Photolithography

Clean Room Bay 1

Cleanroom Procedures

What is the cleanroom?

A cleanroom is a designated space for the fabrication of semiconductor devices.

There are rules and regulations for cleanroom workers and spaces to keep the cleanroom dust and dirt free to ensure quality devices.

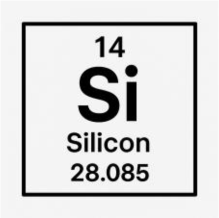
Workers must isolate hair and skin so that cleanroom work is kept hazard-free.

What Is Photolithography?

Photolithography transfers patterns onto silicon wafers using light.

Patterns are important for other semiconductor manufacturing processes to etch or deposit material according to the pattern.

First Stop: Silicon Wafer



Why Use Silicon?

Silicon is an ideal semiconductor.

To marginalize error, the wafer is cleaned before applying the photoresist.

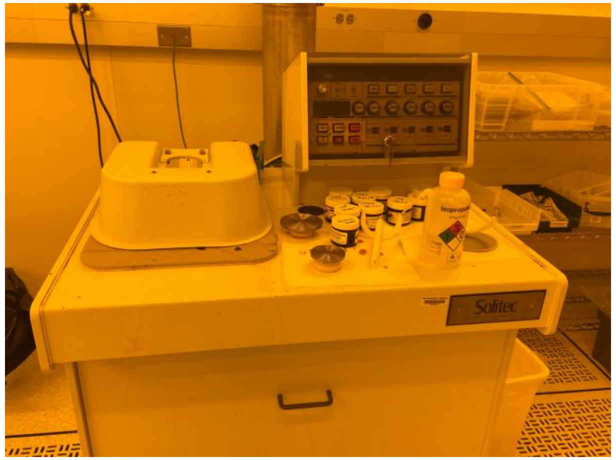
Did you know??

Wafers are round because they are sliced from a cylindrical piece of silicon. The circular wafer results in a uniform coat of photoresist when it is spin coated.

Cleaning the Wafer

The wafer is cleaned with isopropyl alcohol and acetone using the spinner.

The spinner is configured for the use to apply acetone for ten seconds, both acetone and isopropyl alcohol for five seconds, and then only isopropyl alcohol for five seconds.



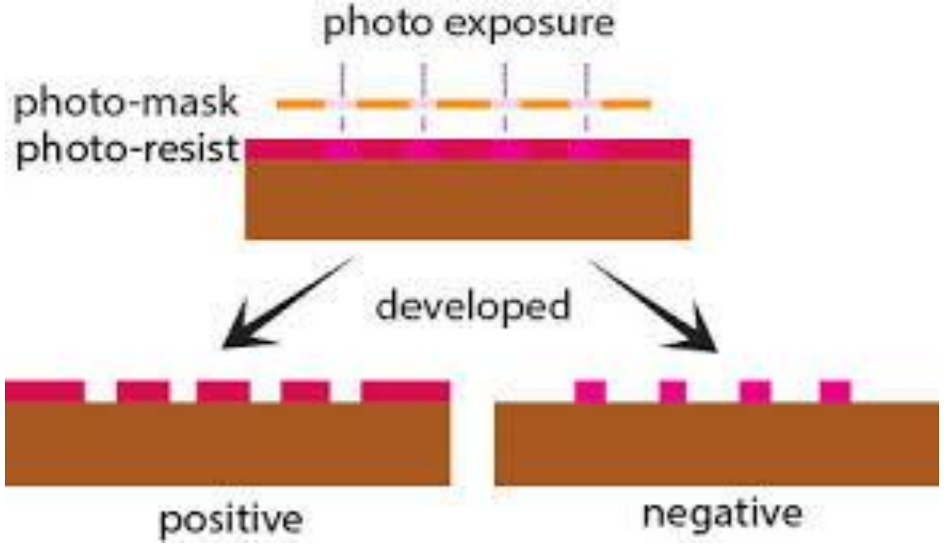
Cleaning the Wafer Demonstration

Second Stop: Photoresist

What is Photoresist?

Photoresist is a light-sensitive material used to create patterns on a surface.

A spin coater is used to apply the photoresist uniformly across the wafer.



Positive vs Negative Photoresist Diagram

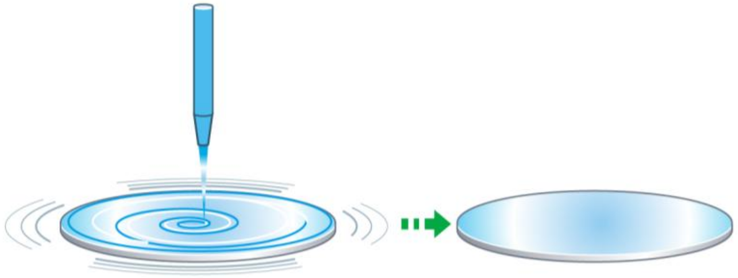
[Source](#)

Did you know??

When the wafer with photoresist is exposed to UV light, the development is either positive or negative. Positive photoresist becomes soluble when exposed to UV light, while negative photoresist hardens.

Applying Photoresist Coating

Using the spinner, an even coat of photoresist is applied to the wafer using a 1 mL syringe.



Photoresist Application Diagram

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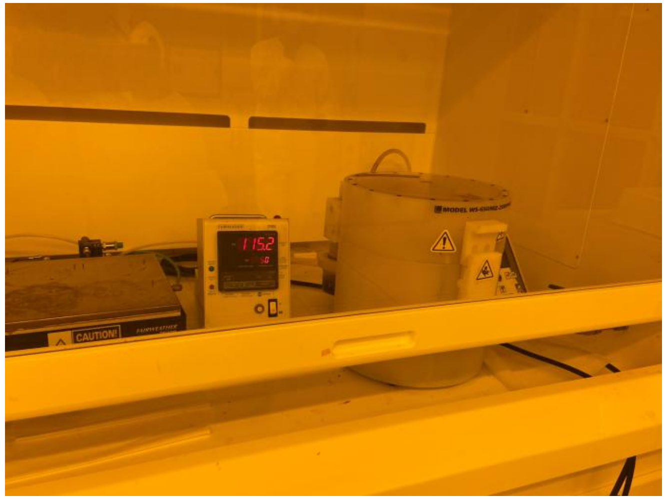
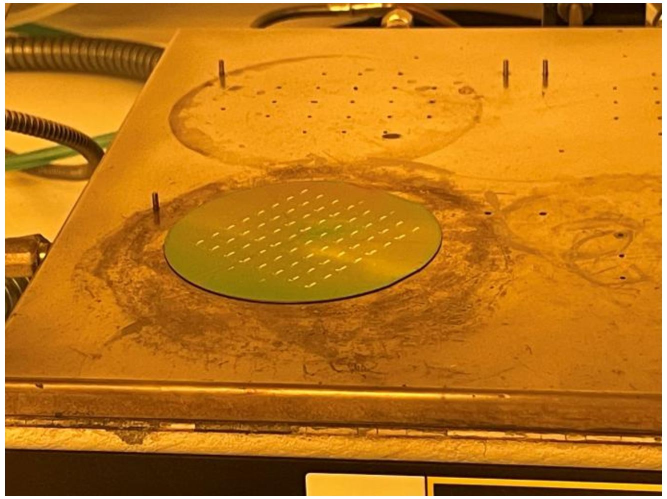
After the photoresist is applied, the wafer is baked on a hotplate at around 115°C to harden the photoresist.





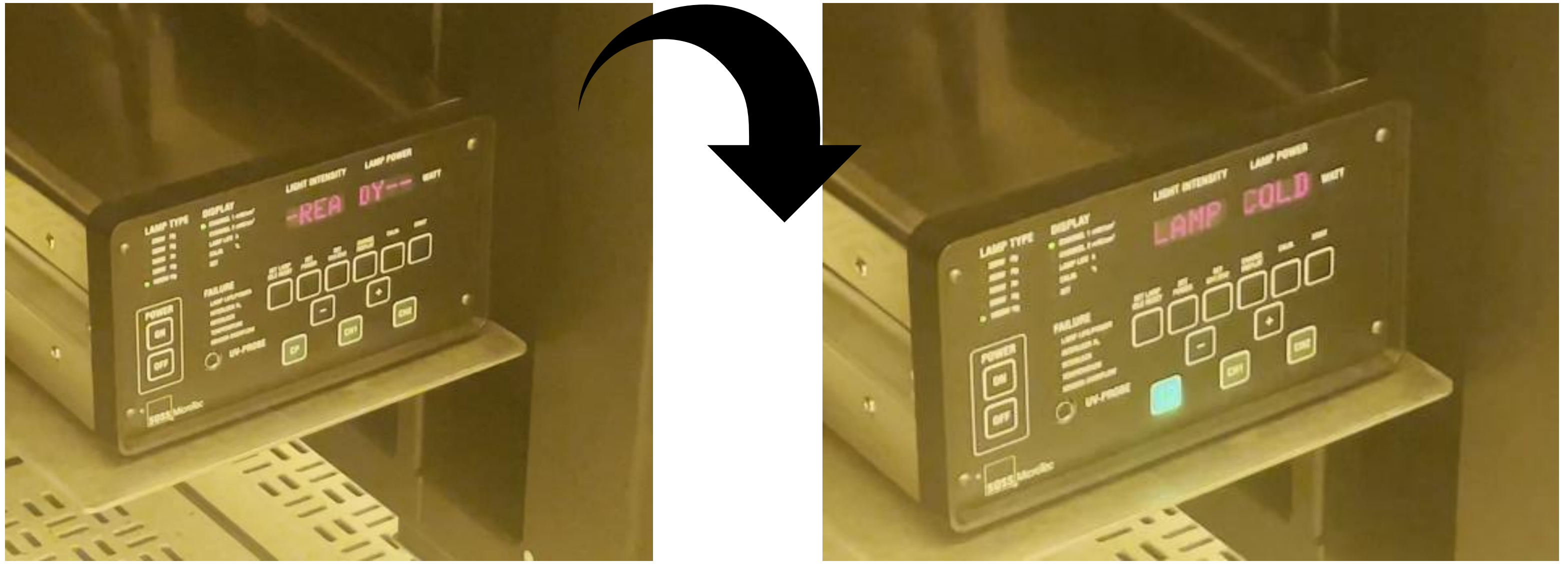
Fume Hood and Hotplate

UV Lamp and Karl Suss

Prior to using the Karl Suss, the nitrogen gas (used for various functions such as cooling the UV lamp) must be turned on.

Wall Nitrogen Gas Supply and Controls

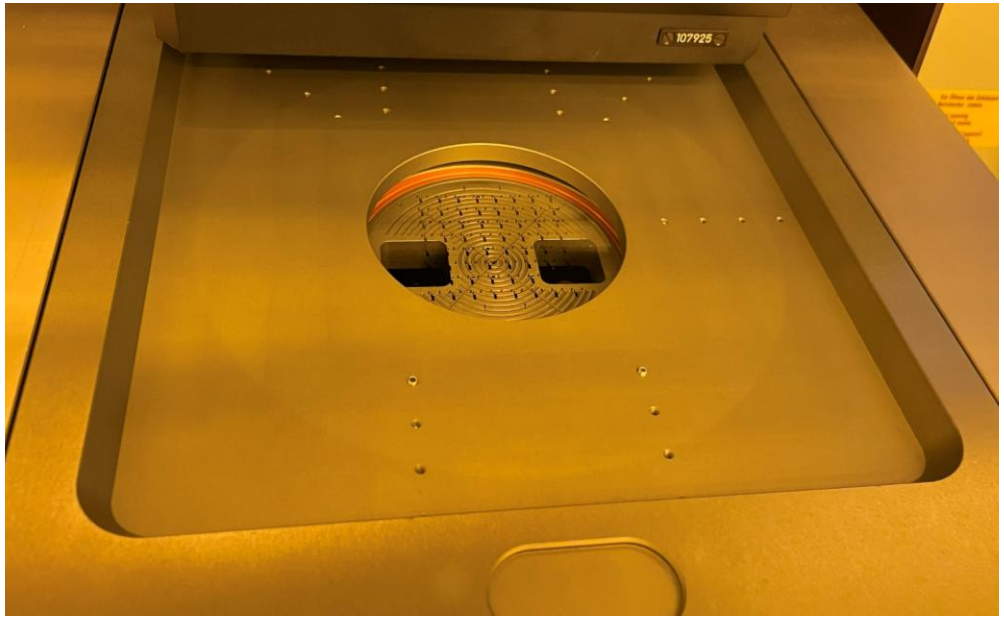
The lamp must then fully warm up prior to using.



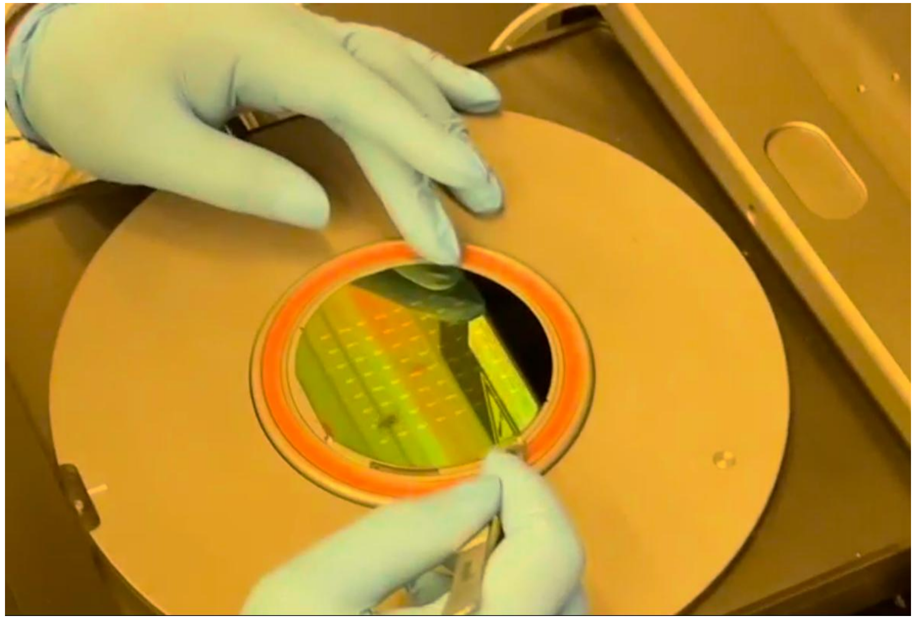
Lamp Ignition Controls and Display Prior to Warming

Loading the Wafer and Mask

The mask and wafer are loaded in and the wafer held in place via vacuum. The next step is to align the two for UV exposure.



Glass Mask in Tray

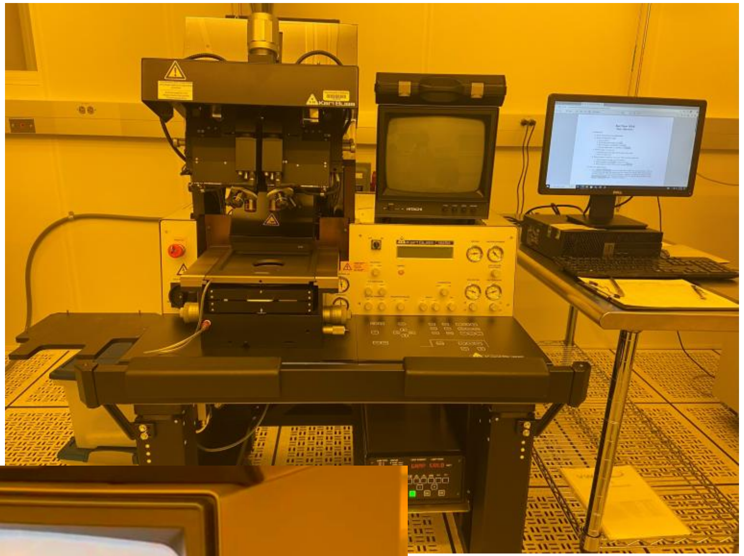


Silicon Wafer In Air Table

Mask Alignment

The mask and wafer are then both carefully placed into their respective locations in the mask aligner. The mask aligner utilizes microscopes and high-precision overlay to align the mask and wafer perfectly. There are several knobs on the machine to achieve this precise aligning.

Karl Suss Photolithography Mask Aligner



Dual Microscope View – Aligning of Mask and Wafer

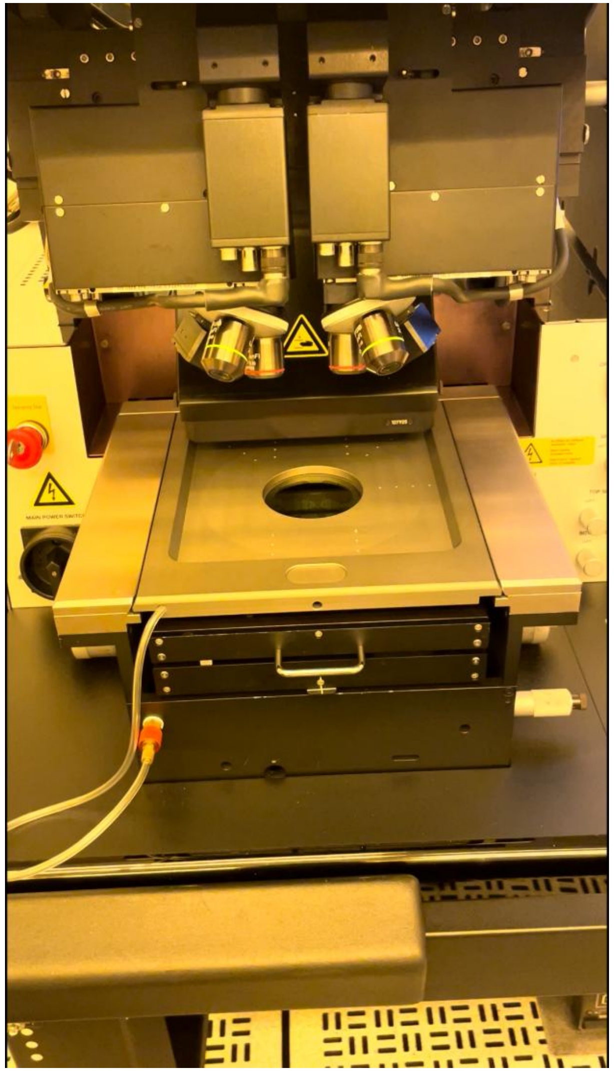
UV Exposure

After the mask and the wafer are properly aligned, they are exposed to UV light to etch the mask patterns onto the wafer.

Karl Suss Instrumentation Panel

All cleanroom workers **MUST** be notified and aware when the UV exposure is occurring to avoid eye contact.

UV Exposure Demonstration



Developing the Wafer

The wafer is then dropped into developer and swirled until the photoresist of the exposed areas is dissolved.

The wafer is then removed from the developer, cleaned off with ionized water, and dried with nitrogen gas.

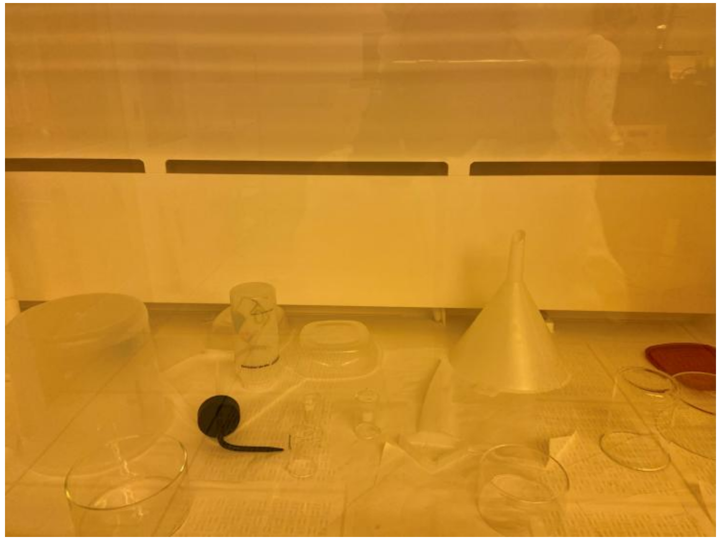
Wafer Development Demonstration

Waste and Hazardous Material

The EHS regulates disposal of hazardous waste.

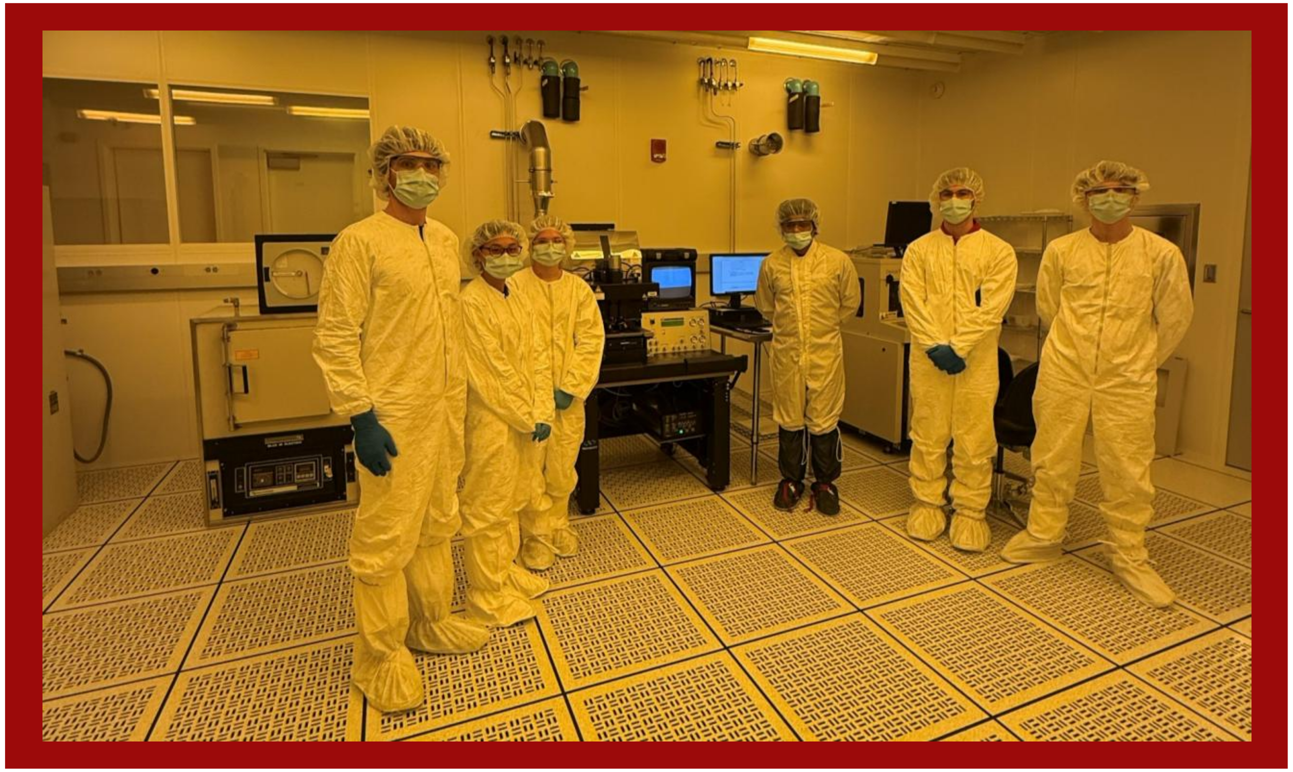
The chemicals used in the clean room should **NOT** be poured down household drains like water.

All chemicals are relegated to a separate waste disposal and only water is drained into the sink. Furthermore, all materials are cleaned with diH2O.



Fume Hood with Materials

UA Photolithography Team



Pictured (left to right) Chad Leino, Lindsey Bowen, Juliet Correll, Anirban Swakshar, Joseph Tzompanakis, Alex Harper

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