

Homework: Photolithography I

Problems 1 -3: Problems 2, 4, and 5 in Chapter 7 (Campbell Book)

Problem 4:

You want to make a photomask to fabricate a device for the first time. As you don't have any mask design experience, you are concerning about the design errors you may have that can be costly when a quartz mask is used. While printing out transparencies for a talk you are about to give, you come up with an idea of making masks with a laser printer in your lab.

- (1) Theoretically, what is the smallest feature (in microns) you can print with a common high-resolution printer (1200dpi)? If the minimum feature size in your design is 5- μm , what will be the printer resolution required? Does such a printer exist?
- (2) Do some survey to find printing shops that provide printing resolution better than 5000 dpi and check the price of printing?
- (3) Since printer toner and transparencies are not designed for masks, what are the potential problems you may encounter while using the transparency masks for microfabrication?

Problem 5:

Calculate the resolutions for the following projection systems (and depth of focus)

- (1) Contact printing with G-line and resist thickness = 1 μm
- (2) Proximity printing with H-line and resist thickness 1 μm and a mask-wafer separation 3 μm .
- (3) Projection printing with I-line and $\text{NA} = 0.3$
- (4) Projection printing with DUV and $\text{NA} = 0.2$
- (5) Proximity printing with 1 nm X-rays and resist thickness = 20 μm and mask-wafer separation = 100 μm