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Anton Paar

Microwave Synthesis



The Complete Microwave Synthesis Family

Any Chemistry, Any Scale, Anyone, Anywhere: The Complete Microwave Synthesis Family

Since its beginning in 1986, microwave synthesis has successfully matured. The new generation of Anton Paar microwave synthesis instrumentation was developed in response to the increasing demand – particularly in the pharmaceutical industry and in material science – for straightforward solutions that cover the entire range of microwave synthesis applications, from initial R&D to kilolab processing.

The key: direct scalability

Method transfer from the development stage to larger quantities is a major concern in microwave synthesis. As no microwave effects are involved, the reliability of a method solely depends on the temperature measurement. Accurate internal temperature measurement and the resulting knowledge of the real reaction temperature is the key issue for successful scale-up.

Once the reaction temperature is known, an optimized protocol can be applied in any suitable scale without losing efficiency.

Serving your needs

From the smallest quantities to gram-scale library generation and multigram batch processing – all the initial steps of chemical research and development are completely covered by Anton Paar's microwave synthesis products and its 21-CFR-Part-11-compliant software. You can be sure to find the right solution for your specific application.



Getting started with the Monowave series

The entry models Monowave 100 and Monowave 200 serve the basic requirements in microwave synthesis. Enhanced method development with Monowave 400 opens up pathways to new reaction routes for a broad variety of applications. The optional MAS 24 autosampler serves sequential multigram synthesis of valuable compounds.

You want more? Scale up with Multiwave PRO

Parallel optimization in Multiwave PRO with silicon-carbide-based high-throughput rotors as well as parallel scale-up to the multigram range with Rotor 16 allows for library generation in various amounts. Looking for extremes? The configuration with the high-performance Rotor 8N is your best choice.

The big deal: a kilo a day

Batch-type processing to the liter scale with Masterwave BTR leads to as much as 250 g of product in a single run. The similar software user interface allows direct method transfer from the Monowave series. Simply multiply the amounts of your mixture and follow your optimized protocols.



The Monowave Series

All you need to get started

Monowave 100



Microwave synthesis for education

Monowave 100 is a dedicated microwave synthesis reactor designed to serve educational purposes and meet the needs of primary academic research. This easily operated, budget-friendly “as-it-is” solution conveniently provides you with the basic requirements so you can get familiar with microwave synthesis in the 2 mL to 6 mL range.

As simple as that

All parameter control features are fully integrated in the instrument; no additional sensors need to be attached. Temperature programs are controlled by the mandatory IR sensor.

The intuitive software user interface allows for quick method programming on the touchscreen.

The helpful tool

A highly advantageous option is the 10 mL silicon carbide vessel, supporting chemistry which is not applicable in glass vials and enabling you to rapidly heat samples – even low-absorbing solvents.



Applicable vial types for Monowave 100

	Monowave 100
Microwave output power	500 W
Max. temperature	260 °C
Max. pressure	20 bar (290 psi)
Operation volume	2 mL to 6 mL
Magnetic stirring	600 rpm

Your door opener to the next level

Monowave 200

Modularity as required

Monowave 200 is developed for covering a wide range of standard synthesis applications. In its basic version, this readily upgradable system works with reaction volumes between 0.5 mL and 20 mL.
Employing Monowave 200 you can step into microwave synthesis with the common basic operation limits widely used for R&D.

If required, you can unlock extended limits, supplementary features and additional accessories using the available software tokens.

Monowave 200
850 W
260 °C
20 bar (290 psi)
0.5 mL to 20 mL
0 rpm to 1200 rpm



Applicable vial types for Monowave 200

The Monowave Series

Working at the top level

Monowave 400

The leader in the lab

Monowave 400 is the reliable choice for chemical research, drug discovery, life science, nanotechnology, polymer chemistry and much more.
The reactor opens up pathways to new reaction routes in a broad variety of applications. Reliability, scalability and reproducibility of methods are proven in great detail.

Serving individual needs

A variety of reaction vials provides access to various scales, from reaction volumes from 0.5 mL to 20 mL. 30 mL wide-neck vials allow for simple use and recovery of bulky materials.
The special 10 mL reaction vessel made of silicon carbide (SiC) allows for trouble-free processing of chemistry not suitable for glass vials and supports efficient heating of low-absorbing solvents.



Take home your advantage

- Rapid and uniform heating
- Simultaneous internal & IR temperature measurement
- Reliable accuracy and reproducibility
- Powerful stirring for optimized agitation
- Integrated digital camera with on-screen operation
- Durable vials and caps
- Operation time up to 100 h
- Minimum lab space required for automation

	Monowave 400
Microwave output power	850 W
Max. temperature	300 °C
Max. pressure	30 bar (435 psi)
Operation volume	0.5 mL to 20 mL
Magnetic stirring	0 rpm to 1200 rpm

Automation as you like it

The optional autosampler MAS 24 guarantees seamless unattended sequential operation. Up to 24 vials of different sizes are easily queued and processed automatically.

Catch a glimpse

Watch your chemistry with the integrated digital camera. Follow all color changes and precipitation directly on-screen or check the dissolution of substrates and stirring efficiency.

Get the real temperature

The optional ruby thermometer provides an internal temperature measurement to determine the exact reaction temperature which is essential for the transfer and scale-up of reaction protocols.



Applicable vial types for Monowave 400



Camera view

Parallel Development & Scale-up

Parallel synthesis at its best

Multiwave PRO

The versatile Multiwave PRO microwave reaction system provides direct scalability from the milligram to the liter scale. All methods developed in small-scale SiC rotors can be applied in the high-performance rotors with their 100 mL reaction vessels.

Optional immersing pressure/temperature probes for a reference vessel in the scale-up rotors combined with the standard IR sensor maximize the accuracy of reaction control.

Individual setup

An ingeniously simple gas-loading system enables you to create a reactive or inert gas atmosphere up to 20 bar in each vessel individually.



Rotor	16MF100	16HF100	8NXF100	8NXQ80
No. of vessels	16	16	8	8
Reaction control	One reference vessel with immersing temperature probe and pressure sensor Remote IR control in 16-position plate		One reference vessel with immersing temperature probe Remote IR control and pressure control in all positions	
Liner material	PFA	PTFE-TFM	PTFE-TFM	n/a
Pressure jacket	PEEK	Ceramic	Ceramic	Quartz
Volume	100 mL	100 mL	100 mL	80 mL
Operation parameters	200 °C @ 20 bar (290 psi)	240 °C @ 40 bar (580 psi)	260 °C @ 60 bar (870 psi)	300 °C @ 80 bar (1160 psi)



The perfect match

As an excellent microwave absorber, silicon carbide works best as a material for high-throughput rotors. Various mixtures, even virtually microwave-transparent ones, can be applied in one run and are heated identically and uniformly in SiC plates.

This equipment perfectly matches the typical requirements in drug discovery, forensics, biomedical research and other areas which predominantly deal with small sample quantities.

Features & benefits

- Reliable temperature and pressure sensors – optimized reaction control
- Installation-free remote-sensor technology – easy handling, wireless data transmission
- Applied silicon carbide technology – efficient homogeneous heating
- Multiple safety system – safe, trouble-free processing under extreme conditions

Rotor	4x48MC	4x20MGC	4x24MG5
Positions	192	80	96
Reaction container	6x8 SiC microtiter plate	HPLC/GC vials in 5x4 SiC plate	Glass vials in 6x4 SiC plate
Reaction control	Remote IR control of each SiC plate		
Operation volume	0.02 mL to 0.3 mL	0.1 mL to 1.5 mL	0.3 mL to 3.0 mL
Operation parameters	200 °C @ 20 bar (290 psi)		

A New Dimension in Microwave Synthesis

Microwave goes kilolab

Masterwave BTR

Based on a revolutionary new technique (patent pending, US 2009/0194528), the Masterwave benchtop reactor closes the gap between research and kilolab processing in microwave synthesis. The powerful instrument overcomes heating difficulties in scale-up and provides efficient heating and outstanding productivity for a 1L reactor. Its rising-sensor temperature measurement technique provides the temperature accuracy required for direct method transfer from any smaller microwave device to the liter scale.

A kilo a day

Total reaction volumes of up to 750 mL and the powerful stirrer's capacity for agitating up to 200 g solid material ensure unrivaled productivity in a single run. Additionally, the instrument's integrated cooling system shortens overall process times.
Each reaction vessel includes its own paddle stirrer and cap with lip-type seal. This enables you to optimize your workflow, since you can prepare the next batch while processing the batch at hand. As a result, the daily production of kilogram amounts by microwave synthesis becomes a reality.

A pioneering "walk on, walk off" solution

Despite its enhanced productivity, Masterwave BTR is still standard laboratory equipment. Placed in a regular fume hood and connected to the corresponding interfaces, any chemistry can be started right away. No specific safety measures have to be observed, no extraordinary pre-installation measures are required – simply use the available lab space in the most efficient way.
For maximum convenience, processing can optionally be remotely controlled from any desktop PC.

Pushing technical frontiers

- 1700 W applicable microwave power
- Reaction conditions up to 250 °C and 30 bar
- Rising Pt100 sensor for internal temperature measurement
- Sliding cover with embedded hydraulic pressure sensor
- Bayonet-locked 1 L PTFE reaction vessel
- Vessel-integrated magnetically driven paddle stirrer
- Internal closed-cycle cooling system
- Compressed-air-driven vessel ejector





Anton Paar microwave synthesis excels in:

- Method development, optimization and scale-up
- Building block synthesis
- Scaffold decoration
- Metal-catalyzed reactions
- Preparation of nanoparticles
- Hydrothermal reactions
- Polymer chemistry
- Ionic liquid applications

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