User Guide : Epoxym Kit

Create Robust Replica Molds

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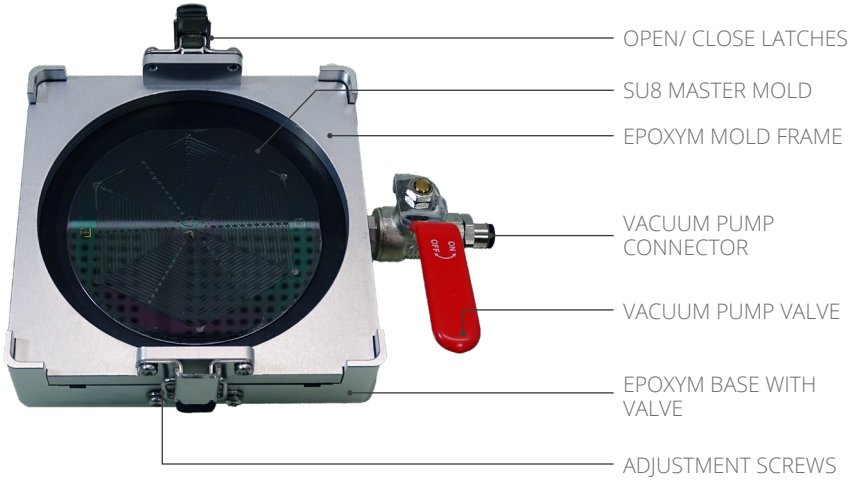
EPOXYM.

DESCRIPTION

Epoxym is an user-friendly solution designed for replicating SU8 master wafers and other types of molds. The replication process involves two steps: first, creating a polydimethylsiloxane (PDMS) positive replica, and then using this as a template to produce an epoxy resin replica of the original master.

EPOXYM COMPONENTS



EQUIPMENT INCLUDED IN THE KIT

- Epoxym base with valve
- Epoxym mold frame for PDMS (Ø: 12 cm)
- Epoxym mold frame for Epoxy (Ø: 10 cm)
- O-RING, FKM, 126 x 3 mm
- Flexdym™ seal sheet
- Epoxy (resin & hardener)
- Silicon spray
- Open/close latches with adjustment screws x2

EQUIPMENT NOT INCLUDED IN THE KIT

- PDMS (base & curing agent)
- Master mold
- Desiccator
- Vacuum pump with 6 mm OD tubing
- Ethanol or isopropanol
- Master mold (Ø: 4")
- Vented oven or Hot plate

SAFETY NOTES

The aim of this quick start guide is to illustrate how to use the Epoxym equipment for Epoxy mold replica fabrication.
Please, always consult the safety notes or procedures that may be related to your specific equipment prior to use.
As with all laboratory activities, gloves and lab coats should be worn at all time during the process. It is the user's responsibility to consult the manufacturer's recommendation for the chemicals used and to ensure adequate ventilation/extraction (e.g., via a fume hood) prior to proceeding. Do not exceed the maximum temperature stated in the equipment specification.

Epoxy handling:
Always use a mask, gloves and protective clothing.
Avoid breathing mist or vapours.
Wash skin thoroughly in case of contact.
Avoid release in the environment.

Epoxy resin (Part A):
Causes skin irritation.
May cause an allergic skin reaction.
Causes serious eye irritation.

Hardener (Part B):
May cause an allergic skin reaction.
Causes serious eye damage.
May cause allergy or asthma symptoms or breathing difficulties.

PROCESS.

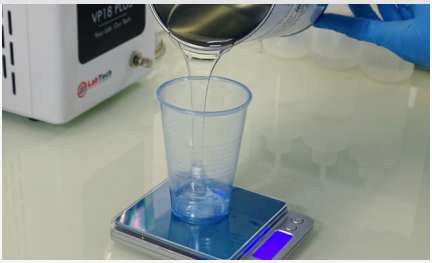
OPERATING INSTRUCTIONS

The Epoxym kit enables the production of durable epoxy molds resistant to high temperatures, up to 180°C. The process begins with the conversion of an SU-8 master mold into an intermediate PDMS positive replica, which is then used to produce the epoxy mold.

1. Preparation of PDMS

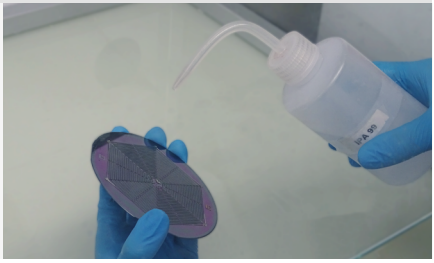
Prepare the PDMS solution by mixing the base & hardener according to the manufacturer's instructions (e.g. ratio of 1:10 for Sylgard™ 184). Evaluate the PDMS volume to get 4-6 mm thick PDMS positive replica.
Desiccate the PDMS mix for at least 30 minutes to remove all air bubbles.

Tip: For Sylgard™ 184, 60g of base and 6g of curing agent should be sufficient.



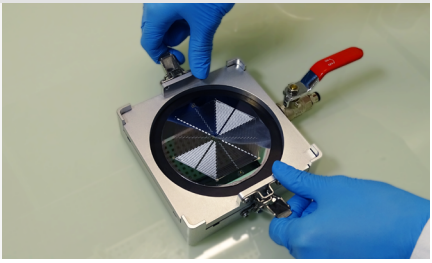
2. Preparation of the Master Mold

In the meantime, gently clean the silicon master mold to be replicated with isopropanol and preferably use an air gun to dry it.



3. Preparation of the Epoxym Kit

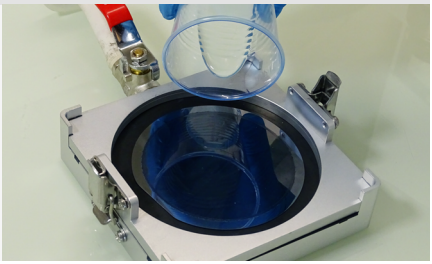
Place the Flexdym™ black sealing sheet on the base and center the master mold on top.
Insert the rubber O-ring seal into the PDMS frame, then fix it to the base closing the side latches.
Connect the setup to the vacuum pump, switch it on, and open the valve.
Check that the mold is securely fixed before proceeding.



4. Pour PDMS

Very gently, pour the degassed PDMS into the mold frame.

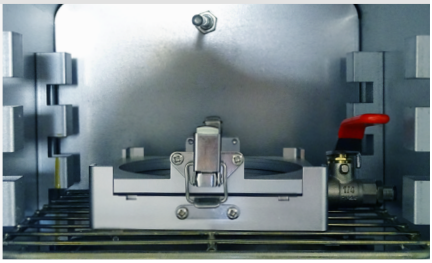
Note: This process should be done slowly to not produce air bubbles at the level of the microstructures.



5. Bake PDMS

Close the vacuum valve and disconnect the Epoxym from the pump.
Bake the PDMS in the oven according to manufacturer's instructions (e.g. 2 hours at 80°C for Sylgard™ 184).

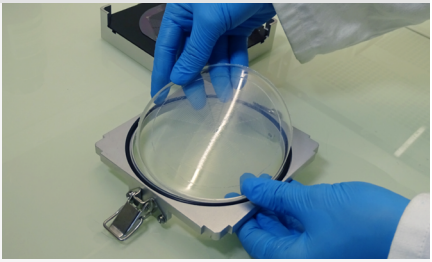
Note: Make sure the oven shelf is flat.



6. Unmold PDMS replica

Remove the Epoxym from the oven and unmold the PDMS from the frame.
Open the vacuum valve and remove the master mold and Flexdym™ sealing sheet from the base using flat tweezers.

Tip: Protect the PDMS microstructures from dust by covering them with adhesive tape.



Note: Store the Flexdym™ sealing sheet in a clean environment to protect it from dust and maintain its adhesive properties.

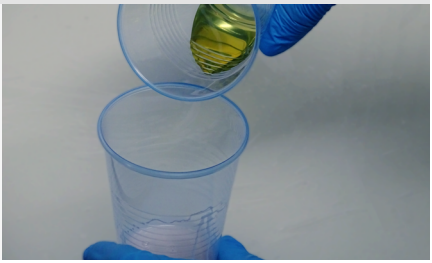
7. Preparation of Epoxy Resin (1/2)

Weigh the epoxy components A (resin) and B (hardener) according to the calculation table (page 14).
Heat up the components separately on a hot plate at 70ºC for at least 10 minutes.

Warning: Always perform epoxy handling and heating in a fume hood or vented oven.

Note: After use, clean the edges of the bottles thoroughly to prevent dried epoxy from sealing them shut. Seal the bottle caps with parafilm and store at room temperature.

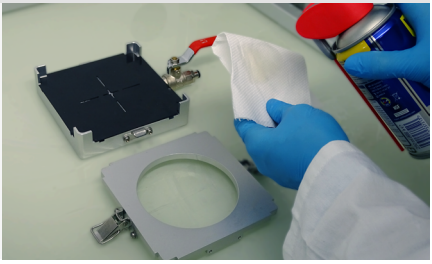
8. Preparation of Epoxy Resin (2/2)



Mix components A and B of the epoxy using a stirrer.
Heat at 70ºC for another 10 minutes.

Tip: By pouring component B (hardener) into component A (resin), volume waste is minimized.

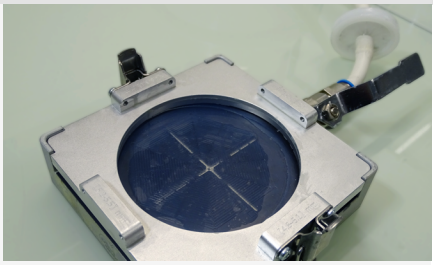
9. Preparation of the Mold Frame



Coat the epoxy mold frame with silicone spray to allow the unmolding step.
The side latches should be screwed into the threaded slot that corresponds to the thickness of the PDMS counter-mold.
Adjust the latches position to ensure proper tightness and an effective seal of the frame.

10. Preparation of the Epoxym Kit

Place PDMS replica face up in the center of the base and use the epoxy mold frame to close the system via the side latches.
Pre-heat the Epoxym system at 70°C, then connect to vacuum pump.
Open valve and apply vacuum. Remove the tape from the PDMS replica.

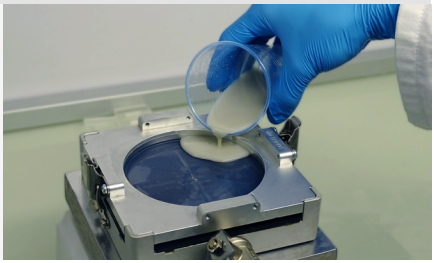


Tip: Pour a small amount of isopropanol onto the PDMS surface and rotate the Epoxym system to verify the tightness and seal of the frame.

Note: The PDMS replica must be flat. If a curvature is observed, it may result from a "meniscus" formed at the edges. Carefully remove this excess material with a scalpel.

11. Cast Epoxy on PDMS replica

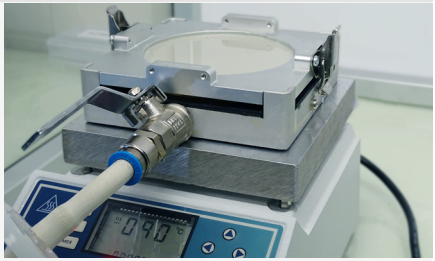
Pour the epoxy mix into the mold frame very gently, in order to not create bubbles.



Note: If the structures to be replicated are small and intricate, place the Epoxym system (with the vacuum valve open) in the dessicator to remove eventual air bubbles from the resin.

12. First Bake

Place the Epoxym - still connected to the vacuum pump - on a hot plate under the fume hood.
Make sure it is flat and bake at 90°C for 3 hours, 120°C for 2 hours, and at 150°C for 2 hours.

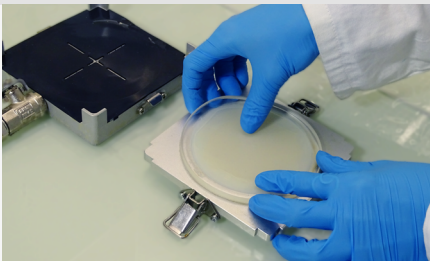


Tip: Keep the vacuum pump connected to the Epoxym base until the resin fully solidifies. This prevents buckling of the PDMS replica, which could compromise the flatness of the final epoxy mold.

Note: This step can be performed in a vented oven. If using an oven, first remove the adapter that connects the Epoxym base to the vacuum pump tubing, as it contains plastic components that may melt. Ensure the oven shelf is flat before proceeding.

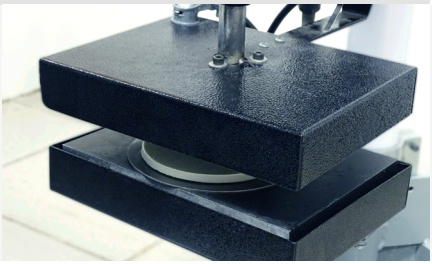
13. Unmold

Open the side latches and unmold the epoxy mold from the frame.
Cover the PDMS counter-mold with a scotch tape for later use.



14. Hard Bake

Hard bake the epoxy mold at 170°C on the structure side and 180°C on the bottom side for 1 hour.
To ensure the mold stays flat, we suggest using a heating press or to use a hotplate with a weight on top of the mold.



EPOXY CALCULATION REFERENCE TABLE

The recommended epoxy mold thickness is 3 to 6 mm.
To achieve this, approximately 35 ml of resin should be sufficient.
The table below indicates the quantities to be used for each epoxy resin component:

	COMPONENT A : RESIN	COMPONENT B : HARDENER
PARTS BY VOLUME	100	67
PARTS BY WEIGHT	100	83

MACHINE MAINTENANCE

After each use, we recommend cleaning the aluminum parts with acetone and ethanol, and the O-ring with ethanol only. Ensure the frame is coated with silicone spray before each use, and promptly clean any epoxy spills before polymerization to maximize the shelf life.

Avoid contact between metallic tools and the frames, as it might damage their surface finish and promote leaks.

TERMS & CONDITIONS

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Warranty

The Epoxym Kit is covered by a one-year warranty from the date of purchase. This warranty ensures that the machine is free from defects in materials and workmanship under normal use and conditions. Any issues arising during the warranty period will be assessed, and repairs or replacements will be provided as necessary. The warranty does not cover damage caused by improper use, unauthorized modifications, or external factors beyond our control.

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