Zirconia Sintering Furnace User Manual

Model: BSM-S30

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www.cdbesmile.com

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1. Product description

Thank you for purchasing and using our products!

The Besmile Zirconia Sintering Furnace uses type 1800 high-purity alumina fiberboard as the chamber's refractory material, which has excellent thermal insulation performance, ensures perfect sintering of zirconia dentures.

Using modern machinery manufacturing and processing equipment, the products are exquisitely made and of high quality. The control interface features a large-size high-definition true-color LCD touch screen with graphic display, allowing for easy operation. Equipped with advanced intelligent temperature control technology, the furnace ensures stable temperature control.

The furnace supports features such as Internet of Things interconnection, remote access terminal, data security, and screen integration. Through its cloud platform, users can remotely monitor, maintain, upgrade firmware, and diagnose the device from anywhere.

It is provided with a simple and beautiful appearance and ergonomic design, which meets the modern requirements for aesthetics and use experience.

To achieve optimal sintering performance, please read this manual carefully before using the product.

- See Section 2 for product safety;
- See Section 3 for product appearance and dimensions;
- See Section 4 for product design and functions;
- See Section 5 for the use of the product;
- See Section 6 for temperature calibration;
- See Section 7 for maintenance and accessories

2. Equipment and operator safety

2.1 Electric safety

The furnace operates on AC 220V/50HZ, which is converted through a transformer into 18V low voltage and a high current of ≤160A at the heating end. The power plug has a capacity of ≥16A and needs to be connected to the Power socketduring operation.

Figure 1. Examples of power plugs in different countries

2.2 Safety Precautions for Use

The chamber and heating elements of the furnace are made from brittle materials. Avoid violent impacts after installation, and handle the furnace with care during movement to prevent damage.

This furnace is designed exclusively for sintering zirconia dentures. Do not use it for heating flammable, explosive, toxic, or harmful substances. Ensure that the sintering heating rate complies with the product parameter requirements outlined in Table 1.

During sintering, the surface temperature of the furnace can reach approximately 60°C. Avoid direct skin contact to prevent burns. The top of the furnace may exceed 80°C due to upward heat flow. Exercise caution to avoid burns, and never place flammable or explosive items on the furnace top to prevent safety hazards.

Table 1 Heating rate

Model	Rated power Kw	Temperature /℃	Max. heating rate ℃/ min	Max. operating temperature /℃
BSM-S30	3	Room temperature -1530	10	1600

2.3 Safety signs

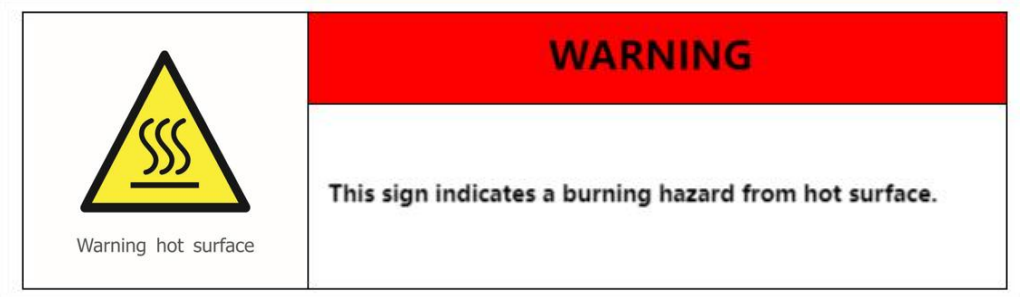


Figure 2. Safety signs

3. Appearance and dimensions

3.1 Overall appearance

Figure 3. Product appearance

3.2 Dimensions

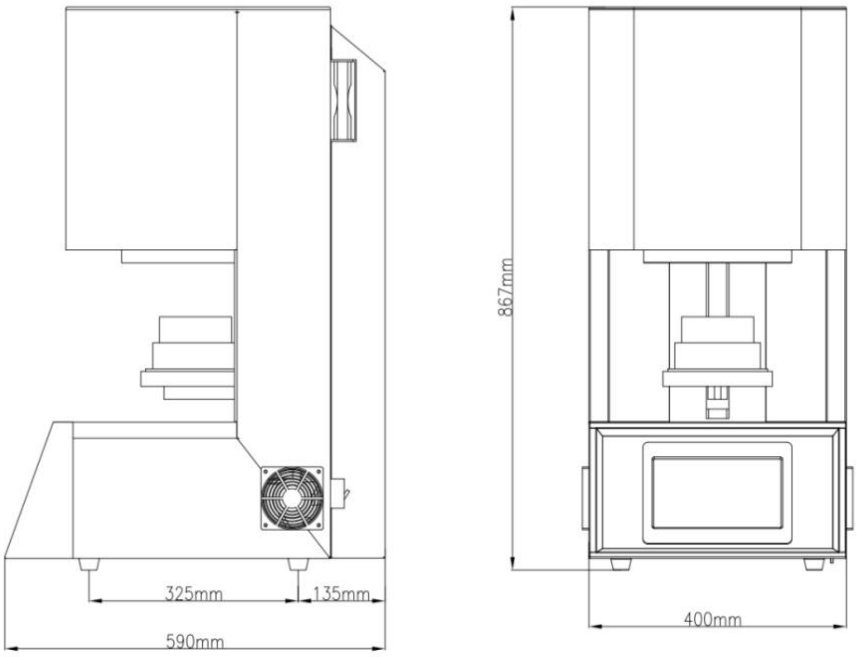


Figure 4. Product dimensions

Before using the product, it needs to be installed in a suitable environment based on the product dimensions, as detailed in the fifth part.

4. Product design and functions

4.1 Functions of different parts

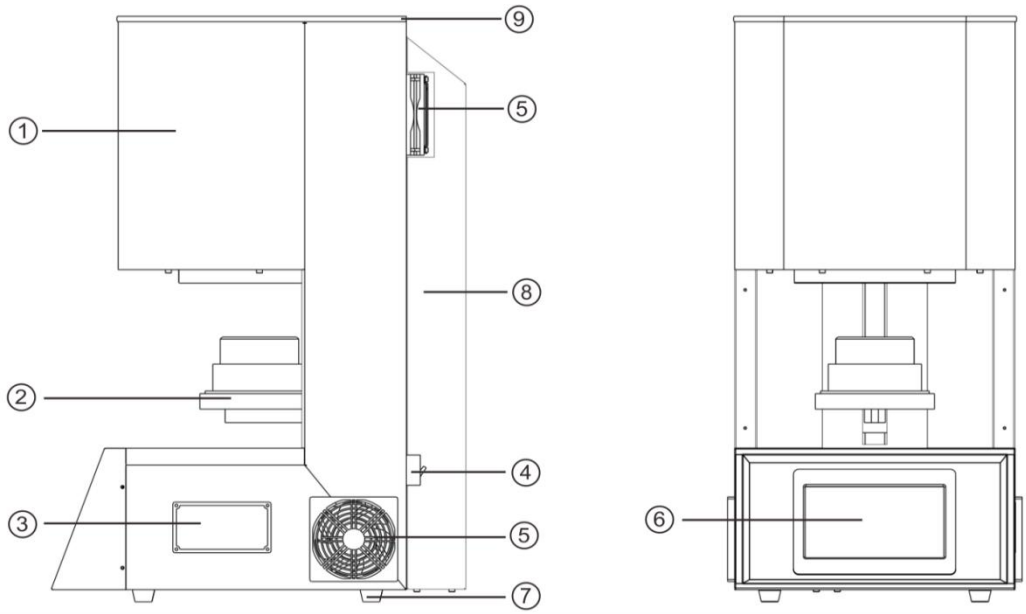


Figure 5. Some functions of the product

① **Furnace body:** It is mainly composed of high-purity silicon-molybdenum rods and 1800 type high-purity fiber refractory materials, which can ensure the purity of

zirconia dentures after sintering.

② **Sintering tray:** A plate that carries the denture.

③ **Electric furnace control system:** It is mainly composed of a control display screen, thyristors, transformers, relays, etc., to control the operation of the equipment.

④ **Power switch:** It switches on or off power supply to the circuit.

⑤ **Fan:** It cools the control circuit and the furnace surface;

⑥ **Touch screen**: It is used to precisely control the heating process to ensure that the temperature rises according to the set heating curve.

⑦ **Support:** It facilitates the movement of equipment.

⑧ **Rear cover:** It protects the safety of the circuits behind the sintering furnace.

⑨ **Top cover:** It protects the furnace top heating elements and operator safety.

4.2 Main screen

Figure 6. Startup screen

Figure 7. Main screen

Figure 7 shows the main screen of the touch screen. The upper right corner shows current status including the actual temperature and the equipment operating status (running or stopping). The main screen also displays the set temperature, current actual temperature, current program name, total time and remaining time. The function buttons are on the right side of middle section. By clicking the buttons, users can control the equipment to run or stop, and control the platform to rise and fall. See program settings in 5.4.

✧ Click the **Curve** button to enter the screen shown in Figure 8, which displays the temperature rise curve recorded by the system:

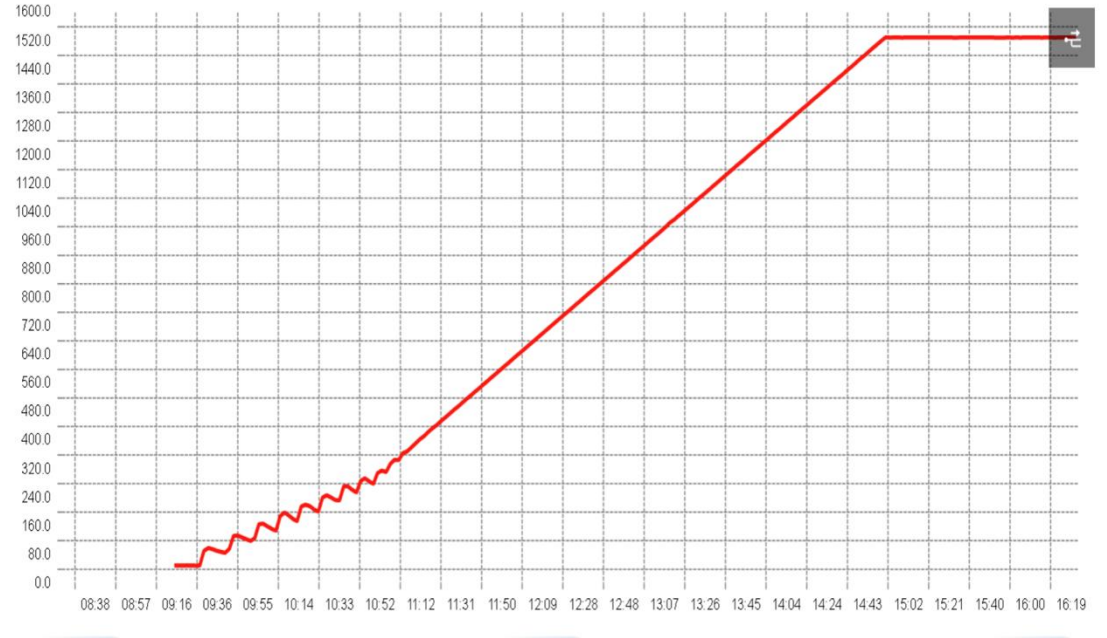
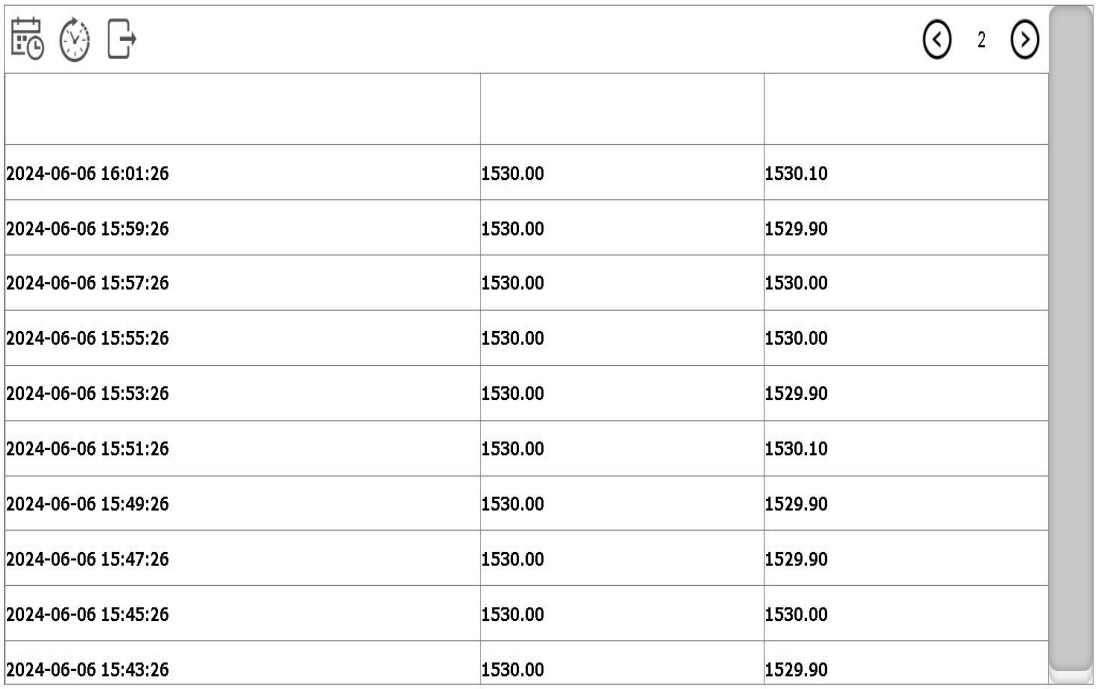


Figure 8. Trend curve

✧ Click the **Data** button to enter the screen shown in Figure 9, which displays the temperature rise data recorded by the system:



2024-06-06 16:01:26	1530.00	1530.10
2024-06-06 15:59:26	1530.00	1529.90
2024-06-06 15:57:26	1530.00	1530.00
2024-06-06 15:55:26	1530.00	1530.00
2024-06-06 15:53:26	1530.00	1529.90
2024-06-06 15:51:26	1530.00	1530.10
2024-06-06 15:49:26	1530.00	1529.90
2024-06-06 15:47:26	1530.00	1529.90
2024-06-06 15:45:26	1530.00	1530.00
2024-06-06 15:43:26	1530.00	1529.90

Figure 9. Data sheet

✧ Click the **Function** button to enter the screen shown in Figure10, which displays various functions:

Figure 10. Function selection screen

Function description:

1. **Automatic adjustment(Recommend use by Besmile Service Engineers Only):**

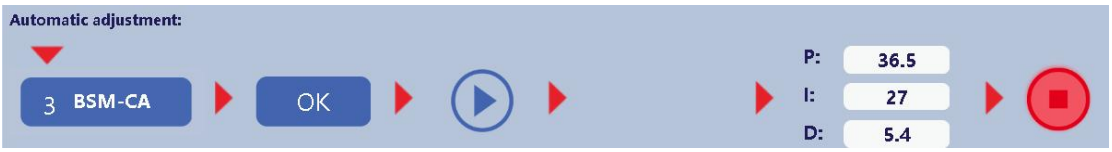


Figure 11. Automatic adjustment function

2. **Temperature calibration (Recommend use by Besmile Service Engineers &experienced technicians)** Click the **Temperature calibration** button to enter the screen shown in Figure 12, and perform temperature compensation.

Figure 12. Temperature compensation function

3. **Installment authorization(Recommend use by Besmile Service Engineers Only)**

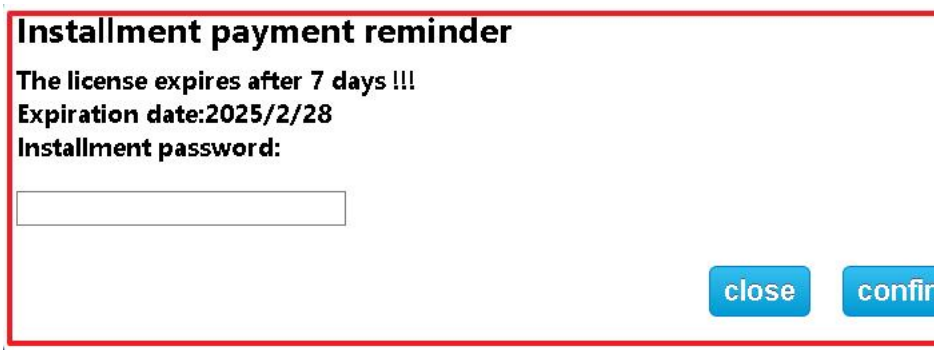


Figure 13. Installment authorization function

4. **Network settings** Click the **Network settings** button to enter the screen

shown in Figure 14, and perform network settings including personal WIFI hotspot.

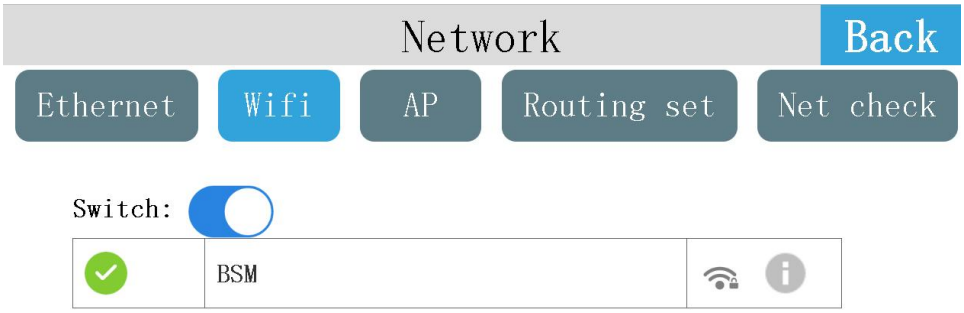


Figure 14. Network settings function

5. **System settings(Recommend use by Besmile Service Engineers Only)**

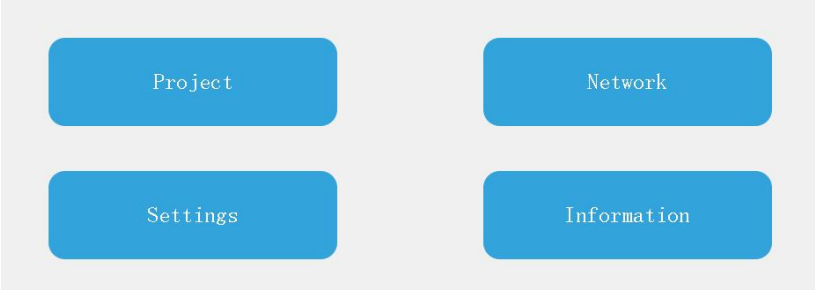


Figure 15. System settings function

6. **Manufacturer (Recommend use by Besmile Service Engineers Only)**

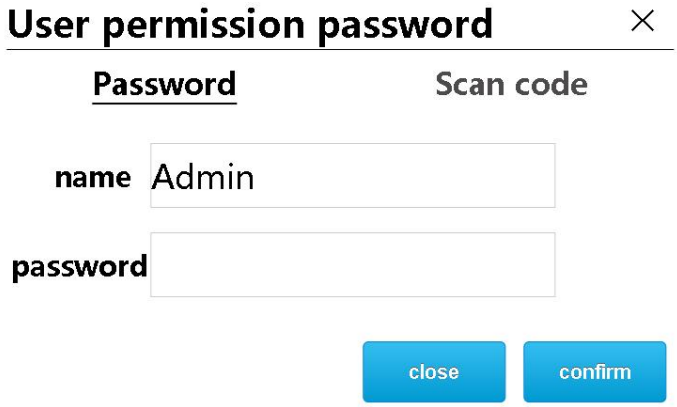


Figure 16. Manufacturer function

✧ Click the **Language** button to enter the screen shown in Figure 17, which

displays four languages: Chinese, English, Russian, and Spanish.

Figure 17. Language settings

✧ Click the **Diagnostic** button to enter the screen shown in Figure 18, which displays the fault record and switch status.

Figure 18. Diagnostic information

4.3 Functions

The BSM-S30 conventional sintering furnace uses 4 silicon-molybdenum rods for heating. The available space in the chamber is 110×90mm, and two layers of crucibles with a diameter of 105×40mm can be placed at one time. This allows the conventional sintering of zirconia dentures.

4.4 Data interface

The system of Besmile sintering furnace is upgraded through a USB interface. The USB interface is behind the display screen. Please contact the manufacturer if necessary.

4.5 Nameplate

Figure 19. Device nameplate

Installation&Usage5.1 Installation environment

- Refer to the product dimensions in Figure 4 to select a suitable installation platform;
- Place the furnace on a dry, ventilated, dust-free indoor platform, and ensure a clearance of at least 25cm away from surrounding objects for proper ventilation and heat dissipation during operation;
- Ensure that the surrounding equipment is heat-resistant, as the device will emit some heat into the environment during use. While the heat levels are within a safe range, prolonged close proximity may cause heat radiation to discolor the outer surfaces of nearby equipment over time;
- It is strictly forbidden to place flammable and explosive items around the furnace.

5.2 Installation

a. Open the packaging box and inspect the equipment for any damage. Verify that all included accessories are complete by referring to the packing configuration list.

b. Open the upper cover of the furnace body and remove the buffer sponge pad protecting the heating rod. Inspect the heating element for any damage caused during transportation and ensure that the silicon-molybdenum rod connections are secure. If everything is in order, securely fasten the furnace cover with screws and remove the filler material from inside the furnace.

c. Install the equipment power cord as shown in Figure 1. Ensure the power supply matches the specifications indicated on the equipment power cord. Do not connect a power voltage that does not meet the requirements (power supply in China: 220V/50Hz), as this may damage the control system.

5.3 Power on/off

The positions of the power switch is shown in Figure 5. When the power switch is off, the device is in the off state; when the power switch is on, the device is in the on state.

Figure 20. Power switch

5.4 Program settings

5.4.1 Conventional program settings

After the device is powered on, enter the main screen as described in 4.2, as shown in Figure 21, and click the **Program** button to enter the program selection screen, as shown in Figure 22.

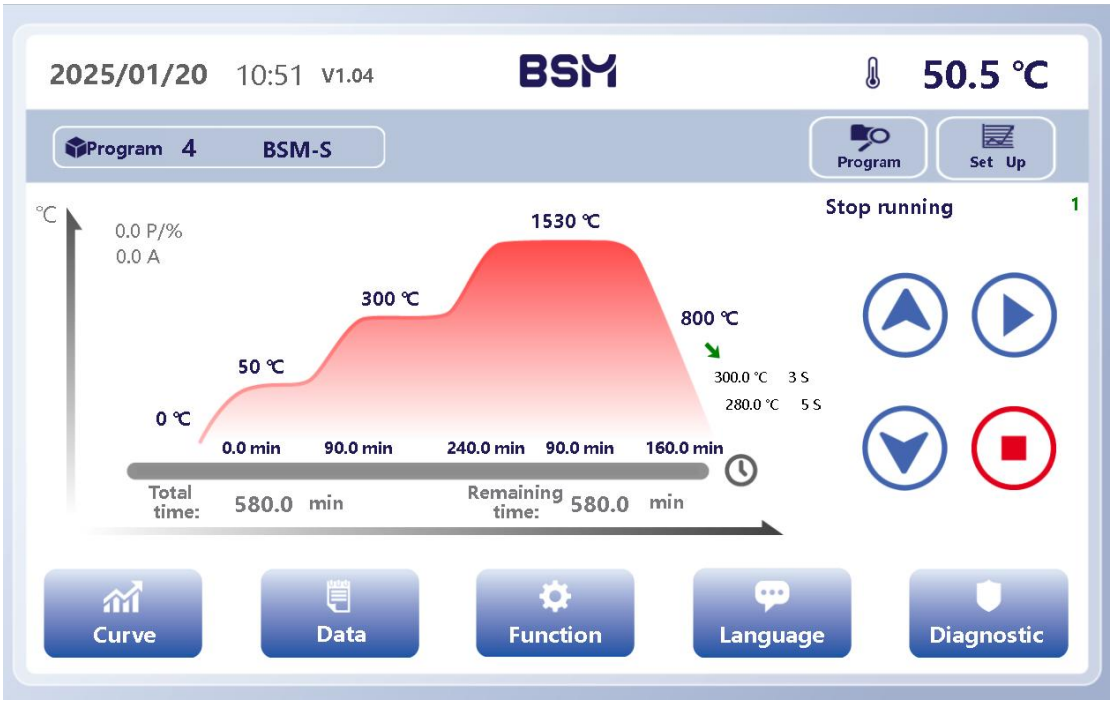


Figure 21. Main screen

Figure 22. Program selection screen

As shown in Figure 22, this screen allows you to select programs. Programs with orange names are manufacturer-locked and cannot be modified, while programs with white names are user-configurable.

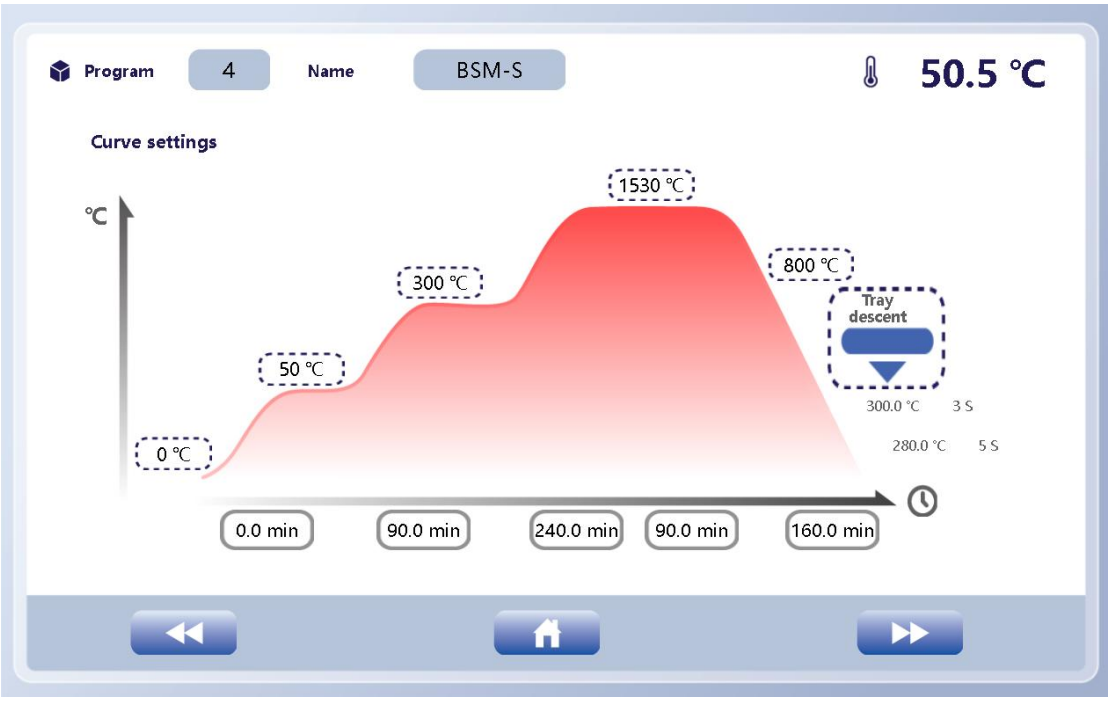


Figure 23. Screen for setting conventional sintering programs

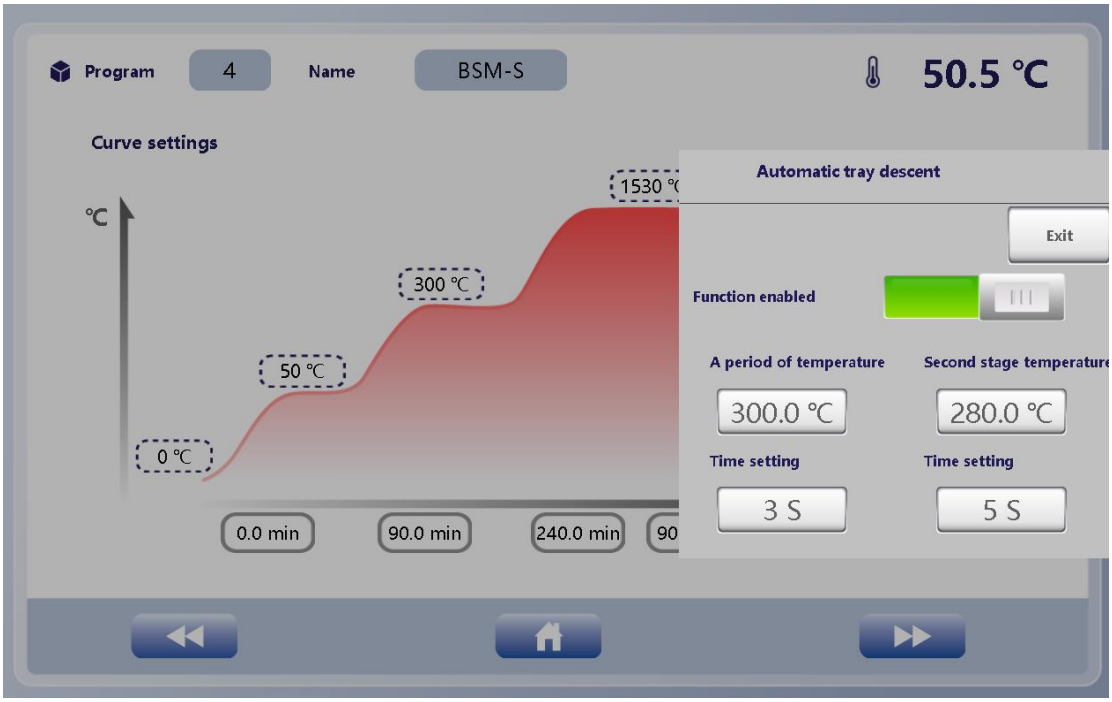


Figure 24. Screen showing whether to enable the automatic tray lowering function

The screen shown in Figure 23 allows to edit the programs. Input the sintering temperature and sintering time according to the material characteristics. The screen in Figure 24 allows to set the parameters related to automatic tray lowering. After input is completed, click the return to main screen icon to return to the main screen shown in Figure 21.

Table 2 Besmile conventional heating curve

Temperature/℃	Time /min	Temperature/℃	Time /min	Temperature/℃	Time /min	Temperature/℃	Time /min	Temperature/℃
50	90	300	240	1530	90	1530	160	800

5.5 Program operation

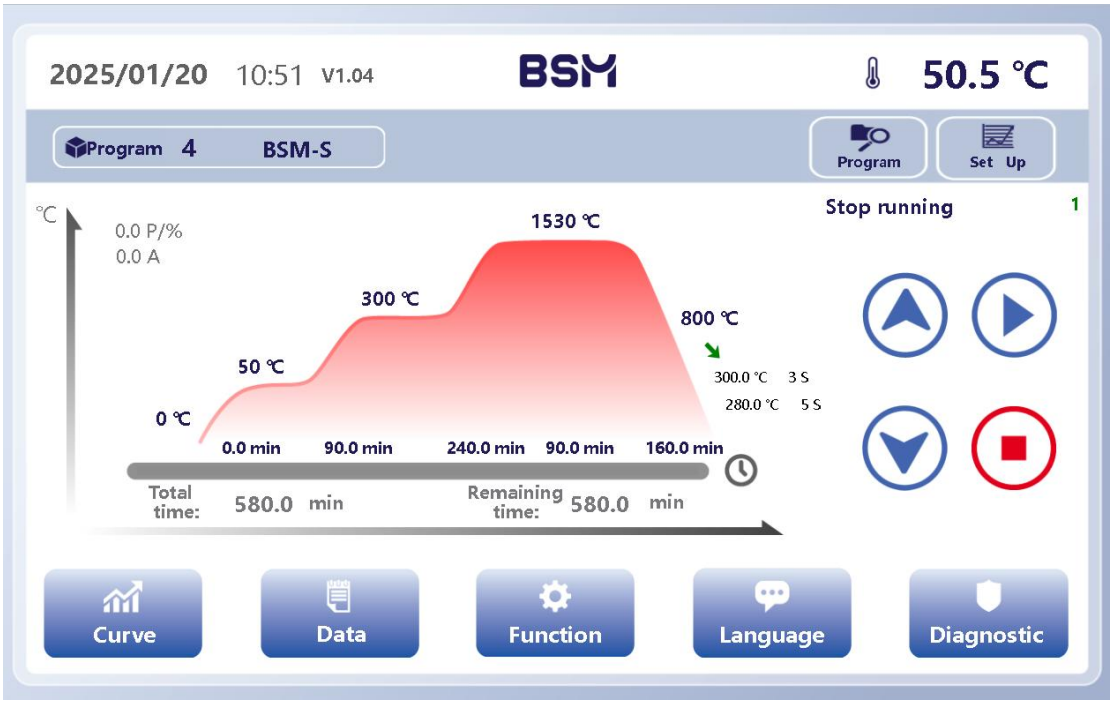


Figure 25. Main screen

After returning to the main interface, click the **Run** button to run the heating program.

5.6 Denture placement and removal

The internal chamber size of the BSM-S30/BSM-F40 zirconia sintering furnace is 110×90 mm, accommodating one or two layers of 105×40 mm sintering trays. The combined height of the two trays must not exceed 90 mm to avoid contact with the thermocouple temperature sensor, which could interfere with accurate temperature measurement. Arrange the sintering trays as shown in Figure 14.

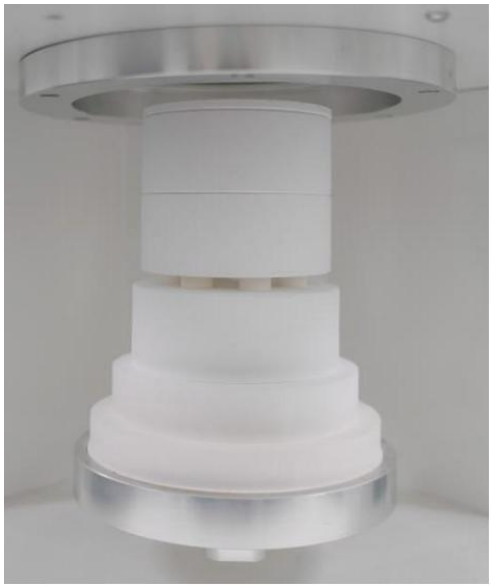


Figure 26. Example of denture arrangement

Place the zirconia denture into the sintering tray and position the tray in the center, as shown in Figure 3. Click the **Up** button on the screen to move the sintering tray into the furnace. After sintering is complete, wait for the furnace temperature to drop to room temperature. Then, click the **Down** button on the screen to lower the tray to the lowest position and remove the sintering tray.

5.7 Program running

Follow 5.4 to complete the program settings. After the program is successfully saved, click the **Apply Recipe** button to apply the recipe. Finally, return to the main screen to confirm that the current recipe group is displayed as **Besmile**. Click the **Start** button to run the heating program.

5.8 Program stop

During the heating process, if you need to stop heating, you can click the Stop button on the main screen to stop the program. Note that it is not recommended to stop the program and lower the furnace table at high temperatures, as this may cause irreversible damage to the chamber, heating elements, crucibles, and restorations, shortening the service life of the sintering furnace.

5.9 Other parameter settings

The system settings screen contains important parameters that should not be modified without caution. Incorrect adjustments to certain parameters could lead to temperature instability or even damage to the machine. Therefore, an authorization password is required to modify these settings.

6.Temperature measurement and

calibration

The temperature during the denture sintering process significantly affects its performance and color. Besmile Zirconia Sintering Furnaces have undergone rigorous testing and temperature calibration before delivery. To maintain optimal performance, it is recommended to measure the temperature regularly, with an ideal cycle of once a month. If any deviation is found, the furnace should be calibrated to the correct temperature value.

A temperature measuring ring is usually used to measure the temperature of the sintering furnace, as shown in Figure 15. Place the temperature measuring ring in the sintering tray. After completing the sintering procedure, measure the diameter of the temperature measuring ring after shrinkage. Then, refer to the table of the corresponding model table (see attachment) to determine the temperature.

Figure 27. Temperature measuring ring and measurement method

7.Maintenance and accessories

The Besmile Zirconia Sintering Furnace is made using high-standard materials and components with reliable quality. The buyer is responsible for any issues not caused by the quality of the equipment itself.

7.1 Maintenance of fixture for silicon-molybdenum rods

The aluminum sheet fixture used to connect the silicon-molybdenum rods in series may develop loose edges after repeated use. Customers are advised to check the fixture regularly, and if it is loose, simply tighten it.

7.2 Replacing silicon-molybdenum rods

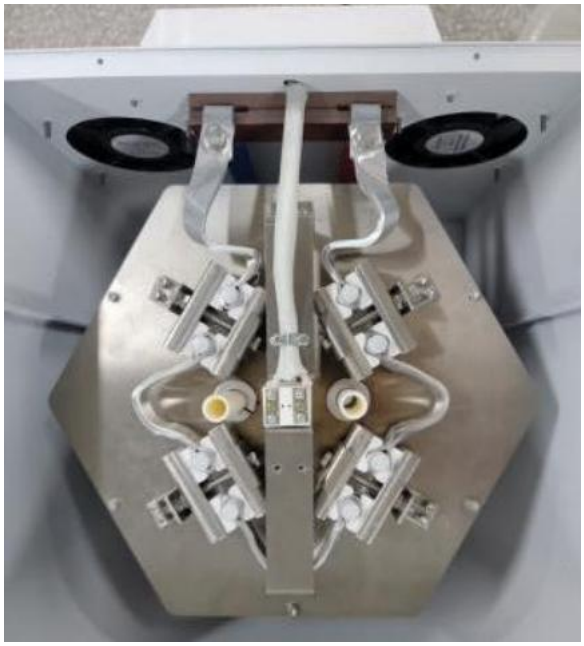
If the silicon-molybdenum rods have been in use for too long or are broken and need replacement, the damaged rods can be removed one by one. If any broken pieces fall into the chamber, they must be cleaned up to prevent contamination of the sintering furnace. The specific steps for replacement are as follows:

Step 1: Prepare silicon molybdenum rods and connecting pieces:

Step 2: Remove the wooden block in the middle of the silicon-molybdenum rod and pass the rod through the holes of the brick:

Step 3: Loosen the connecting piece, and remove the rubber ring in the middle. Install the connecting piece to the silver end of the silicon-molybdenum rod, and tighten the screws:

Step 4: Install the silicon-molybdenum rod with the connecting piece into the silicon-molybdenum rod holes in the chamber, and connect it in series with the neighboring silicon-molybdenum rods:



7.3 Chamber cleaning

During the sintering process, metal ions may evaporate and be adsorbed inside the furnace when zirconia dentures are soaked in dyeing liquid. Over time, excessive accumulation of these ions can lead to contamination, affecting both the sintering results and the color of the denture. To prevent this, it is recommended to clean the furnace regularly during downtime. The cleaning method is as follows: fill the sintering tray with discarded zirconia ceramic block scraps and place it in the furnace for sintering. This will allow the waste to absorb the pollutants. If the waste shows significant pigmentation, repeat the cleaning process until the color and transparency of the waste return to normal, indicating that the furnace is clean.

7.4 Accessories List

Name	Model	Quantity
Sintering tray	105*40	2
Zirconium beads	1.6-1.8mm	300g
Temperature measuring ring and comparison table	1450℃-1750℃	2
Fuse	RT18－32	1

8.Precautions

- Do not open the furnace during high-temperature firing. Doing so is not only dangerous but may also cause the surface protective layer of the silicon-molybdenum rods to break due to the sudden temperature drop, leading to contamination. Furthermore, the chamber may crack and suffer damage.
- When the furnace is used for the first time or after extended periods of non-use, perform an empty burn to remove impurities and moisture. Ensure the furnace temperature does not exceed the rated limit to avoid damaging the heating elements or the furnace lining. Never pour liquids or molten metals directly into the chamber to maintain cleanliness.
- The furnace uses silicon-molybdenum rods as heating elements. These rods are brittle at room temperature. Therefore, do not disassemble or move the furnace after the heating elements are installed.
- When using a cold furnace, avoid fast heating rates in the low-temperature range, as the furnace chamber will absorb significant heat. Ensure the heating rate in each temperature section follows the manufacturer's guidelines.
- Regularly check the electrical connections of the temperature control system to ensure good contact, especially the connections to the heating elements.
- Silicon-molybdenum rods should not operate for extended periods in the 400-700°C temperature range, as this can cause low-temperature oxidation of the rods.
- During operation, if the furnace temperature is consistently between 200°C and 300°C, and control deviations persist (e.g., temperature display not matching the set value or large temperature fluctuations), contact the manufacturer for calibration.
- The furnace is suitable for the following conditions:

  1) Ambient temperature: -10°C to 75°C

  2) Relative humidity: ≤85%

  3) No conductive dust, explosive gases, or corrosive gases that can seriously damage metal and insulation materials present around the furnace.

4) No significant tilt, vibration, or impact.

- If the product malfunctions or fails to operate properly due to quality issues within 12 months from the shipment date, and the user has adhered to storage, use, installation, and transportation conditions, the company will provide free repair services for the entire unit (excluding damage caused by user mishandling).
- After the warranty period, the company will continue to offer paid lifetime maintenance upon user request.
- The equipment may only be used after receiving authorization from the company.

9.Warranty

- Within 12 months from the date of equipment arrival, if the equipment is damaged and cannot function properly due to product quality issues, the company will provide free repair for the entire unit (excluding damage caused by user mishandling).
- Please note that consumable parts, including heating elements, furnace chambers, crucibles, and zirconium beads, are not covered under the warranty.
- After the warranty period, the company will continue to offer paid lifetime maintenance upon user request.

10.Company information

10.1 Company information

Thank you for choosing Besmile Zirconia Sintering Furnace for your laboratory needs. For any questions or additional support, please contact us and we will look forward to assisting you.

Chengdu Besmile Biotechnology Co., Ltd.
Address: No.9, Sec.2, Shengwucheng North Rd., Chengdu Tianfu International Bio-Town, Shuangliu District, Chengdu, Sichuan 610200, P.R.China.
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10.2 Technical support

If you have any question or meet any problem about our products, please kindly contact with our technical support.

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service@cdbesmile.com