

Lecture 10: Surface Micromachining III

• Announcements:

- HW #2: Due today
- HW#3 online

• Today:

- Reading: Senturia Chpt. 3, Jaeger Chpt. 11, Handout: "Surface Micromachining for Microelectromechanical Systems"

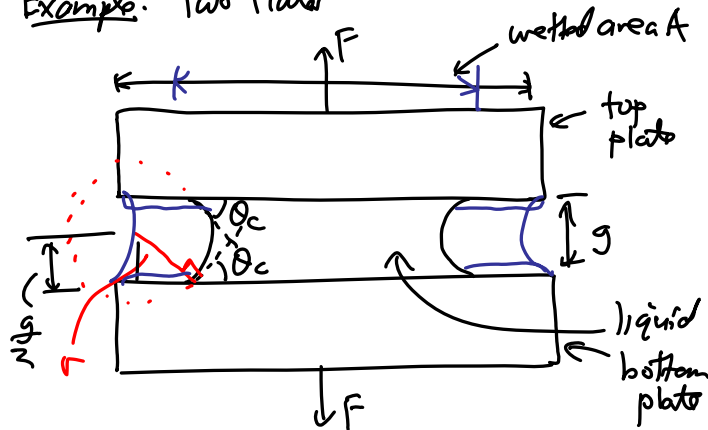
↳ Lecture Topics:

- ↳ 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



• Last Time:

Example. Two Plates



Laplace Equation

$\Delta p_{la} = \frac{\sigma_{la}}{r}$
 ↑
 Pressure Difference @ the Liquid-Air Interface
 ← surface tension @ liquid-air interface
 ← Radius of Curvature of the Meniscus
 (-) if concave
 includes σ_{la}, σ_{sa}

$$\left[r = \frac{-(g/2)}{\cos \theta_c} \right] \Rightarrow F = -\Delta p_{la} A = \frac{2A \sigma_{la} \cos \theta_c}{g}$$

↑
 Force needed to keep the plates apart.

⇒ This depends on: (to avoid stiction)

- ① A → wetted area → (want small)
- ② g → gap! → (large)
- ③ θ_c → contact angle! → (large)
- ④ σ_{la} → (small)

