StonyLab®

Microwave Chemical Reactor

Operation Manual

(Please read the instruction carefully before you use the machine)

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1. Introduction

Microwaves are a type of high-frequency electromagnetic wave that do not generate heat by themselves. In nature, microwaves are dispersed and unfocused, so they cannot be used as an energy source. However, by using a magnetron, electrical energy can be converted into microwaves, which penetrate media at an oscillation frequency of 2450 MHz per second. When the medium has a suitable dielectric constant and dielectric loss, high-frequency oscillation occurs in the alternating electromagnetic field, causing energy to accumulate inside the medium. For chemical reactions, this process can produce both thermal and non-thermal effects.

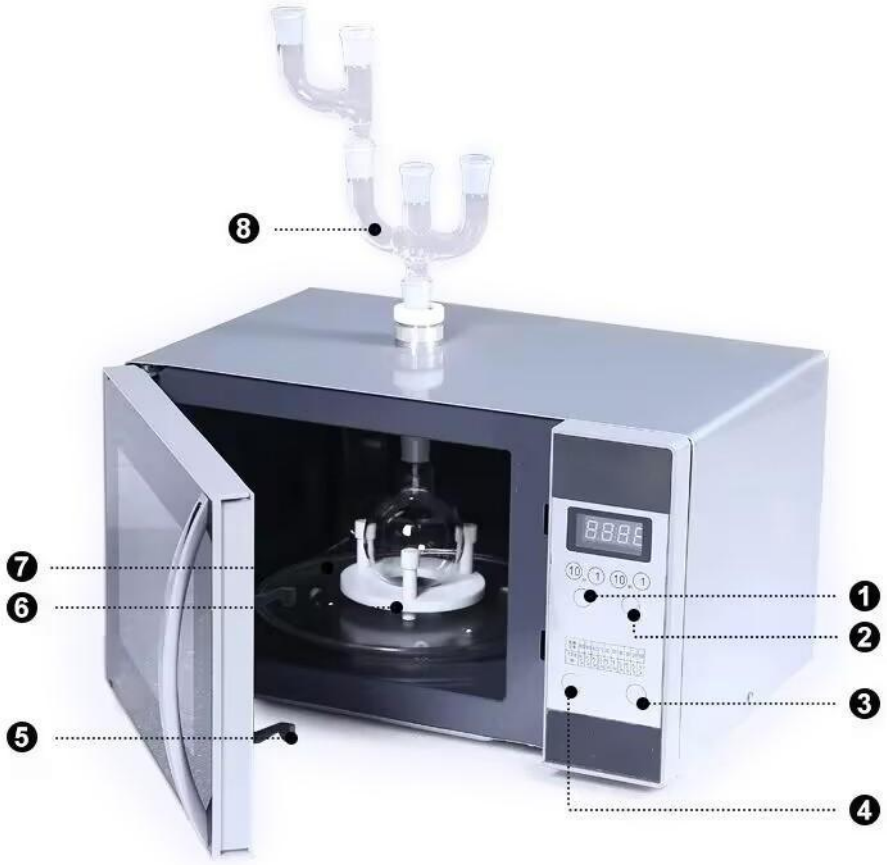
Microwaves can penetrate non-polar materials such as polytetrafluoroethylene (PTFE), but they are reflected by metal surfaces. In household microwave ovens, the magnetron output power is generally fixed. Lower power is achieved by adjusting the on/off duty cycle of the current. Microcomputer control allows precise timing of the current on/off cycles, making it possible to reproduce identical working conditions and obtain repeatable chemical reaction results.

2. Schematic Diagrams

Model 205

1. Power Option
2. Microwave
3. On
4. Off
5. Function Adjustment Knob
6. Stirring Adjustment Knob
7. Switch
8. Wattmeter
9. PTFE Plate Frame
10. Door Interlock Switch
11. H-type Glass Tube

Model 201



1. Microwave
2. Power Option
3. Off
4. On
5. Door Interlock Switch
6. PTFE Plate Frame
7. Glass Tablewheels
8. H-type Glass Tube

3. Specification

Model	Model 201	Model 205
Uniform Heating Method	Rotation Turntable	Magnetic Stirring
Frequency Performance	10-level adjustment	arbitrary adjustment
Power Consumption (W)	1100	1300
Max Output Power (W)	600-650	750-800
Input Current (A)	7.8	7.8
Voltage (V)	220	220
Microwave Frequency (Mhz)	2450±50	2450±50
Chamber Dimensions (mm)	290x290x190	300x330x200
Overall Dimensions (mm)	480x400x320	490x400x440
Weight (Kg)	20	35
Chamber Material	Stainless Steel	Stainless Steel

4. Features

- The device has a maximum power output of 800 W.
- The device allows five power levels, achieved by adjusting the on/off duty cycle to obtain the desired effect.
- By selecting different power levels and working times, identical reaction conditions can be reproduced, ensuring excellent experimental repeatability.
- Suitable for installation with reflux apparatus, equipped with a cut-off waveguide to prevent microwave leakage.
- Adjustable-height polytetrafluoroethylene (PTFE) support plate.
- Compatible glass accessories designed for chemical reactors.

5. Installation Instructions

5.1 Unpacking and Inspection

After unpacking, remove the microwave reactor unit. Press the door release button to open the door, and carefully take out all items inside the cavity. Check against the packing list to confirm all components are included. Inspect the unit for any damage, and verify that the door and switches function properly.

5.2 Cut-off Waveguide

The cut-off waveguide has been pre-installed at the top of the reactor chamber. In case it becomes loose during transportation, please retighten it before use.

5.3 PTFE Support Plate

Generally, three long screws are used for adjustment. Insert them into the threaded holes of the circular plate and adjust to the desired height. After placing the object, ensure that it does not touch the spindle at the bottom of the chamber. When placing the screws, the flat head should face upward. Short screws are reserved for other special configurations.

5.4 Placement of the Microwave Chemical Reactor

1) Working environment: Ideally, the reactor should be placed inside a fume hood. It must be positioned horizontally. Any reflux device or liquid-feeding device on top should be fixed securely with a laboratory support stand. Do not place any objects within 15 cm of the rear ventilation outlet. The reactor must not be operated without its supporting feet.
2) Power supply: A regulated power supply is recommended. If a regulated power supply is not available, ensure that the reactor is connected to a dedicated power line separate from other heavy equipment. The line must be properly grounded, and a fuse rated at 8 A or higher should be used.

6. Reaction Setup and Operation

6.1 Drying of Solids

Moist solid substances (e.g., silica gel for dehumidification) can be placed directly in the microwave reactor cavity for drying. For Model 201, after operation, allow the glass turntable to cool completely before cleaning or immersing in water to prevent cracking.

6.2 Sealed Tube Experiments

For the safety of both the microwave chemical reactor and the operator, the following points must be strictly observed during sealed tube experiments:

1) Reactions known to produce gas must not be performed in sealed tubes.
2) Sealed tubes must be made of pressure-resistant 95-grade glass, and the amount of reactants must be strictly controlled.
3) It is recommended to place the sealed tube inside a plastic microwave container, then position it on the glass turntable before starting the reactor.

6.3 Liquid-Phase or Liquid/Solid-Phase Reactions

1) For reactions with a small amount of reactants that do not require stirring, use a 50 ml or 100 ml flask. Place the PTFE plate frame at the center of the furnace bottom, insert the direct tube through the cutoff waveguide from the top of the furnace into the flask, and install an appropriate reflux device above the furnace.

2) For larger reaction volumes, use a 50–250 ml flask. Insert the direct tube through the cutoff waveguide into the flask opening, connect a U-shaped or Ψ-shaped three-way tube, and arrange the stirrer, reflux device, and dropping funnel as needed.

3) Device-Specific Notes:
   - ❖ Model 201: Equipped with a glass turntable and turntable bracket, which must be removed before use.
   - ❖ Model 205: Features a bottom-mounted magnetic stirrer capable of clockwise rotation at variable speeds (low to high). If a stirring rod is required, only glass or PTFE rods should be used; metal rods are strictly prohibited.

6.4 Solid-Phase Reactions

The reactor setup and operating method should be flexibly arranged according to the

needs of the reaction, but the following principles must be observed:

1) Reactions that generate gases, especially corrosive or irritating gases, can easily damage the circuitry and computer board. A reflux device should be installed, and the gases should be safely vented outside the furnace through a conduit.

2) Reactants and products have different dielectric constants and dielectric losses, leading to uneven microwave absorption. After a period of reaction, local temperature differences often occur. Therefore, during solid-phase reactions, it is often necessary to intermittently mix or shake the materials and select a lower power setting to ensure the reaction proceeds as uniformly as possible.

3) No chemical reaction in the microwave reactor should be performed in an open container, and under no circumstances in a completely sealed container. Open containers can cause splashing and contaminate the chamber, while sealed containers carry a risk of explosion.

7. Operating Precautions

7.1 Before Operation

1) Check whether the utensils are suitable for microwave use. Do not place non-microwave-safe containers in the microwave, as this may cause arcing or other abnormal phenomena that could damage the microwave.

2) If the outer casing, door, or door seal is damaged due to collision or dropping, stop using the microwave immediately and contact our company directly.

3) Do not cover the outer casing vents, as this may cause excessive temperature rise and damage the microwave.

7.2 During Operation

1) The reactor furnace is tightly constructed. The cutoff waveguide is precisely designed and tested with a microwave leak tester according to national regulations. Do not remove the cutoff waveguide.

2) Do not use airtight containers without safety devices.

3) Do not operate the microwave cavity empty.

4) When possible, operate at a lower power setting.

5) For chemical reactions with unknown conditions, start with low power and small-scale testing.

6) Do not place any metal objects in the furnace.

7) Use protective tubing with a 14 interface and PFA hoses. PFA material is microwave-transparent; do not substitute with other materials.

8) After operation, turn the power adjustment knob counterclockwise to the minimum position.

9) Do not heat low-boiling-point reagents or flammable materials in a reflux device inside the microwave cavity.

8. Warranty

Warranty is effective from the date of purchase and is non-transferable.
For more details about the warranty, please refer to the link below:
stonylab.com/pages/warranty

For any inquiries or assistance, feel free to contact us:
Company: StonyLab Inc.
Email: support@stonylab.com
Phone: 631-406-6080
Website: stonylab.com

This instruction manual is subject to change without prior notice.