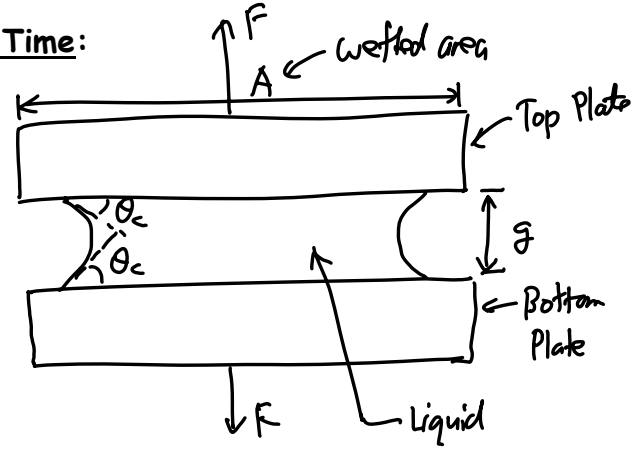
- Announcements:
- HW#2 is due tomorrow night at 7 p.m.
- Time for Make-Up Lectures:
  - Lec: M 5-6:30; Dis: Th 3:30-5
- ---
- Today:
- Reading: Senturia Chpt. 3, Jaeger Chpt. 11, Handout: "Surface Micromachining for Microelectromechanical Systems"
- Lecture Topics:
  - Polysilicon surface micromachining
  - Stiction
  - Residual stress
  - Topography issues
  - Nickel metal surface micromachining
  - 3D "pop-up" MEMS
  - Foundry MEMS: the "MUMPS" process
  - The Sandia SUMMIT process
- ---
- Last Time:



Laplace Equation

$\Delta p_{la} = \frac{\gamma_{la}}{r}$

γ_{la} ← Surface tension @ liquid-air interface

r ← Radius of Curvature of the meniscus (<0 if concave)

Δp_{la} ↑ Pressure Difference @ the Liquid-Air Interface

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

↑ Force needed to keep the plates apart.

$\Rightarrow$ (+) force means (-) Laplace pressure

Note: This depends on θ_c, so depends on all materials/gases associated w/ the interface!

Remarks.

① To prevent stiction:

✓ $\Rightarrow$ reduce A (wetted area)

✗ $\Rightarrow$ choose liquid-air interface so that γ_{la} = small

✓ $\Rightarrow$ make g = large

✓ $\Rightarrow \theta_c > 90°$

Liquid	Solid	Contact angle
water	soda-lime glass	0°
ethanol	lead glass	
diethyl ether	fused quartz	
carbon tetrachloride		
glycerol		
acetic acid		
water	paraffin wax	107°
	silver	90°
methyl iodide	soda-lime glass	29°
	lead glass	30°
	fused quartz	33°
mercury	soda-lime glass	140°

Some liquid-solid contact angles[5]