

Lecture 6: Process Modules

- Announcements:
- HW#1 due Tuesday, 2/14 at 10 a.m.
- Lecture Modules 3 & 4 on Process Modules online
- Lecture Module 5 on Surface Micromachining online
- Process Module Details lecture videos online soon
 - ↳ These give more details than I will give in class
 - ↳ Watch these if your background in microfabrication is weak
 - Very helpful to understand course material
 - Very helpful for upcoming homework

• Today:

- Senturia, Chpt. 3; Jaeger, Chpt. 2, 3, 6
 - ↳ Example MEMS fabrication processes
 - ↳ Photolithography
 - ↳ Etching
 - ↳ Oxidation
 - ↳ Film Deposition
 - ↳ Ion Implantation
 - ↳ Diffusion
- Reading: Senturia Chpt. 3, Jaeger Chpt. 11, Handout: "Surface Micromachining for Microelectromechanical Systems"
- Lecture Topics:
 - ↳ Polysilicon surface micromachining
 - ↳ ...

• Last Time:

- Finished Micro Gas Analyzers and Benefits of Scaling

Process Module Overview:

- Lecture Topics:
 - ↳ Photolithography
 - ↳ Etching
 - ↳ Oxidation
 - ↳ Film Deposition
 - ↳ Ion Implantation
 - ↳ Diffusion
- As stated earlier, this is now assumed knowledge
- I will gloss over this material to review it a bit, but will not go over it in detail
- You can watch my lectures from EE245, Fall 2012 on the Webcast Berkeley site for more in depth coverage: Lectures 6-8

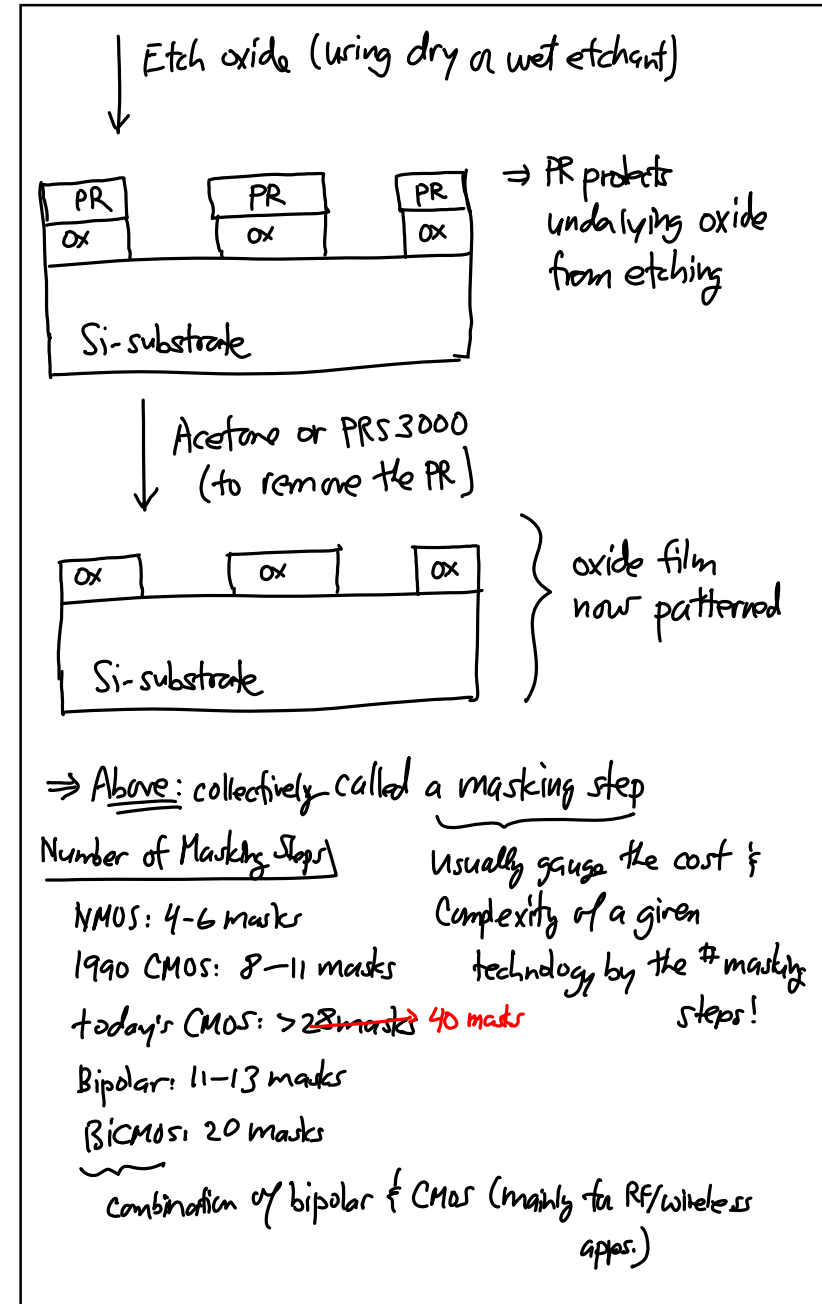
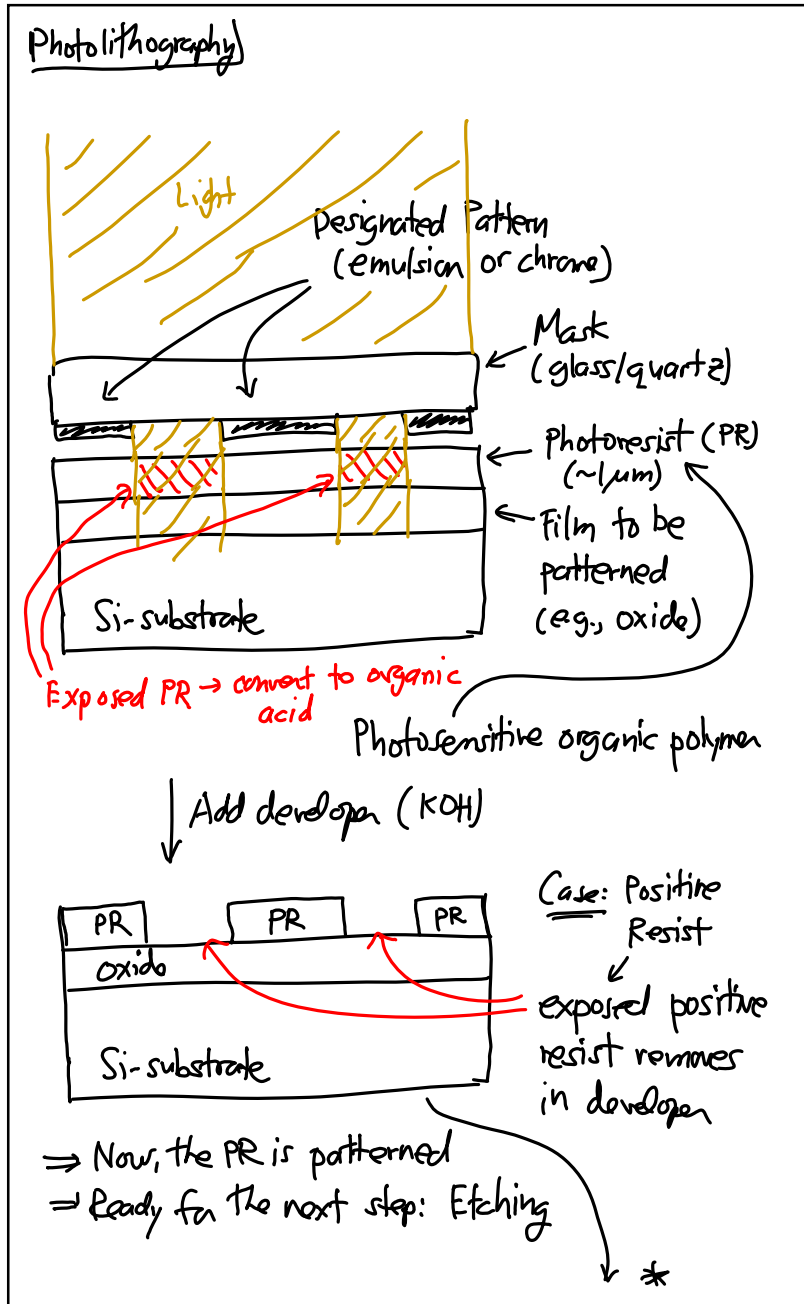
Process Modules

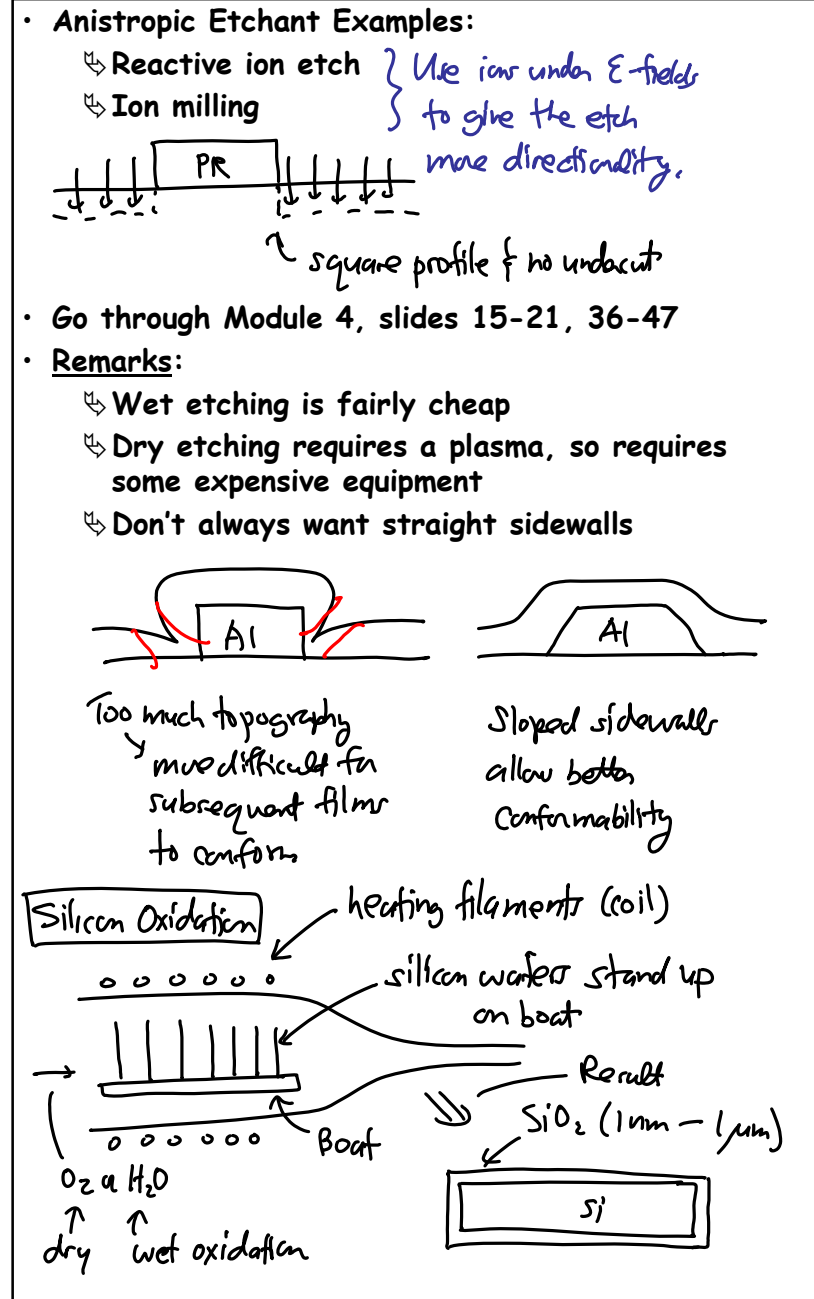
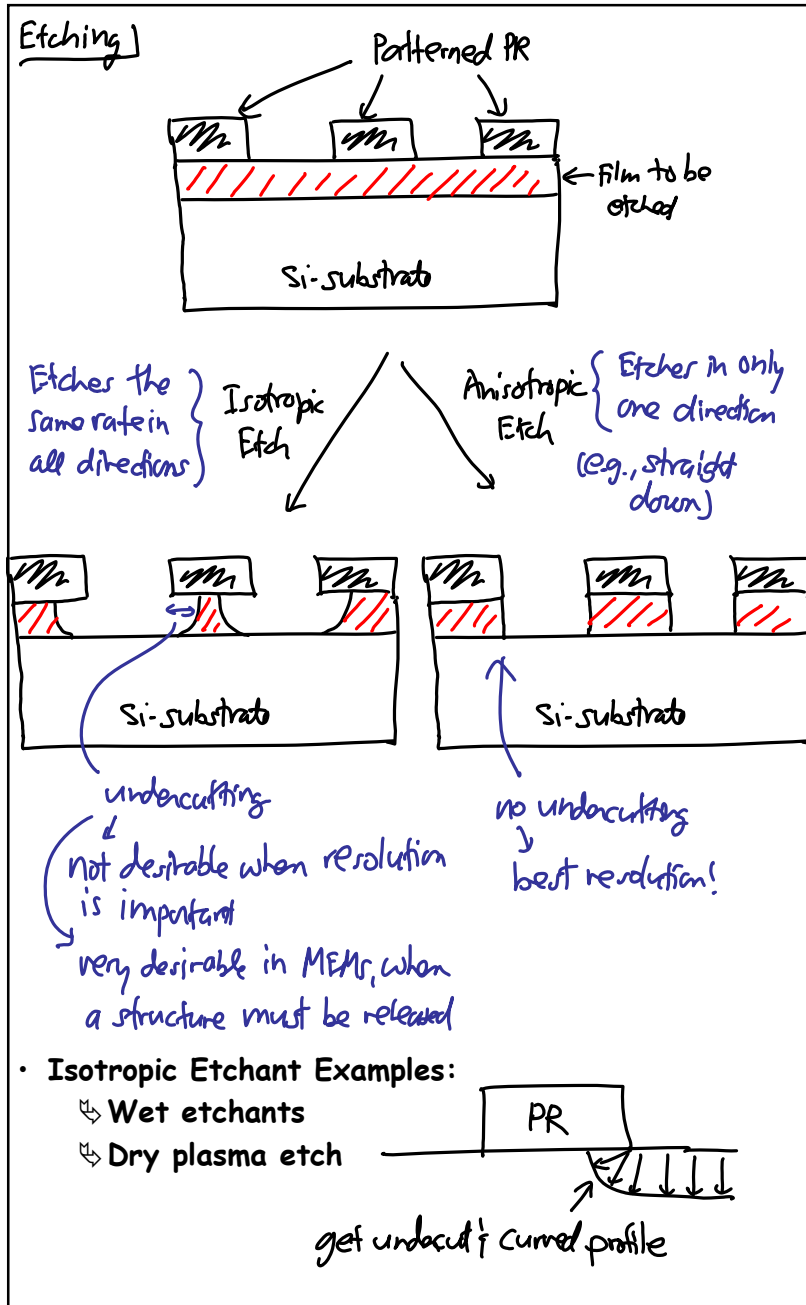
⇒ there are actually only a few basic modules used for processing

↓
Combination of these in the correct sequence yields an integrated circuit technology that provides transistors, MEMS, nanodevices, etc.

⇒ For each module, need to understand:

- ① Physics and engineering of each module in detail.
- ② Interactions between modules.
- ③ The effect of each module on the finished device.





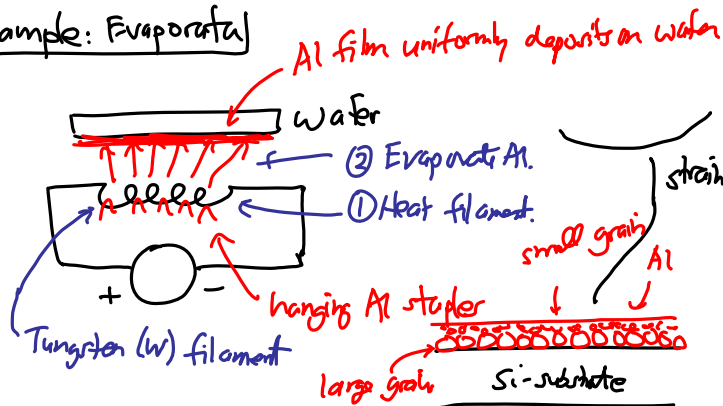
• Remarks:

- ↳ Uniformity can be better than 2% across the wafer from lot to lot
- ↳ Need to flow the O_2 fairly fast in order to minimize reactant losses from the first boat to the last one

Thin-Film Deposition:

- For deposition of films like Al (and other metals), SiO_2 , Si_3N_4 , and polysilicon
- Deposition, not thermal growth

Example: Evaporation



Example: Sputtering

