Photolithography II

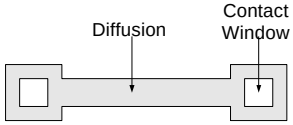
- Basics
- Nature of light
- “Steppers”
- Contact Printing
- Alignment
  - Marks
  - Errors
  - Design Rules
- Lithography Trends

Basics

- Resolution
  - Simply put the smallest feature that can be resolved. Ultimately, it is not just home thin a line of PR we can pattern, but also how thin we can carry out our process
    - Diffusion under masks
    - Undercutting of masks
- Pattern registration
- Throughput

Basics

- Pattern registration
  - How well can a previous mask step be fit to to following mask step.



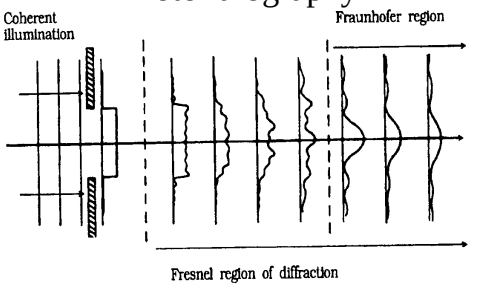
Basics

- Throughput
  - This is a measure of how many wafers you can pattern per unit time.
    - For instance: I am down to 3 minutes per 4” wafer including exposure time with 99% accuracy. What if I could go faster, but my accuracy dropped? How would you determine which was more cost effective?

Photolithography

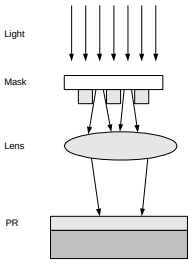
- Nature of light
  - Light can behave as if it were a particle and as if it were a wave.
  - Depending on the type of photolithography exposure system will dictate how you have to treat light in your model.

Photolithography



“Steppers”

- The Mask is separated from the wafer
- The image is reduced (makes it easier to make a mask)
- The same pattern is stepped over the entire surface automatically



“Steppers”

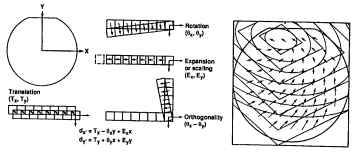
- Expensive to maintain
- Susceptible to lens errors

Contact Printing

- Inexpensive, but not automatic.
- The features have to be the same size on the mask as the are on the wafer.
- The mask are in contact with the PR which can cause damage to the masks.

Alignment

- This is the ability to successfully line up successive features on a wafer. What would happen if the gate metal were placed over the S or D contacts?



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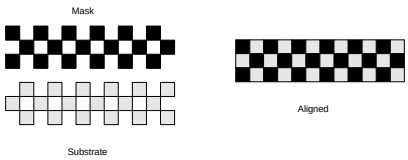

Lithography Trends

- E-Beam
  - Electron beams have a large energy or small wavelength, but have to be scanned across the wafer, not flood exposed
- Deep UV or Soft x-ray
  - Lenses can still be used to focus light as is a stepper reduction system
- X-ray
  - Back to Contact Printing?