Anton Paar

Synthesis reactors

Synthesis reactors for research, development, and education

The leader in the lab – Monowave microwave reactors

The Anton Paar Monowave product line is a series of high performance microwave monomode reactors designed for small to medium scale microwave synthesis.

Rapid and uniform heating is guaranteed by 850 W unpulsed microwave power (automatically adjusted to the sample) and powerful stirring (up to 1200 rpm). This means improved productivity and product purity across all applications in research and development laboratories.

Monowave 200 Monowave 400 Monowave 450

Make your choice – there is a vial suitable for any application

- Vials for reaction scales between 0.5 mL and 20 mL with tool-free handling
- Wide-neck vial for bulky samples and extractions (only available for Monowave 400 and Monowave 450)
- Silicon carbide vials for efficient heating of all solvents and processing of chemicals not suitable for glass vials (see Fig. 1)

Precise internal temperature measurement – for improved traceability and reproducibility

- Essential for transfer and scale-up of reaction protocols
- IR temperature sensor included in all Monowave reactors
- Simultaneous internal temperature measurement with the fibre optic ruby thermometer (optional accessory) for accurate control of highly exothermic reactions

Fig. 1: Reaction vials

Fig. 2: Real-time reaction monitoring

Monowave 400 Monowave 450

Setting the standard – for demanding chemical reactions

- Maximum temperature and pressure: 300 °C and 30 bar
- Reaction time: up to 100 h
- Remote control via VNC
- 21 CFR part 11 compliant

Built-in digital camera – for real-time monitoring of your reaction

- Record images and videos with the integrated digital camera
- Follow color changes and precipitation, check the dissolution of substrates, optimize stirring efficiency (see Fig. 2)

Monowave 450

Automation on top – for increased productivity

- Autosampler MAS 24* accommodates up to 24 vials of different sizes
- Queued and processed automatically
- Small footprint – no extra lab space required

Monowave 200

A strong foundation – for education and fundamental research

- High-speed, closed-vessel microwave chemistry at temperatures of up to 260 °C and pressures of up to 20 bar
- Unlock extended operational limits, supplementary features, tools and accessories with a software upgrade

*Optionally available for Monowave 200 (after the software upgrade)

Synthesis reactor systems for any application

Multimode microwave reactors

Multiwave 5000 – one system, endless possibilities
From high performance chemistry suited for materials synthesis and nanotechnology, high-throughput screening and compound library generation to solvent extraction and parallel scale-up, there is a Multiwave 5000 configuration fit for any task. The Multiwave 5000 microwave reaction system provides unmatched operational parameters of up to 300 °C and 80 bar. Carry out up to 96 chemical reactions in parallel.

Masterwave BTR – think big
Designed for speeding up the large-scale synthesis of crucial intermediates, building blocks, fine chemicals, and materials, the Masterwave BTR benchtop reactor offers unrivaled productivity in a single run (up to 750 mL reaction volume) at up to 250 °C and 30 bar.

Conventionally heated synthesis reactor

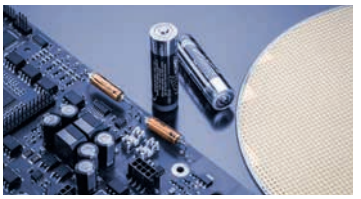
Monowave 50 – Conventional heating with microwave speed
Monowave 50 bridges the gap between affordable but difficult to operate synthesis autoclaves and microwave reactors. It offers utmost convenience and solid performance of up to 250°C and 20 bar. With its small dimensions and minimal installation requirements, it fits into the tightest lab spaces. Reusable consumables and a low initial investment make this synthesis reactor both environmentally and economically friendly.

Anton Paar's solutions for your application



Publication title	"Parallel Microwave Chemistry in Silicon Carbide Microtiter Platforms: A Review"	"Synthesis of a Tetrazine-Quaterthiophene Copolymer and its optical, structural and photovoltaic properties"	"Microwave synthesis of high-quality and uniform 4 nm $ZnFe_2O_4$ nanocrystals for application in energy storage and nanomagnetics"
Instrument	Multiwave 5000 with Rotor 4x24MG5	Monowave 50	Monowave 400 and Masterwave BTR
Samples	Active pharmaceutical ingredients (APIs)	Conjugated donor-acceptor polymers for organic photovoltaics (OPV)	Magnetic nanocrystals with a narrow size distribution
Solution	Homogeneous temperature distribution and fast, reliable heating rates allow for efficient high-throughput parallel synthesis of compound libraries in SiC plates in Multiwave 5000.	Conventional heating with microwave-like specifications in Monowave 50. The reactor can be used inside a glove box.	Method development in Monowave 400 and direct scale-up in Masterwave BTR made possible by internal temperature monitoring.
Reference	C. O. Kappe, M. Damm, Mol. Divers. 2012, 16, 5 - 25	A.-C. Knall et al., J. Mater. Sci. 2019, 54, 10065-10076	C. Suchomski et al., Beilstein J. Nanotechnol. 2016, 7, 1350-1360

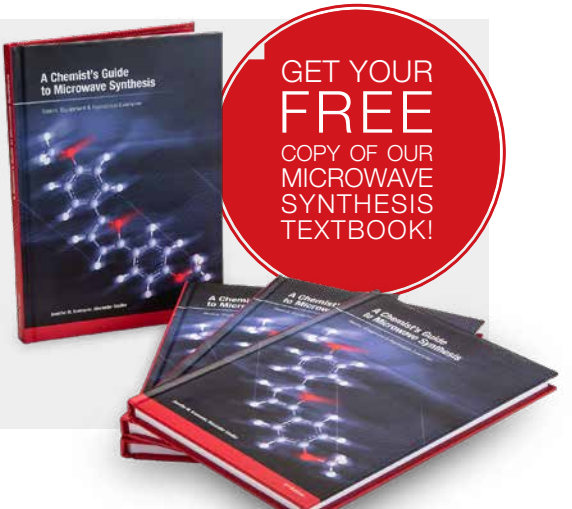




Publication title	"Synthesis of EDOT-containing polythiophenes and their properties in relation to the composition ratio of EDOT"	"Reversible Sodium and Lithium Insertion in Iron Fluoride Perovskites"	"High-Capacity, Aliovalently Doped Olivine $LiMn_{1-3x/2}V_x\square_{x/2}PO_4$ Cathodes without Carbon Coating"
Instrument	Monowave 400	Monowave 400	Multiwave 5000 with Rotor 8
Samples	Semiconducting polythiophenes	$NaFeF_3$ Perovskite Nanoparticles from Rutile Precursors	Solvothermal synthesis of $LiFePO_4$ Nanocomposite Cathodes for Li-Ion Batteries
Solution	Direct CH-Arylation Polycondensation in microwave reactors makes polymerizations easier while avoiding potentially toxic reagents.	FeF_2 precursors were converted into perovskites in a microwave-assisted reaction under inert conditons.	Rotor 8 for highest temperature and pressure specifications with real-time pressure monitoring of all vessels.
Reference	I. Imae et al., RSC Adv. 2015, 5, 84694-84702	A. Martin et al. Adv. Funct. Mater. 2018, 1802057	A. Gutierrez et al., Chem. Mater. 2014, 26, 3018-3026

Still looking for your application?
Discover the world of microwave synthesis.
www.anton-paar.com/synthesis

Find the right reaction conditions in our application database. Explore our collection of over 1000 chemical reactions that have been successfully performed in our reactors.
For a quick start with sealed-vessel synthesis, use our protocol converter and find the right reactor with the help of our configuration finder.



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