

Detailed steps to make a PMMA based chip.

- Draw a designed chip map using SOLIDWORKS and export it to DXF file format;
- Use RDWorksV8 to import the drawn print files into the laser cutting machine.
- Place a 2mm thick acrylic plate in the laser cutting machine, set the cutting speed to 5mm/s, start the laser cutting machine, and wait for the chip to be cut.
- After cutting the layers of the chip, wash and dry with deionized water;
- Arrange, align and align the layers of the chip according to the design;
- Clamp the chip with two aluminum plates to make the layers of the chip closely fit together;
- Put the aluminum plate and chip into the oven at 170 °C, control the temperature change within ± 5 °C, and heat for 14 min.
- Take out the heated aluminum plate and chip, and apply a small amount of water to the outside of the aluminum plate with a test tube brush to slowly cool it to a free evaporation state.
- Place the cooled aluminum plate and chip in a ventilated place, and then take out the chip after natural air cooling to check whether the bonding is successful. If successful, the chip is completed.

Precautions:

- When cutting the chip, complete it as much as possible, and repeating the cutting multiple times may cause the chip cavity error to become larger;
- Check whether the layers of the chip are aligned before bonding. Use a small amount of tape when fixing to avoid the indentation on the surface of the chip.
- When bonding, pay attention to the stability of the bonding temperature. If the temperature is too low, the bonding may fail. If the temperature is too high, the chip may melt.

Detailed steps to make a PDMS based chip.

1. silicon pretreatment

(1) Cleaning of single crystal silicon wafer: using deionized water + detergent, cleaned and dried with nitrogen.

(2) Add the solution to the large beaker as concentrated sulfuric acid: hydrogen peroxide = 7:3, put it into the washed and dried silicon wafer, and seal the beaker mouth with a plastic film (when there is no plastic mold, the glove can be covered) The beaker is placed on a heating table and heated at 100 ° C for 15 min. If the silicon wafer is used for a long time, it takes a long time to clean.

(3) After the cleaning, the silicon wafer was clamped with rubber tweezers, washed with

deionized water, dried with nitrogen, and placed on a hot plate on which aluminum foil was laid, and the water was evaporated to dryness at 200 ° C for 10 min. (This can be done depending on the situation, such as nitrogen has dried the moisture in the silicon wafer, this step can be simplified)

(4) Put the processed silicon wafer in a clean petri dish and wait for use.

2.spin-coating

(1) In the darkroom, open the homogenizer, check if the vacuum pump is connected, and adjust the temperature to 65 °C.

(2) Turn off the light, turn on the red light, and use the centrifuge tube to pour the SU8 photoresist according to your needs.

(3) Turn on the pump, check if it can be sucked, put the silicon wafer, tilt the glue slowly onto the silicon wafer, suck the film, start

(4) After the silicone is finished, the silicon wafer should be taken out after 10 minutes (to remove the silicon wafer, first push it with a tweezers)

(5) Remove the silicon wafer on the heating table on the left and raise the temperature to 95 ° C (average 1 min / 1 ° C, put it at 75 ° C for 10 min) and rise to 95 ° C, then cool to below 75 ° C.

3.lithography

(1) It can be used after turning on the lithography machine for 15 minutes.

(2) Turn on the power of the lithography machine and set the time to 1 min (the specific time should be determined by the required process)

(3) Remove the silicon wafer, cover the mask, and add it with a clip. Suction, alignment (manual), do not look directly at the UV light. Protect from light after removal. Heating on a hot plate (75 ° C for 1 min and 105 ° C for 10 min)

(4) Remove and place in the culture dish

4.development

(1) Pour the developer into the Petri dish, submerge the silicon wafer, and gently oscillate

(2) Rinse the silicon wafer with isopropyl alcohol to remove residual photoresist. If it cannot be removed, put it into the developer and shake it. Then continue to rinse with isopropyl alcohol.

(3) After rinsing, rinse with deionized water and blow dry with nitrogen.

5.silanization

(1) Make a good mold, 20µl pipette, centrifuge tube, tip

(2) Take 2 drops of C₂H₆Cl₂Si (very toxic), place in a centrifuge tube, insert the tube into the foam board, and place the silicon wafer flat.

(3) Align the grooved side with the tube, open the vacuum pump, and evacuate for 10 minutes.

(4) Turn off the vacuum pump, remove the cover and let it stand for 1 hour, it can put overnight.

6.molding

(1) Dispense PDMS and curing agent in the required amount at 10:1 and 5:1, place in a centrifuge tube, vacuum with a vacuum pump, observe at any time to prevent foam overflow, when no bubbles are drawn. You can stop.

(2) Wrap the aluminum plate with tape around, do not have gaps around, cut off the unsuitable parts with scissors, and place the silicon on the aluminum plate. A channeled silicon

wafer was cast with a 10:1 PDMS mixture and a 5:1 PDMS mixture was used to cast a silicon wafer without channels. Be careful not to show bubbles during the casting process. After casting, it is best to place it on the water platform for 10 minutes, and then put it into the oven at 100 °C for 90 minutes.

7.preparation

- (1) After taking out the silicon chip, carefully take PDMS from the silicon chip with a knife.
- (2) Be sure to align the holes when punching.
- (3)After punching, perform plasma cleaning on PDMS.
- (4)After cleaning, bond the PDMS to the glass plate.