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HELPING CHEMISTS

SynthWAVE

The Game Changer in Microwave Synthesis

The new Milestone SynthWAVE is designed for safe, reliable and reproducible scale-up of microwave-enhanced chemical reactions.
It handles single or multiple reactions at temperatures up to 300°C and pressures to 199 bar.
Small-scale synthesis methods are easily transferred to the SynthWAVE.
Incredibly easy to use, the SynthWAVE allows the chemist to run large-scale batch and parallel reactions like never before.

SynthWAVE Benefits

Easy scale-up

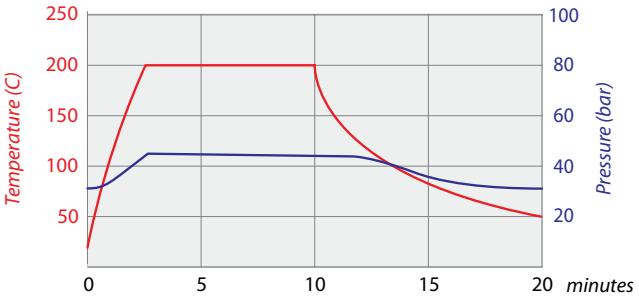
The combination of high microwave power density of 1.5kW/L and powerful stirring allows the same conditions developed for small-scale reactions to be replicated.

Faster screening

Multiple reactions are carried out simultaneously under exactly the same temperature and pressure conditions - even using different solvents.
Quickly and easily evaluation of different catalysts, solvents and reaction conditions.

High pressure capability

The SynthWAVE allows for the use of a wider range of low-boiling reagents, reactants and solvents. Perform aqueous reactions and extractions below boiling point.
Extremely efficient cooling of the reaction vessel avoids or minimizes degradation and side reactions.



Operate under modified conditions

Simply add an inert gas to achieve an inert environment.
Add hydrogen or oxygen to produce a reducing or oxidizing atmosphere respectively.
Speed up reactions with gas molecule insertion using gases such as CO or CO_2. Example: the preparation of isocyanates derivatives by the Staudinger-Aza-Wittig reaction.

Easy sampling

Easily and conveniently sample reaction products at any time during the experiment.

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Since its foundation in 1988, Milestone has been the technology leader in microwave-based laboratory instrumentation, with innovative and unique products that combine high technology and ease of use.
As a result, over the past 24 years, more than 15,000 chemists around the world have chosen to work with our microwave systems.
We aim to create long term relationships with our customers, to whom we offer the highest level of applications and service support.

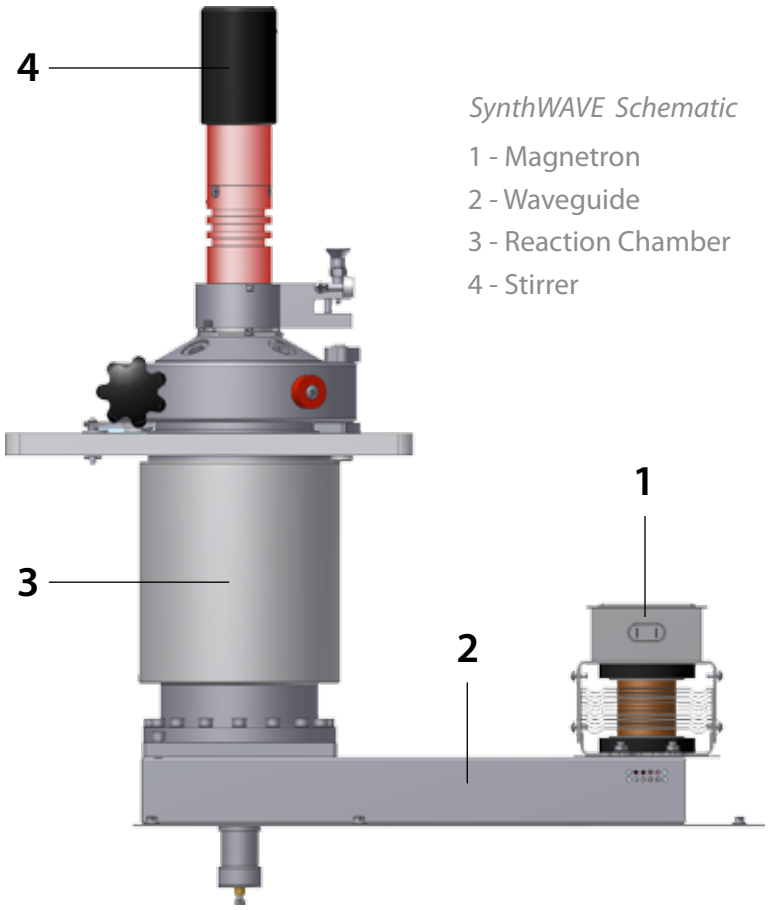
The benefits of microwave synthesis

Microwave enhanced chemistry represents a fundamental step forward in the capabilities of the synthetic chemist.
It enables the running of experiments faster and better than ever before, and is today recognized as cutting-edge technology across the pharmaceutical, biotech, polymer, fine chemical and agrochemical industries.
There is also a growing demand for scale up of chemical reactions from grams to the kilogram range.
To address these needs, Milestone has created a new concept in microwave instrumentation, the revolutionary SynthWAVE, a true game changer in microwave synthesis.

The new Milestone SynthWAVE

SRC Technology

Milestone's unique Single Reaction Chamber (SRC) technology overcomes the limitations of current microwave synthesis instrumentation.
At the heart of the SynthWAVE is a PTFE lined, 1 L stainless steel reaction chamber, which is also the microwave cavity.
This allows the design of the microwave source to be perfectly matched to the cavity shape for optimum microwave distribution and fast, even heating.
The chamber is pre-pressurized with gas to prevent boiling of the solution, and is equipped with mechanical and magnetic stirrers.
The microwave cavity is water cooled, which greatly reduces reaction cooling time and increases productivity.
Reaching up to 300°C and 199 bar, the SynthWAVE is capable of higher temperature and pressure than any other microwave system.



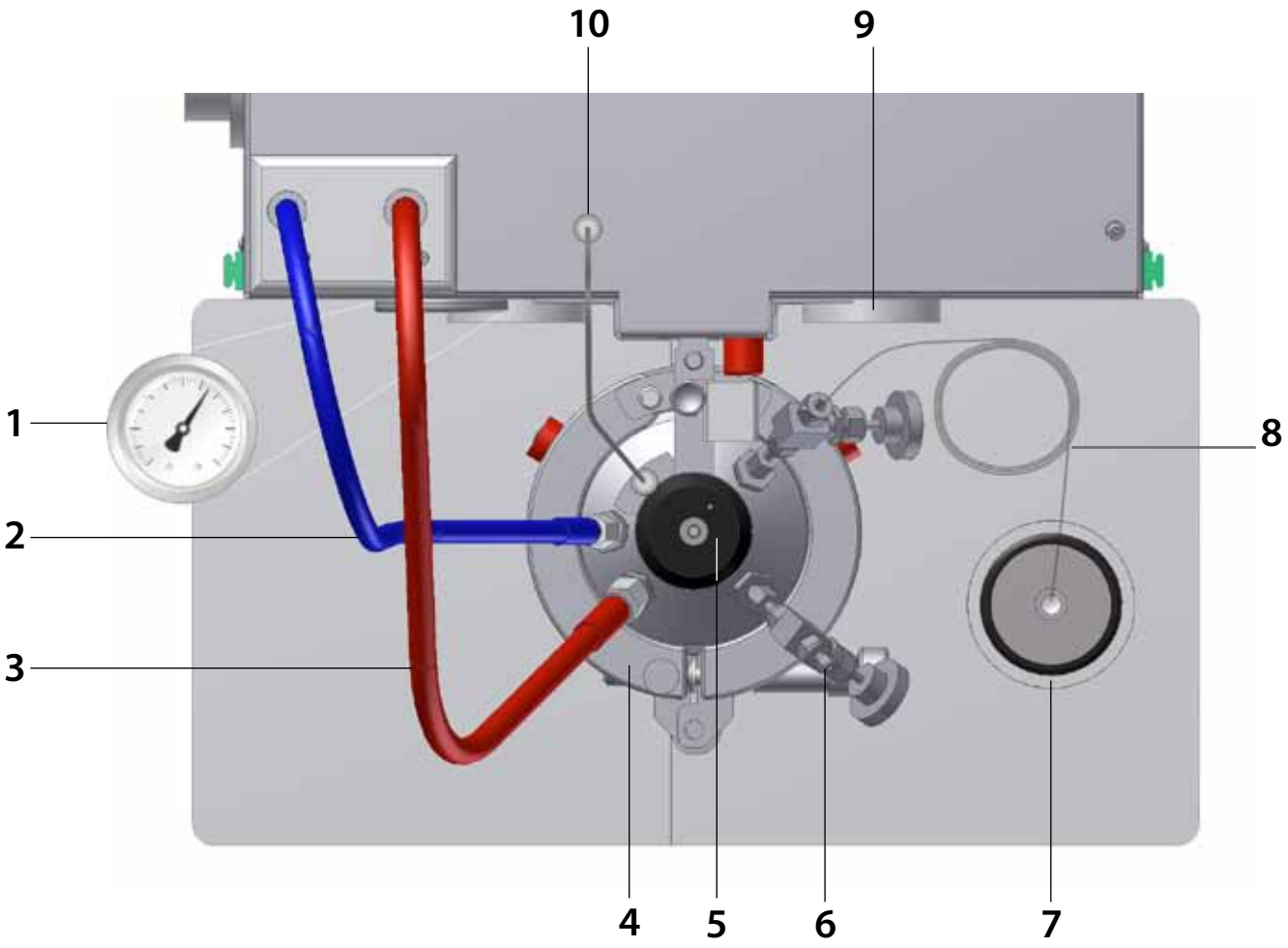
SynthWAVE Schematic

1 - Magnetron
2 - Waveguide
3 - Reaction Chamber
4 - Stirrer

Safety

Like all Milestone products, the SynthWAVE has been designed with operator safety of paramount importance.
A thick acrylic shield surrounds the work area, and it lowers into position automatically as the chamber is closed.
A microwave run cannot be started unless the chamber clamp is in position, and the clamp cannot be released until the chamber is cool, and pressure has been released.
The PID controller continuously monitors temperature and pressure, instantaneously adjusting microwave power to control even highly exothermic reactions.

SynthWAVE Reactor



1 - Analog pressure gage
2 - Gas inlet
3 - Gas outlet
4 - Clamps
5 - Overhead stirrer
6 - Gas release valve
7 - Dewar flask
8 - In-situ sampling
9 - Exhaust system
10 - Temperature sensor

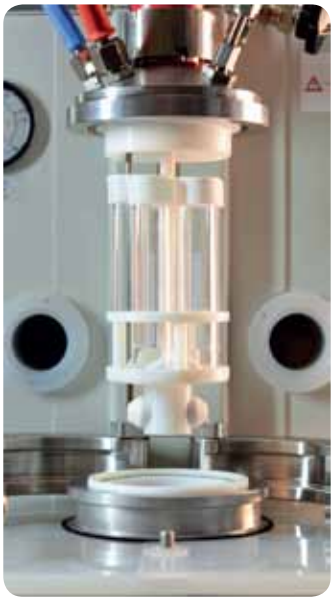
Software-controlled Stirrer

The SynthWAVE features a powerful stirrer, which ensures vigorous stirring in the 1L PTFE vessel, or in all vials whenever a rack is used, thus assuring reliable and consistent results.

Racks and Vials

With the SynthWAVE, reactions can be carried out directly in the 1L PTFE vessel, or in multiple vials. Vials are available in glass (disposable), quartz or PTFE, and are fitted with PTFE caps, which are loose fitting to ensure pressure equalization. Available rack configurations include 4, 5, 15 and 22 positions.

Large 1 L PTFE Vessel



5-position Rack

15-position Rack

Numbered rack trays give the operator an easy visual check of vial number.
The SynthWAVE sample racks fit easily on a balance, so reagents can be weighed directly into vials already loaded into a rack.
No vessel assembly or disassembly is required - and with the disposable glass vials, no cleaning step is needed, greatly increasing work efficiency.

User Interface

The SynthWAVE is operated via a control terminal featuring a full-color 6.5" touch screen display.
The terminal runs Milestone's renowned EasyCONTROL software, which enables simple and intuitive, but extremely flexible and powerful control over the reaction process. Method setup could not be simpler: set target temperature, ramp time and hold time.
Press 'Start', and the system automatically follows the desired temperature profile, continuously varying the microwave output via a sophisticated Proportional Integral Derivative (PID) controller, regardless of reagent volume or number of vials in the run.
EasyCONTROL features full audit trail capability plus multi-level user access security: each operator has a personal password to access the software.
Run data are stored on a flash drive or USB memory stick and can be transferred to a PC with the optional EasyDOC software.

SynthWAVE User Interface

Technical Specifications

Microwave Hardware

- High-pressure stainless steel reaction chamber.
- Chamber volume 990 ml with 900 ml TFM liner.
- SRC design enables the same temperature and pressure to be achieved in all vials simultaneously.
- Auto-lift mechanism for automated loading of the sample rack into the SRC.
- SRC securely closed by double interlocked stainless steel clamps.
- Sensors ensure the correct positioning of the SRC cover during automatic opening and closing of the SRC.
- High microwave power (1500W) for fast heating.
- Microwave energy optimized to the shape of the SRC for even energy distribution and maximum efficiency.
- No sample rotation is necessary.
- Thick acrylic shield with automated lift/close for maximum operator safety.
- Integrated overhead magnetic stirrer in all vials.
- In-situ sampling device with Dewar flask.
- Integrated twin exhaust system extracts fumes away during chamber opening.
- Automated pressure release at the completion of the microwave program and cooling step.
- SRC is water cooled for fast cool down step and increased sample throughput.
- Failsafe mechanism to safely release pressure inside the cabinet in case of overpressure situation (over 199 bar).
- Analog manometer for easy reading of SRC pressure from across the lab.
- Safety valve enables manual release of pressure after a microwave cycle, in case of power failure.

Temperature pressure controller

- Temperature sensor to directly monitor and control the temperature in the SRC and in all vials simultaneously.
- Operating temperature up to 300°C.
- Pressure transducer to directly monitor and control the pressure in the SRC and in all vials simultaneously. Operating pressure up to 199 bar.
- Built-in temperature sensor to monitor and control the external temperature of the chamber
- Built-in sensors to monitor magnetron and microwave antenna temperatures.

Racks and Vials

Positions	4	5	15	22
Vials material	PTFE, Quartz and Glass			
Volume (mL)	35-70	40-50	15	7-10

Control terminal

- Industrial grade touch-screen controller with high resolution 6.5" screen and 65000 color display.
- 1 USB port for printer, 2 PS2 ports for mouse and keyboard, 3 RJ 45 ports for external devices.
- Methods and runs can be saved on a PC-compatible removable flash-card or USB pen-drive.

Specifications are subject to change without notice.

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UNI EN ISO 9001: 2008 CERTIFIED

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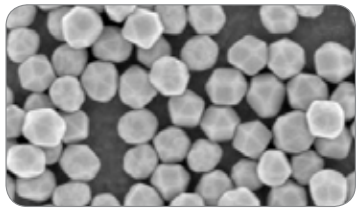
SynthWAVE Fields of Application

- NANOMATERIALS
- DRUG DISCOVERY
- FINE CHEMICALS
- POLYMERS
- CATALYSIS

OPTIMIZATION OF GREEN/EFFICIENT CHEMICAL PROCESSES

Pharmaceuticals

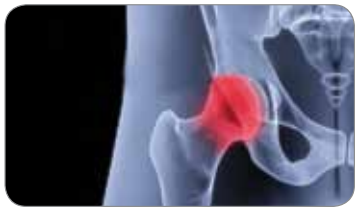
Plastics



Materials

Cosmetics

Petrochemical



Contrast agents

Food additives & Flavorings

Coatings

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Organic and Inorganic Synthesis

Milestone SynthWAVE

- Oxidations and Reductions
- Esterification & Ammidation
- Coating
- Polymerization
- Nanoparticles preparation
- Modification of carbon nanotubes
- Reactions with sensitive reagents and materials
- Desulphurization
- Cycloadditions
- Reagents and Materials
- Click chemistry
- Gas insertion
- Multicomponent reactions
- Dechlorination
- Subcritical fluids extracion
- Stereoselective transformations
- C-C, C-X Couplings

- PLASTICS
- DYES
- CATALYSTS
- COMPOSITE
- CONTRAST AGENTS
- NATURAL PRODUCTS
- BUILDING BLOCKS
- EXTRACTS
- VITAMINS
- BIOCONJUGATES

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