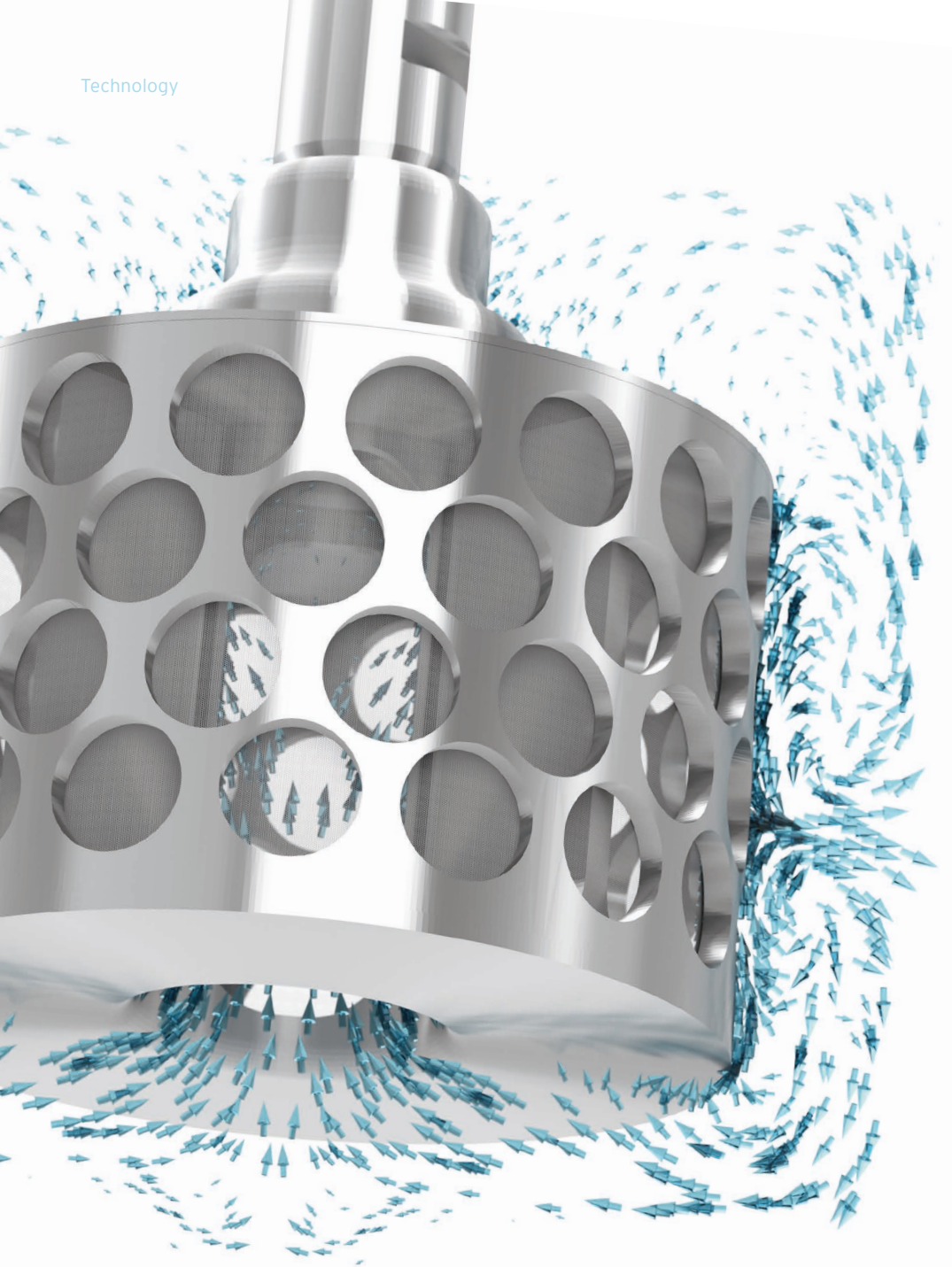
Rotating Bed Reactor

Applications and products

SPINCHEM®



Rotating bed reactor technology

✓ **Short reaction time**
Due to fast mass transfer

✓ **Simple to scale**
Due to generic principle

✓ **Long catalyst lifetime**
Due to protected solid phase

✓ **Easy to automate**
Due to quick catalyst recycling

✓ **No filtration required**
Due to contained solid phase

✓ **Perfect for screening**
Due to quick catalyst exchange

The SpinChem® rotating bed reactor (RBR) holds the solid phase as a packed bed and rapidly aspirates the reaction solution from the bottom of the vessel, percolates it through the solid phase and quickly returns it to the vessel. By intelligent design of the SpinChem® RBR and vessel, the axial mixing and convective transport are maximized. The resulting efficient mass transfer minimizes reaction time and boosts product yields even with liquids that are immiscible or of different viscosity, or for reactions demanding distribution of dissolved gases.

With a SpinChem® Rotating Bed Reactor (RBR) you can eliminate slow reaction kinetics caused by poor mass transfer between your solution and solid phase. The SpinChem® RBR design is flexible and can be used for heterogeneous reactions with numerous types of solid phases, including immobilized enzymes, encapsulated cells, ion exchangers, or for purification using metal scavengers, active carbon and water adsorbents. This typically results in faster processes, higher yields or reduced consumption of reagents, depending on the type of process. In addition, the SpinChem® RBR extends the lifetime of the solid phase particles by minimizing grinding and fines, while also making it easier to collect and recycle them. The SpinChem® RBR concept is fully scalable from laboratory to production, thus providing both more efficient reaction development and improved production economy.

Find out more on spinchem.com

Immobilized enzymes

Application 1014

Biocatalysis by immobilized enzymes in a rotating bed reactor.

An example of straightforward biocatalysis by immobilized enzymes in a rotating bed reactor. Ester hydrolysis by an immobilized lipase formed a yellow coloured product from 4-nitrophenyl octanoate, a substrate commonly used to screen and characterize lipases. A video of the reaction progress is available online.

Read more about application 1014 and watch the video on spinchem.com

Encapsulated cells

Application 1002

Efficient synthesis of chiral lactones by encapsulated cells in a rotating bed reactor.

Comparison of a rotating bed reactor (RBR) with traditional reaction set-ups such as stirred tank reactor and packed column for a demanding biotransformation. The SpinChem® RBR matched or outperformed the other systems and gave a 10 to 25-fold more time-efficient recycling of the encapsulated cells.

Read more about application 1002 on spinchem.com

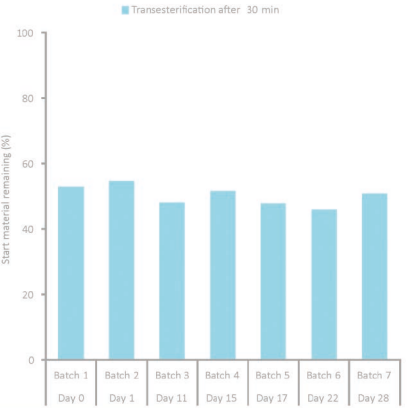
One-pot multistep
Application 1009

Simultaneous extraction of two dyes selectively onto different resins.

Illustration of how the different compartments of a rotating bed reactor (RBR) can be used for cascade reactions or one-pot multistep processes. This example shows selective extraction of red and blue dyes with different chemical properties onto different adsorbents within the same run. The dyes were separated based on ionic and hydrophobic interactions, respectively.

Read more about application 1009 and watch the video on spinchem.com

Biocatalyst recycling
Application 1019



Recycling of immobilized enzymes using rotating bed reactor technology.

Study of catalyst recycling during esterification and transesterification reactions with immobilized lipases in rotating bed reactors. Data from several laboratories showed that no attrition or grinding occurred and that no filtration was necessary between reaction cycles. The production capacity was estimated to 50 kilograms per gram of catalyst thanks to the high catalyst stability.

Read more about application 1019 on spinchem.com

Immiscible liquids

Application 1003

Effective phase-transfer between immiscible liquids and an ion exchange resin.

A phenolic colorant was deprotonated and extracted from an organic to an aqueous solvent while also changing colour from red to blue. The use of SpinChem® RBR in a flower-baffled reaction vessel created fine emulsion droplets resulting in effective phase-transfer between the two liquids and the solid phase. A video of the reaction progress is available online.

Read more about application 1003 and watch the video on spinchem.com

Avoid grinding

Application 1010

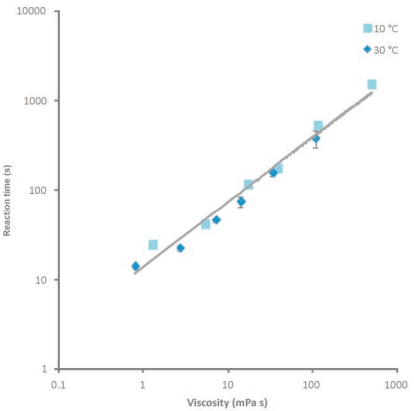
Rotating bed reactors completely avoid grinding of molecular sieves.

The photos show how grinding caused by stirring of molecular sieves can be completely avoided by using a rotating bed reactor (RBR). Molecular sieves contained in an RBR for a 200 mL vessel can theoretically hold 0.23 moles of water. This allows synthesis of product in the range of 100 grams by ester condensation or drying of 25 L analytical grade organic solvent.

Read more about application 1010 on spinchem.com

Viscous solutions

Application 1004



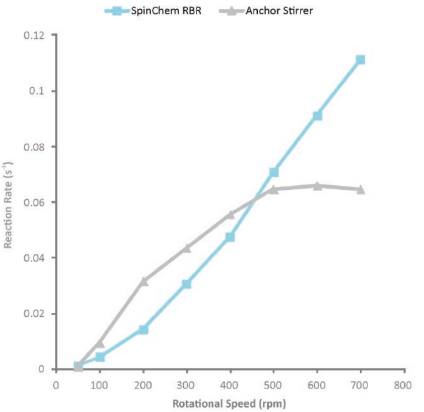
Consequences of viscous solutions on the reaction rate with rotating bed reactors.

Log-log plot of how viscosity affects the reaction time for a mass transfer limited reaction at a fixed rotational speed of a rotating bed reactor (RBR). The SpinChem® RBR behaved very predictably and delivered reaction times that increased monotonously with reaction media viscosity up to at least 500 mPa·s.

Read more about application 1004 and watch the video on spinchem.com

Optimizing rotation

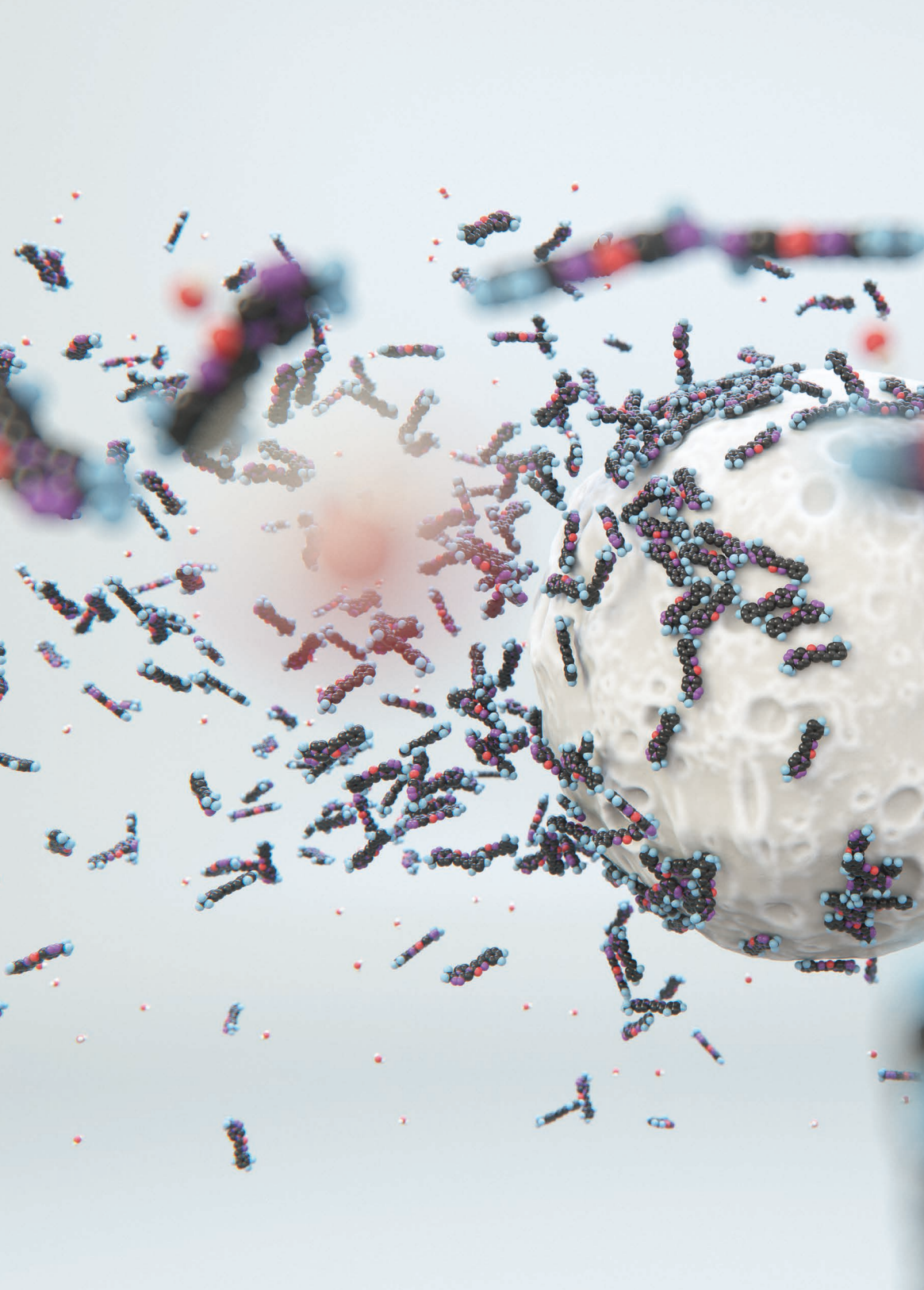
Application 1001



Optimizing the rotational speed of rotating bed reactors in baffled reaction vessels.

Investigation of how rotational speed influences the efficiency of rotating bed reactors (RBR) for a diversity of processes such as adsorption, neutralization and ammonolysis. It was demonstrated how reaction rates could reach a plateau with the SpinChem® RBR when mass transfer efficiency exceeded reaction speed.

Read more about application 1001 on spinchem.com



"Results are quite amazing; significantly improved reaction rate, very easy recycling and bullet-proof stability of our enzyme."

Dr. Michiel van Vliet
R&D Manager, ChiralVision, The Netherlands

"The SpinChem RBR has become an often used technology for heterogeneous catalysis at our research group."

Dr. Dennis Kaufhold
BASF Personal Care and Nutrition, Germany

Production scale

Application 1018

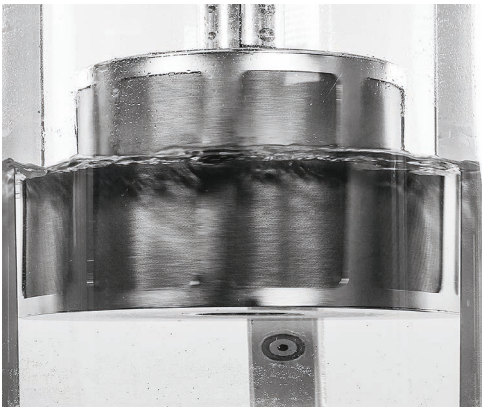
Preview of rotating bed reactor scale-up for large liquid volume processing.

Capable of processing at least 100 L of reaction liquid while holding nearly eight litres of solid phase, this SpinChem® rotating bed reactor (RBR) is designed for highly efficient production within your existing plant equipment. This photo shows the latest version delivered to customers performing biocatalysis for production of chemicals.

Read more about application 1018 on spinchem.com

Loading and unloading

Application 1021



Demonstration of loading, reaction and unloading in a production scale RBR.

A SpinChem® rotating bed reactor (RBR) for use in 20-300 L vessels was charged with solid particles, used for pH neutralization, drained from reaction liquid and finally emptied from solid phase without opening the RBR. This procedure illustrates one approach to using RBR in production scale equipment without opening the reaction vessel.

Read more about application 1021 and watch the video on spinchem.com

Automated processing

Application 1007

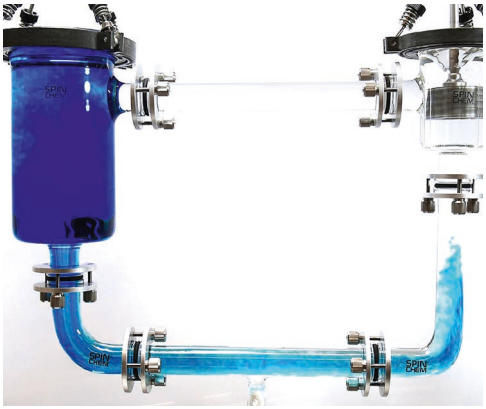
Automated semi-continuous batch processing system with rotating bed reactor.

Outline of an automated SpinChem® rotating bed reactor system capable of filling a solution, neutralizing it by ion exchange and draining it. By micro computer control, unattended semi-continuous batch processing was accomplished for many cycles until the ion exchanger was completely saturated.

Read more about application 1007 and watch the video on spinchem.com

Externally connected

Application 1012



An externally connected system for large scale downstream processing.

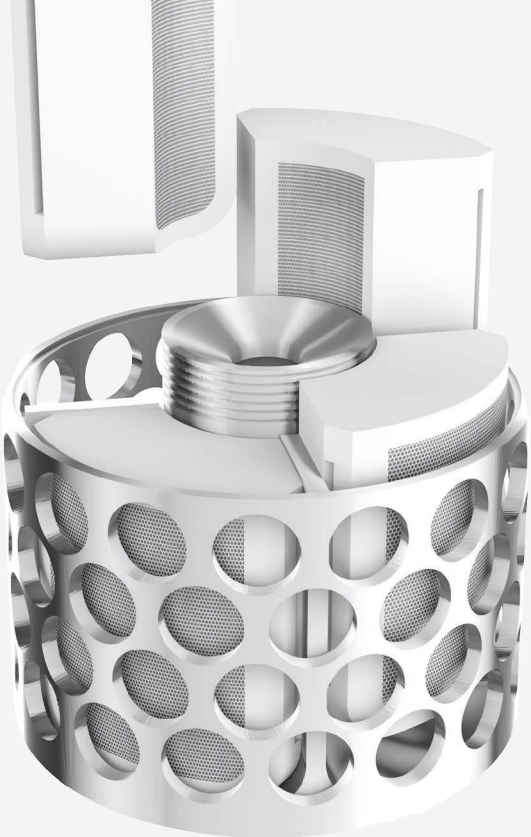
Illustration how an externally connected SpinChem® rotating bed reactor (RBR) can pump and process large liquid volumes by the convective flow created by the spinning RBR. The concept enables handling of volumes at least 10-100 times larger than the external vessel, thus facilitating installation of RBR technology into existing plant equipment.

Read more about application 1012 and watch the video on spinchem.com

SpinChem® cartridges

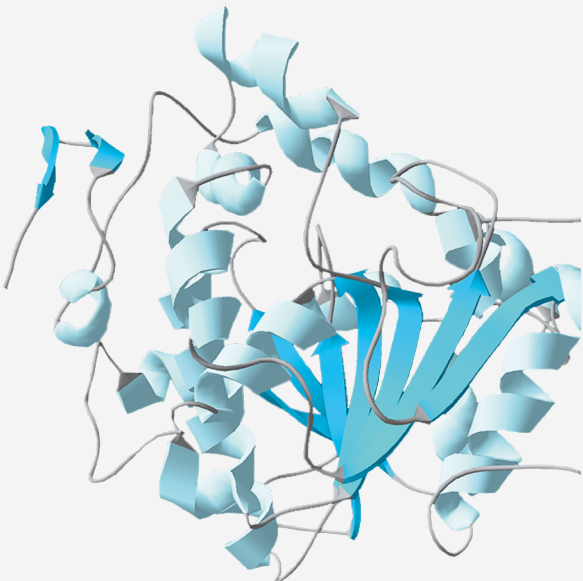
The SpinChem® cartridges provide easy and convenient handling of solid phases used in the rotating bed reactor.

Please contact SpinChem® for requests of catalysts and sorbents or more information.



Biocatalyst screening kits

The new SpinChem® biocatalyst screening kits are based on Purolite® Lifetech™ ECR (enzyme carrier resins). They contain immobilized enzymes or plain ECR for your own enzyme. The cartridge format makes screening of lipases or carriers quick and convenient.



Purolite® Lifetech™ screening kits

Purolite Life Sciences

CalB immo screening kit

S2 B1

Purolite® Lifetech™ CalB immo screening kit for SpinChem® RBR S2. Contains six different resins with immobilized CalB for biocatalyst screening. Four cartridges of each type.

CalB immo 8285
CalB immo 8806
CalB immo 1090
CalB immo 5587
CalB immo 5872
CalB immo Plus™

Find out more on spinchem.com

Lipase immo screening kit

S2 B2

Purolite® Lifetech™ lipase immo screening kit for SpinChem® RBR S2. Contains resins with six different immobilized lipases for biocatalyst screening. Four cartridges of each type.

CalB immo Plus™
CalA immo
TL immo
RM immo
CR immo
PS immo

Find out more on spinchem.com

ECR screening kit

S2 B3

Purolite® Lifetech™ ECR enzyme carrier resin screening kit for SpinChem® RBR S2. Contains six different resins for enzyme immobilization screening. Four cartridges of each type.

ECR8204F
ECR8309F
ECR8285
ECR8806F
ECR1090M
ECR1030M

Find out more on spinchem.com

Rotating bed reactors

SpinChem® RBR S2

SpinChem® rotating bed reactor for 100–500 mL vessel.

SpinChem® RBR S3

SpinChem® rotating bed reactor for 300–2000 mL vessel.

SpinChem® RBR S4

SpinChem® rotating bed reactor for 2–30 L vessel.

SpinChem® RBR S5

SpinChem® rotating bed reactor for 20–300 L vessel. Custom made to fit customer's reaction vessels.

Complete starter kit S2

The quickest way to your rotating bed reactor experiments up and running. Includes RBR S221, reaction vessel V221, lid, seal, hose connectors, shaft guide, holder, stand & motor.

Complete starter kit S3

The quickest way to your rotating bed reactor experiments up and running. Includes RBR S311, reaction vessel V321, lid, seal, hose connectors, shaft guide, holder, stand & motor.

Read more about our products on **spinchem.com**

Technical support

Manuals and video-based product assembly guides are available at the SpinChem® website.

The SpinChem® support team are happy to answer any questions about how to practically adapt applications to conditions that are suitable for RBR technology and devices.

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