Lecture 9: Surface Micromachining I

- Announcements:
- HW#2 due this Friday at 9 a.m.
- Module 5 on "Surface Micromachining" online
- No lecture Thursday
  - This room reserved for a meeting
  - Thursday lecture is moved to Friday at 2 p.m. in this room (540 Cory)
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- Today:
- Reading: Senturia Chpt. 3, Jaeger Chpt. 11, Handout: "Surface Micromachining for Microelectromechanical Systems"
- Lecture Topics:
  - Polysilicon surface micromachining
  - Stiction
  - Residual stress
  - Topography issues
  - Nickel metal surface micromachining
  - 3D "pop-up" MEMS
  - Foundry MEMS: the "MUMPS" process
  - The Sandia SUMMIT process
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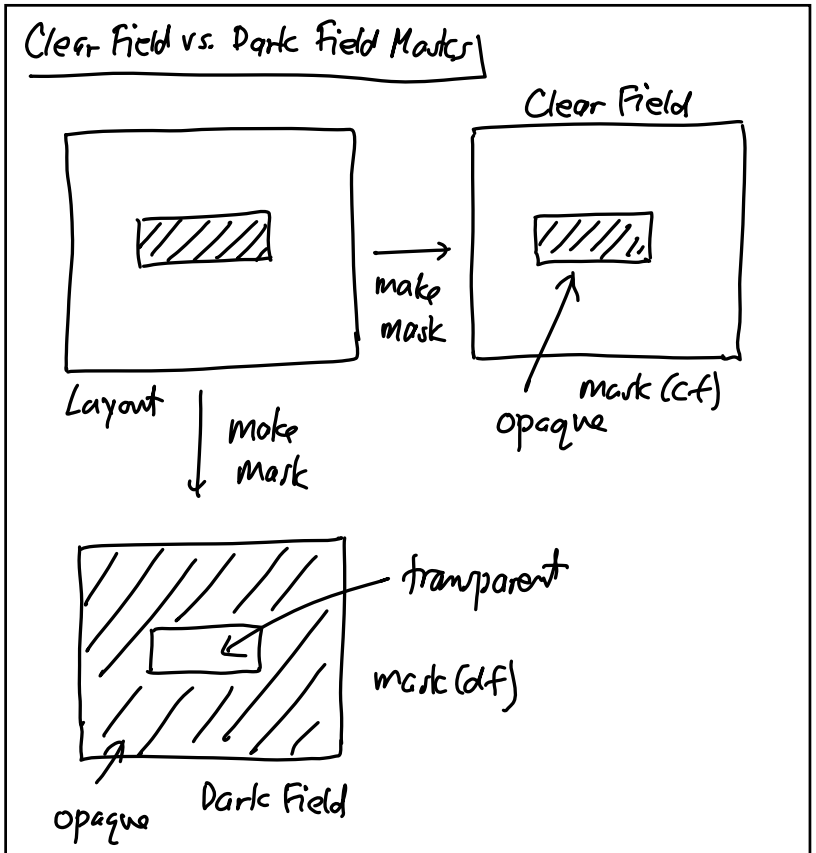
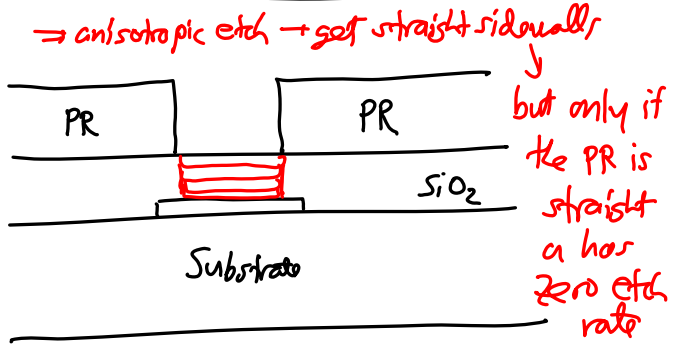
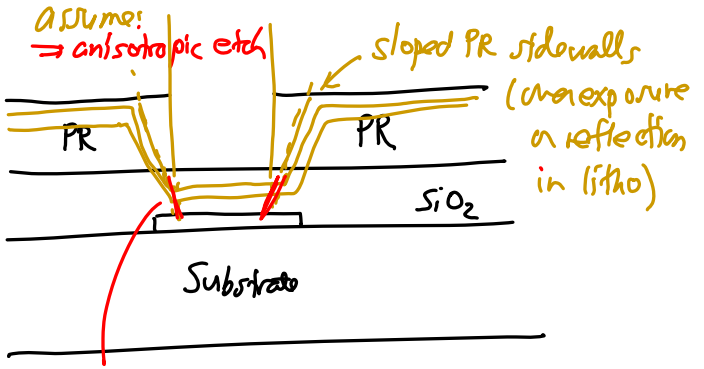
- Last Time: Finished Module 4
- Start Module 5 on "Surface Micromachining"



- Straight or Sloped Sidewalls:
- Often want sloped sidewalls in order to reduce the sharpness of corners
  - Easier to deposit over
  - Sharp corners concentrate stresses
  - High stress can weaken structures creating a reliabilty concern
  - High stress can dissipate energy, lowering Q
- When you want straight sidewalls (e.g., for lateral electrostatic drive), use a hard mask
  - PR can't last for thick structures
  - A hard mask suppresses angle transfer

Etching to Select Sidewall Type





transfer to some degree the slope of the PR into slope in the etched film

What can we do to get straight sidewalls?