Lithography

- 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

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

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

- 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

- 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

- 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?