



Version 2 ▾

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Microfluidics 2 - Mold Fabrication: UV Lithography V.2

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ABSTRACT

Su8 is a photoresist resin used in MEMS technology for thick structures. PDMS microfluidic chips fabrication is suitable for SU8+Si wafer molds. This protocol describes the direct UV laser lithography application performed in our laboratories.

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KEYWORDS

Microfluidics, Spin coating, SU8, Si wafer

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MATERIALS TEXT

SU8 developer chemical; Propylene glycol methyl ether acetate.
Cleaning; Isopropanol alcohol.

SAFETY WARNINGS

- * All the related steps must be done in a class-D cleanroom (minimum) and under yellow or red light.
- * All photoresist-related steps must be performed inside the fume hood.
- * Please learn well about the hazards of SU8 development chemicals.

BEFORE STARTING

This protocol is derived from

[Reference: Processing guidelines for permanent epoxy negative photoresist SU8 2025, SU8 2035, SU8 2050 and SU8 2075, MicroChem company]

Direct UV Laser Lithography Setup

30m

- 1 Lithography on photoresists is mostly performed by 2 methods; UV exposure using a mask and direct UV exposure on the material.^{30m}

NehirBT uses a maskless direct UV laser lithography method. It transfers drawings by CAD software to channels on mold.

The important parameters arranged are;

A	B
Specs	Info
Total size	100x100 mm
Light source	UV laser
Laser point	2 microns
Velocity	0,1 - 10 mm/sec
Resolution	2 microns
Aspect ratio	1:15
3D structures	microlens and microslope

Direct UV Laser Lithography

Kloe Dilase 250

Microfluidic Channel Design

5h

- 2 The designs are generated using a CAD software in DXF format and with micron as a unit.

5h

The flow simulation is performed using a multiphysics finite element analysis software, so the design optimization is performed by simulation support and correcting the errors.

Kloedesign software is used for converting the design file to LWO format which is suitable for KLOE DILASE 250 instrument.

Dilasesoft software controls the KOE DILASE 250 instrument by arranging the power of the laser source and velocity of stages.

UV Lithography

2d

- 3 The photoresist coated wafer is put inside KLOE DILASE 250 instrument. The objective focus is aligned by the thickness^{2d} of the photoresist. The vacuum is arranged and the instrument is started by the setup of Energy Modulation and writing Velocity.

Post-Exposure Baking

10m

- 4 Post-exposure baking is for thermally catalyzing the chemical transformation of photoresist film which is exposed by^{10m}

UV light at a certain design.

Wafer, coated with photoresist and exposed, is heated on a hot plate device. The thickness of the photoresist is important for the duration of heating steps. For example;

- For 25-40 micron thickness; 1 minute of baking at 65°C and 5 minutes of baking at 95°C are applied.
- For 45-80 micron thickness; 2 minutes of baking at 65°C and 6-7 minutes of baking at 95°C are applied.



Extended durations of baking causes lift-off of SU8 mold during or after the development process.

Hot Plate
Electromag LB.EM.M4060

SU8 mold development process

30m

- 5 Development is the chemical clearing the unexposed photoresist away and cleaning of the exposed photoresist to obtain microchannel mold. 30m

The wafer is left to cool down for a few seconds after removing off the hot plate and then developed with SU-8 developer chemical. Development is performed at room temperature inside fume hood and within a suitable glass plate.

Development recipe can be calculated using website:

<https://cleanroom.byu.edu/su-8-information-page>



Please learn well about the hazards of SU8 development chemicals and perform all reactions in a fume hood.

Washing and Hard Baking of the Mold

30m

- 6 The prepared mold is washed with isopropanol after developing and then dried with pressurized nitrogen gas. 30m

The mold is now ready for PDMS microchannel manufacturing after heating at 95°C for 10 minutes and then left to cool down for a few seconds. Put the mold in a petri dish, and label it with all appropriate information.

All the above steps are performed inside the cleanroom facility. Pouring PDMS material on mold in a petri dish is performed in class2 laminar flow hood.