

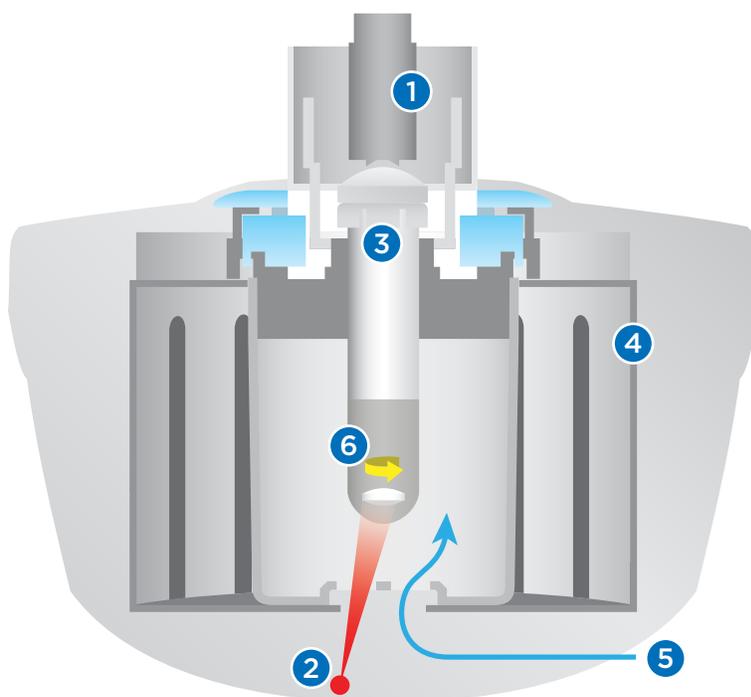


**Discover<sup>®</sup>**  
Microwave Synthesizer



# Reliable and Easy to Operate

The Discover provides an economical, robust platform for heating sealed pressure vessels with the power of microwave energy. Access temperatures and pressures up to 300 °C and 300 psi for the highest purity synthetic results. Start with a basic system and add on more capabilities as you need.



## 1 Benchmark Pressure Management

Safety based technology seals reaction vessels up to 300 psi and automatically relieves excess pressure to prevent vial failures. Optional upgrades include IntelliVent pressure measurement/monitoring capabilities and atmospheric pressure applications in conventional round bottom flasks.

## 2 Volume-Independent Temperature Sensor

The floor mounted, infrared temperature sensor enables the Discover to accurately measure temperature for reaction volumes from 0.2 to 60 mL.

## 3 High Temperature/Pressure Sealed Vessels

10-mL vessels for research and optional 80-mL vessels for scale up.

## 4 Self-Tuning, Efficient Microwave Cavity

Take the guesswork out of microwave chemistry. The Discover cavity automatically adjusts power output based on the polar and ionic properties of your reaction solution.

## 5 Compressed Air Reaction Quenching

Rapid cooling upon reaction completion allows safe handling in less than a minute. Superior performance to fan-based systems.

## 6 Electromagnetic Stirring

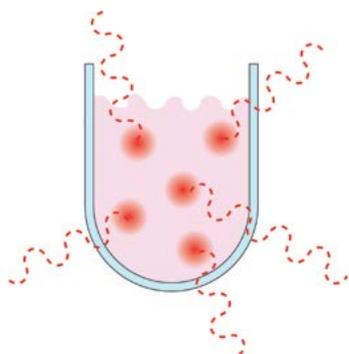
Homogenize your reaction mixture for the best synthetic results and consistency. Fully adjustable.

# Microwave Advantage

A refined form of energy, microwaves provide unique heating benefits to synthetic chemistry.<sup>1, 2, 3</sup> Reactions are heated **volumetrically**, **directly**, and **instantaneously**, faster and more efficiently than any other form of heating. These microwave characteristics give organic chemists better product yield and more control over reaction conditions for precise results in materials and inorganic chemistry. Microwave energy is the industry standard for medicinal chemistry, nanomaterials synthesis, and academic teaching labs, owing to these clear advantages.

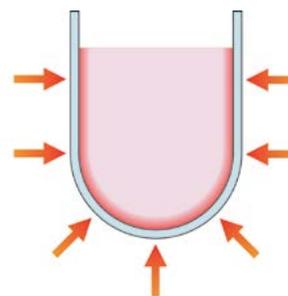
## Microwave Heating

The vessel wall is transparent to microwaves allowing energy to be directly absorbed by the reactants. This direct molecular activation limits side reactions and provides a fast and efficient form of heating. Reactions that previously took hours, or even days, to complete can be performed in minutes.



## Conventional Heating

With hot plates, oil baths, and heating mantles, energy is transferred indirectly to the reactants by applying heat to the outside surface of the vessel and solvent. This form of heating is slow and inefficient, leading to reduced synthetic results.



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Synthetic reactions up to 300 °C and 300 psi

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Perform reactions faster than conventional heating

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Achieve greater yields and increased purities

<sup>1</sup>Dudley, G. B.; Richert, R.; Stiegman, A. E. *Chem. Sci.* **2015**, *6*, 2144-2152.

<sup>2</sup>Chen, P.-K.; Rosana, M. R.; Dudley, G. B.; Stiegman, A. E. *J. Org. Chem.* **2014**, *79*, 7425-7436.

<sup>3</sup>Hunt, J.; Ferrari, A.; Lita, A.; Crosswhite, M.; Ashley, B.; Stiegman, A. E. *J. Phys. Chem. C* **2013**, *51*, 26871-26880

# Run Sealed Tube Reactions Much Faster than Conventionally Heated Systems

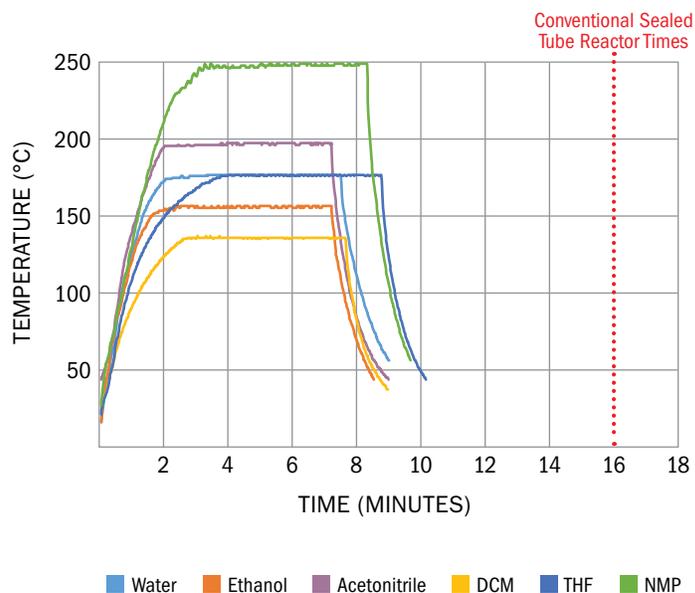
## Microwaves Safely Heat Much Faster

- Microwaves directly heat the sample
- Conventional heating must be used more conservatively

*Because when applying convective heating, the heating process will continue even when power is already reduced, it appeared advantageous to regulate the power more conservatively to prevent any significant thermal overshoots, especially when exothermic reactions are processed. This invariably leads to the comparatively slow heating ramps.<sup>1</sup>*

## Reduced Cooling Time

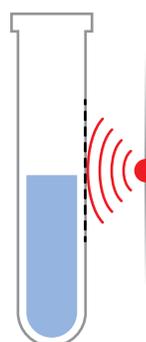
- The Discover's compressed air system cools much faster than integrated fans<sup>2</sup>
- Typically < 1 minute for compressed air vs. up to 5 minutes for integrated fans



## Save Money — Use Less Reagents

Run reactions as low as 0.2 mL (10x lower than conventional heating systems). This is based on both the Discover's unique bottom mounted temperature control system and the ability of microwave energy to be turned OFF instantly thereby avoiding excessive temperature overshoot of small sample volumes.

### OTHER REACTORS

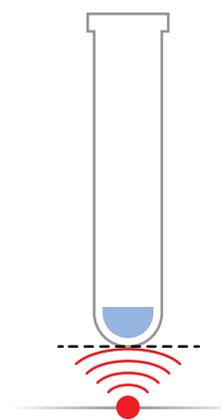


### Limited

IR sensor  
from side

(Higher Volume Required)

### DISCOVER



### Ideal

IR sensor  
from below

(Lower Volume Required)

<sup>1</sup>Obermayer et al, J. Org. Chem. 2016, 81, 11788-11801

<sup>2</sup>Typically used in conventional heating systems with sealed tubes

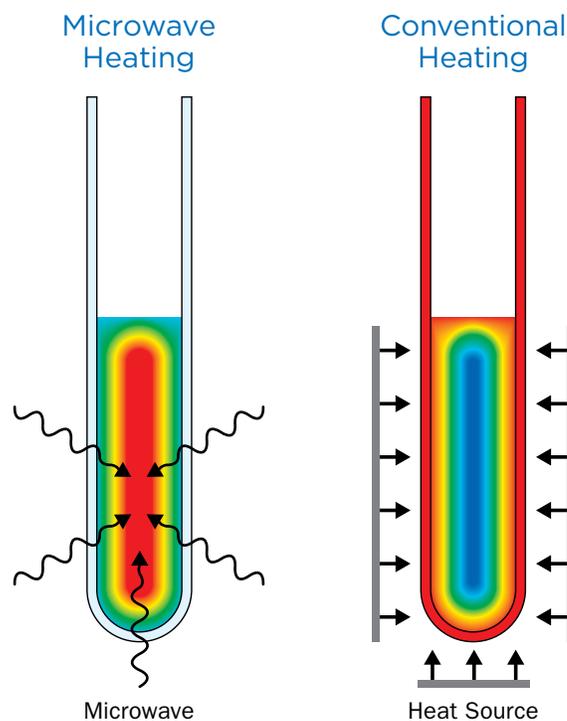
# No Temperature Overshoot

## Microwaves Turn OFF Instantaneously

Microwave energy can be turned OFF instantaneously. In contrast, conventional heating can't as the vessel continues to be heated for a period of time after the heat source is turned OFF. This makes controlling temperature overshoot much more difficult with conventional heating.

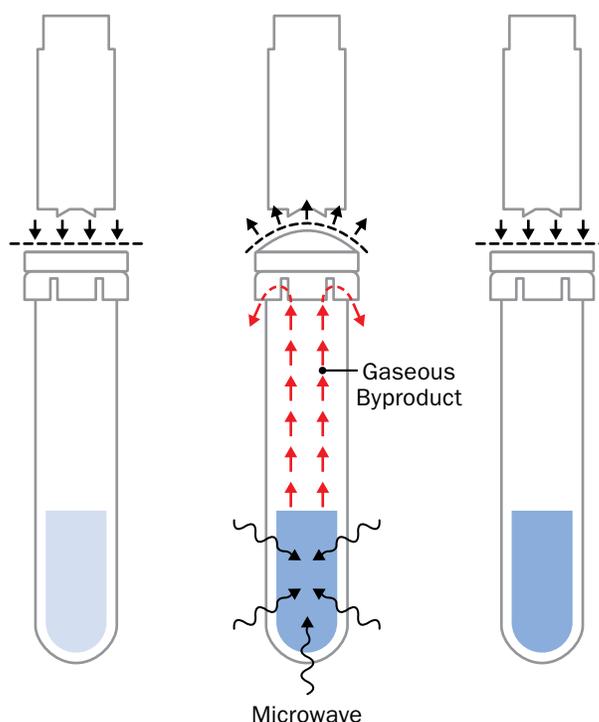
## Unique Active Cooling of Discover

The Discover also features an integrated cooling system that provides automated cooling during a run. This system further ensures desired run conditions and quickly eliminates any overshooting of the target temperature.



# Fewer Broken Vessels

The pressure control on the Discover provides venting of excess pressure during the run **as it happens**. This reduces the chance of vessels breaking inside the system. Other systems vent excess pressure at the end of a run which is often too late. Conventionally heated systems also are more at risk of vessel ruptures from exothermic reactions since the heating can't be instantaneously turned OFF.



## IntelliVent Pressure Option

Upgrade your Discover to the most comprehensive feedback about your reaction system with the IntelliVent pressure measurement option. Safely control and record reaction pressure from 0 – 300 psi, with the same automated vent-and-reseal technology of the Benchmate pressure device.



## Open Vessel Option

Add the power of microwave chemistry to reactions in conventional laboratory glassware. The Discover is the only microwave synthesizer to allow the use of a conventional round bottom flask, up to 125 mL, in its reaction cavity. Using an open vessel format, it is easy to cannulate or add reagents and remove aliquots of reaction solution for TLC or instrumental analysis of reaction progress.

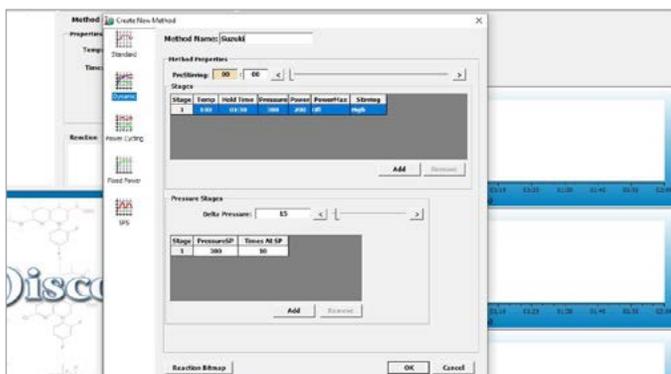
Advantages of Open Vessel:

- Use standard glassware
- Work on a larger scale
- No risk of pressure build up
- Easy access to reaction for reagent addition or reaction sampling
- Use of overhead stirring for viscous mixtures



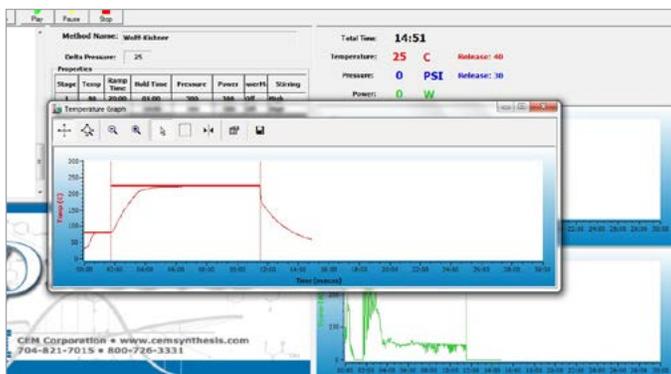
# Synergy Data Analysis Software

Programming microwave methods and recording data with Synergy software is fast, simple, and flexible. Users have access to individual, password protected logins to review reaction parameters and run details including temperature, pressure, and power. Analyze graphs in Synergy or quickly export this data to a spreadsheet for incorporation into presentations, papers, and laboratory notebooks.



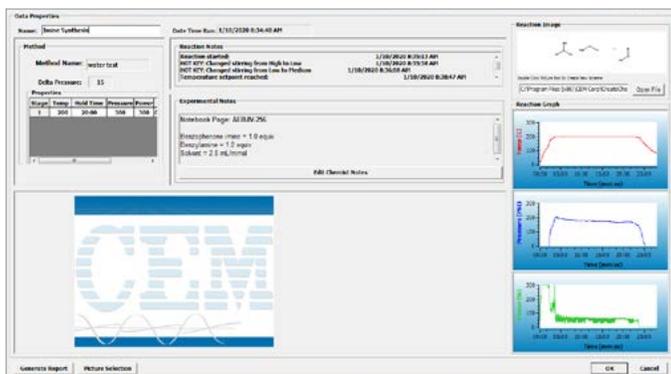
## Specialized Reaction Programming

Synergy software provides the most convenient way to access the unique power control modes of the Discover. Routine synthetic chemistry can be performed with Standard methods while 4 additional control algorithms allow scientists to further explore the advantages of microwave heating.



## Accessible Reaction Data

Record temperature, pressure, and power data for your reactions and store everything in Synergy for fast and organized retrieval. Information can be directly exported into a spreadsheet or data visualization program for reports and publications using the convenient laptop interface.



## Protected Electronic Notebook

All reaction data is saved to Synergy's database and cannot be deleted. Add notebook numbers, chemical structures and reaction schemes, and other sample identifiers and notes without concern for data integrity.



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