products as well as components and fittings, all designed and constructed to our usual exceptional standards. Moreover, we can personalise them for your specific application!





Tadpoles and other Species

The little things that make our big things great!



Miniature check valves



Low cost Waste Management



Tadpole range of novel check valves



Leak-tight stirrer assembly



From check valves to stirrer assemblies, a range of quality components developed to underpin our Chameleon, Zebrafish, Eagle and Rattlesnake systems is now available to our customers.

At CRD we can't always find components of the quality we are looking for – so we design and manufacture them ourselves!

We can only give you a taste of our capabilities here, so if you can't see what you want, please contact us on +44(0)1954 252522 or e-mail sales@crduk.com

Our Tadpole range of patented check valves

A range of novel check valves, including the smallest check valve in the world!

Our Tadpole range of check valves have a completely novel, patented design, which allows them to be extremely small and enables their manufacture in a range of resilient materials.

With a cracking pressure of 50 mbar – 1 barg, these new check valves are ideal for applications requiring miniaturisation or for use in instrumentation with space constraints.

Stirrer Assembly

Our Stirrer Shaft Seal has been designed to allow stirring under both pressure and vacuum conditions with proven leak resistance over 168 hours of testing.

The units are made to fit "Rodavis" B19, B24 and B29 ground glass female taper fittings. Each unit is supplied complete with a "Rodavis" screw cap.

Construction is in PEEK with sealing, for pressure and vacuum, provided by spring energised seals in a PTFE based compound.

Waste Management accessories

Our Waste Management system is a cost effective method for both collecting used solvent in a waste solvent container (with minimal personnel exposure) and for ensuring the container doesn't overflow. This is particularly useful in managing the continuous waste stream from HPLC systems, and when liquid levels cannot be readily monitored.

If you would like to speak to a technical representative please call us on +44 (0) 1954 252522, e-mail sales@crduk.com, or alternatively you can visit www.crduk.com for further information.

