Lithography

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- Lithography is the process of applying resist to the wafer before patterning it and removing some of the resist in accordance with that pattern
- Lithography is one of the most basic processes in Microelectronics
- It is used repeatedly throughout building devices in the cleanroom, and it is important to properly line up each consecutive pattern with each other
- Photolithography is the method used in this class, where UV light is exposed through a photomask in a Mask Aligner.
- This class will utilize positive photoresist for lithography, where the exposed photoresist is removed during development

What Lithography Does

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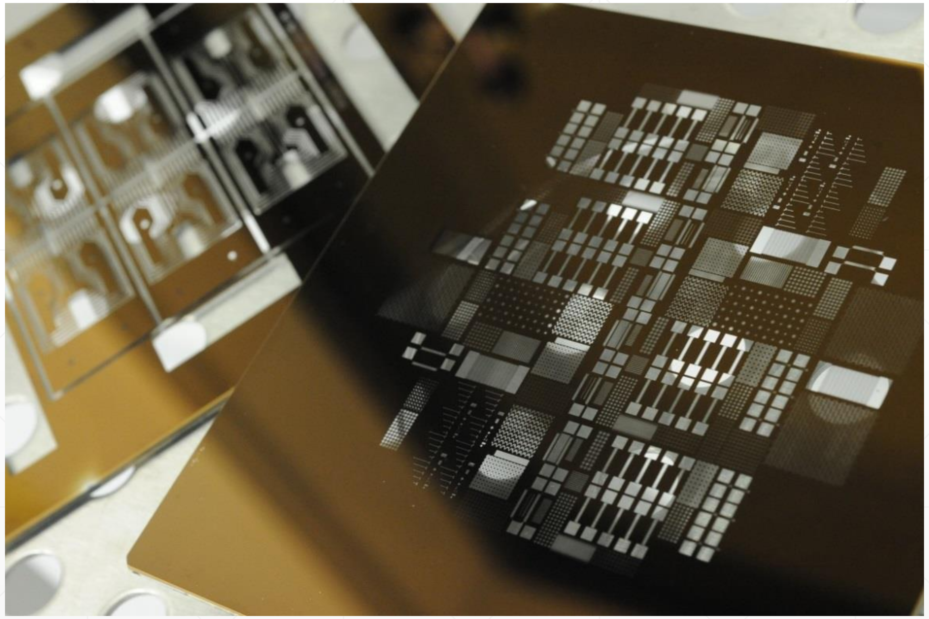
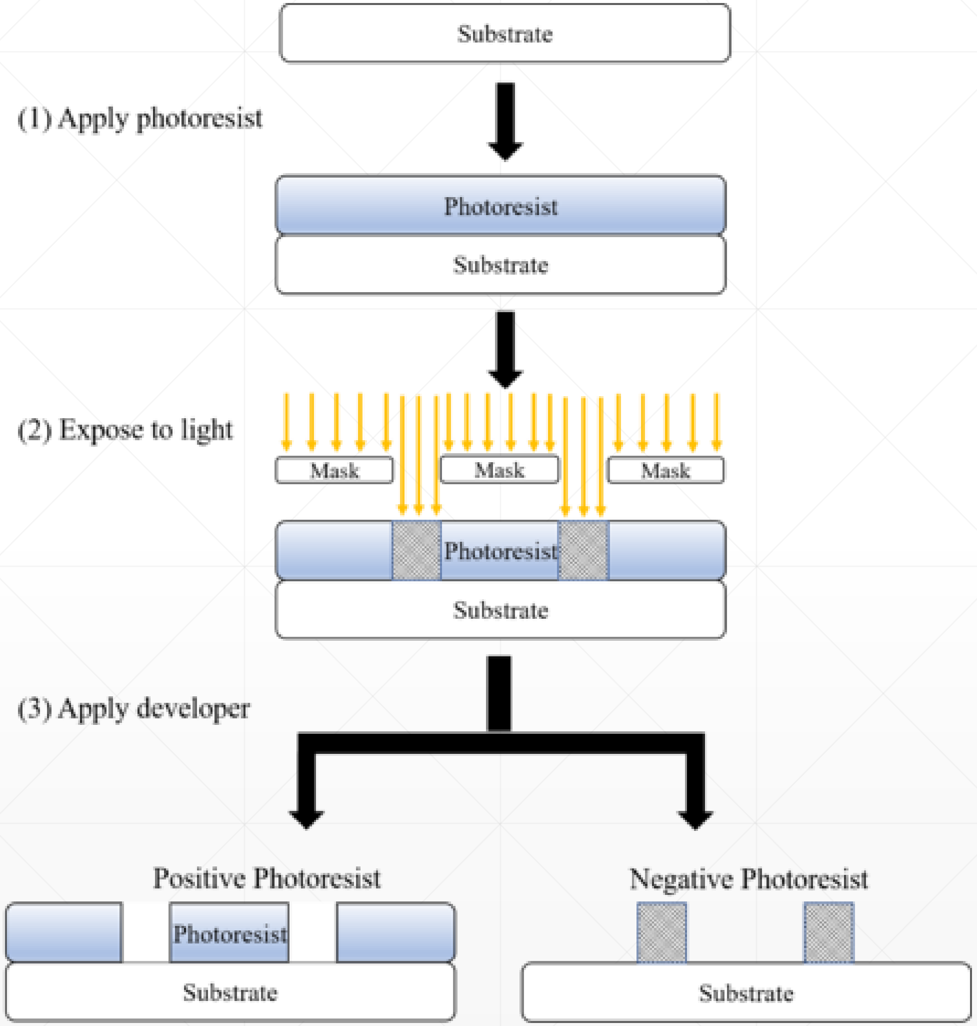
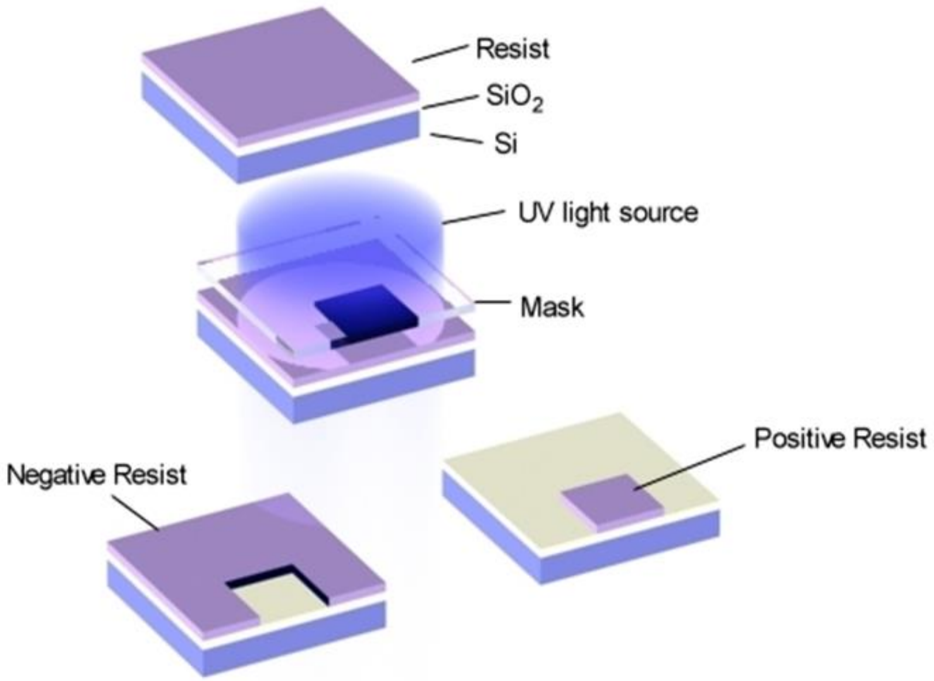
Photolithography is about creating a temporary mask for your wafer to enable following processes to only effect a portion of the surface





Different Types of Lithography

- Positive resist is removed when it encounters UV light
- Negative resist stays when it is hit with UV light
- If both resists are used with the same mask they will produce photo-negative results



How Lithography Works

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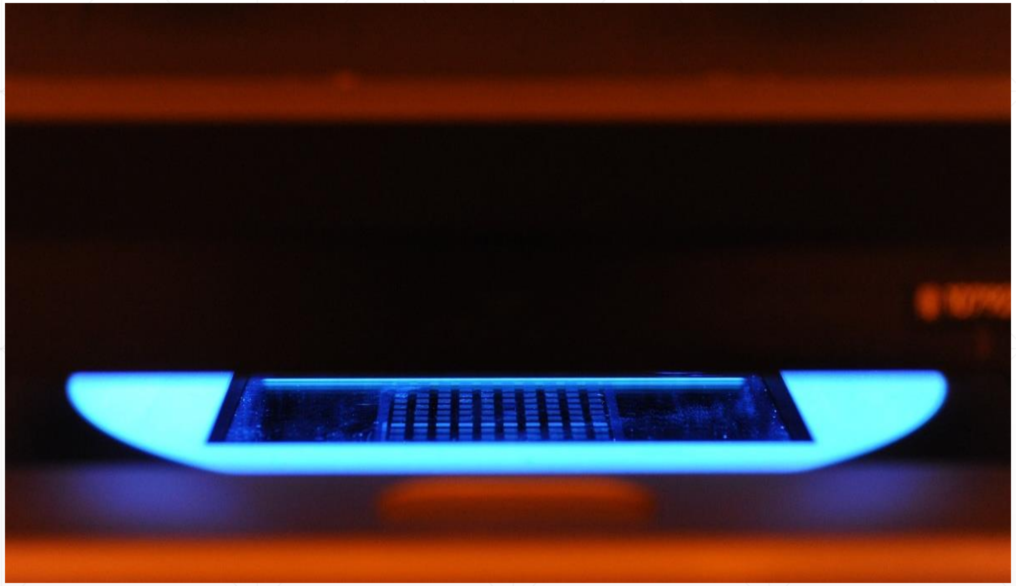
Negative Resist

- Photoresist crosslinks when hit with UV light
- Exposed resist becomes very difficult to remove once it undergoes high temperatures

Positive Resist

- Photoresist becomes developer soluble with hit with UV light
- Otherwise the resist remains developer resistant until it is hit with UV light



Uses for Lithography

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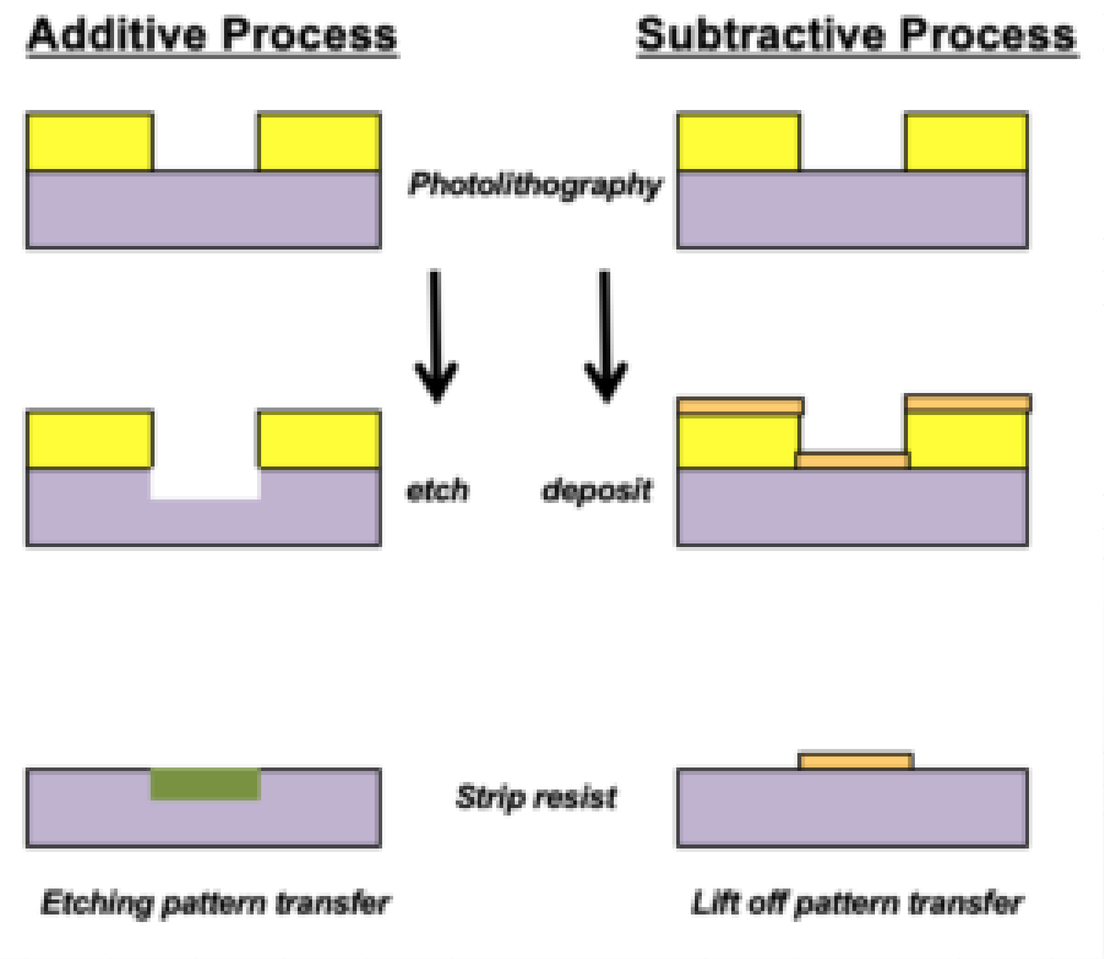
- The two primary uses for Lithography are for etching or for liftoff
- The left image shows its use in etching – where a opening is created in lithography that exposes a portion of the wafer to a chemical/mechanical etching process that is resisted by the photoresist around it
- The right image shows its use in liftoff – where a material is deposited on top of the photoresist that will float away when the resist is dissolved



Spinning Photoresist

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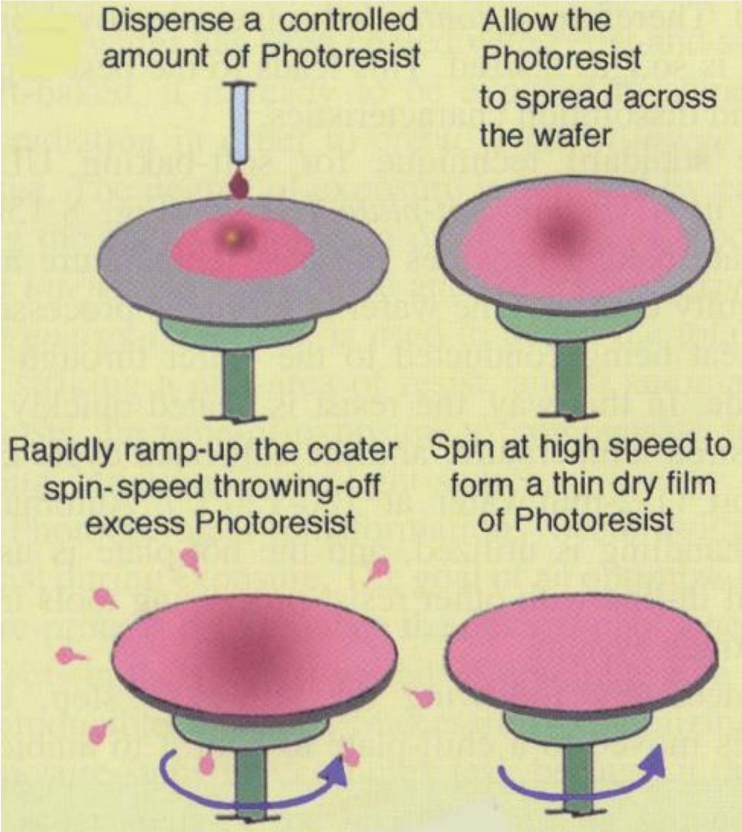

- There are three stages for spinning resist
  - Dispensing resist: coverage of between 30% - 50% of the wafer
  - Spread: A low speed to encourage the resist to spread across the surface evenly
  - Spin: A high speed to produce the targeted thickness for the resist
- The thickness of the resist will depend on its viscosity and the speed we spin
- An ideal wafer will have a reflective reddish color with no artifacts
- Common Spinning issues
  - Dust / Other artifacts marring the surface
  - Incomplete coverage – the resist did not spread evenly
  - Edge Bead – A buildup of resist near the perimeter usually produces a different thickness in that area

Lab Assignment #1

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- Question 1: What is the exposure intensity of the Suss Mask Aligner?
- Question 2: At what spin speed is needed for the spin (not spread) step to get Shipley 1813 at a thickness of 1.3 microns?
- Question 3: Based on the datasheet for Shipley 1813, what is the necessary exposure energy necessary for our process?