Neural Interfaces

Problem Set No 2

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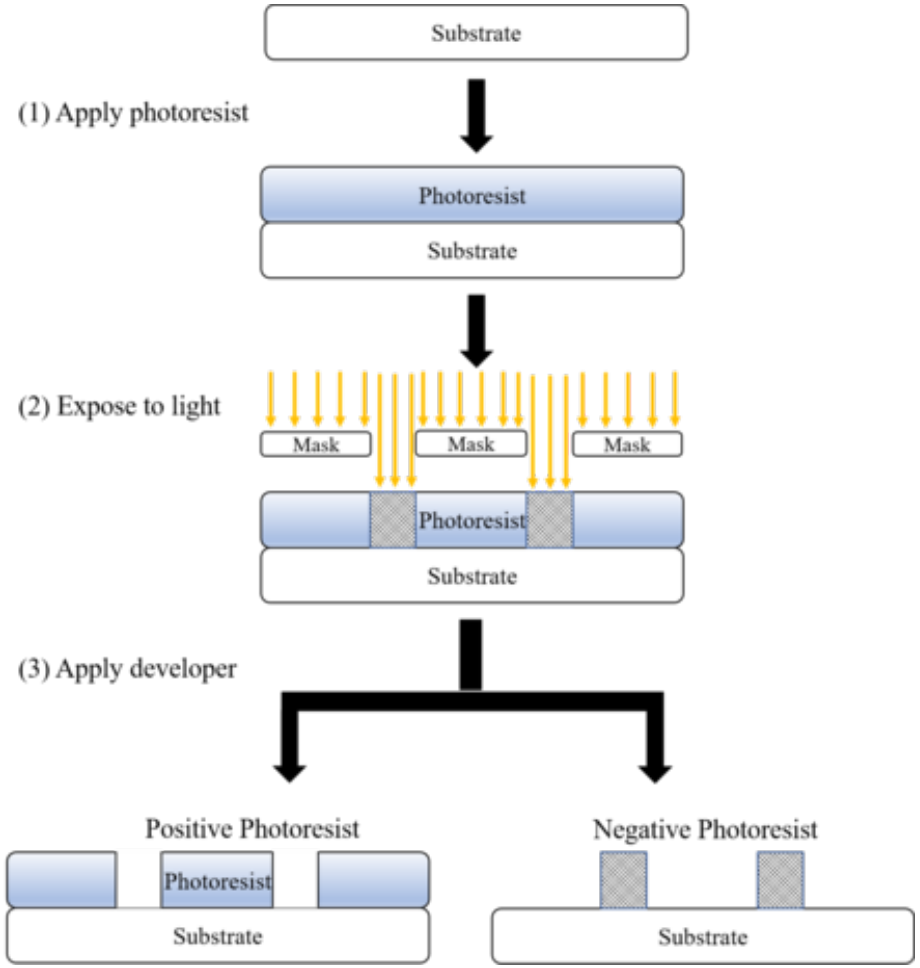
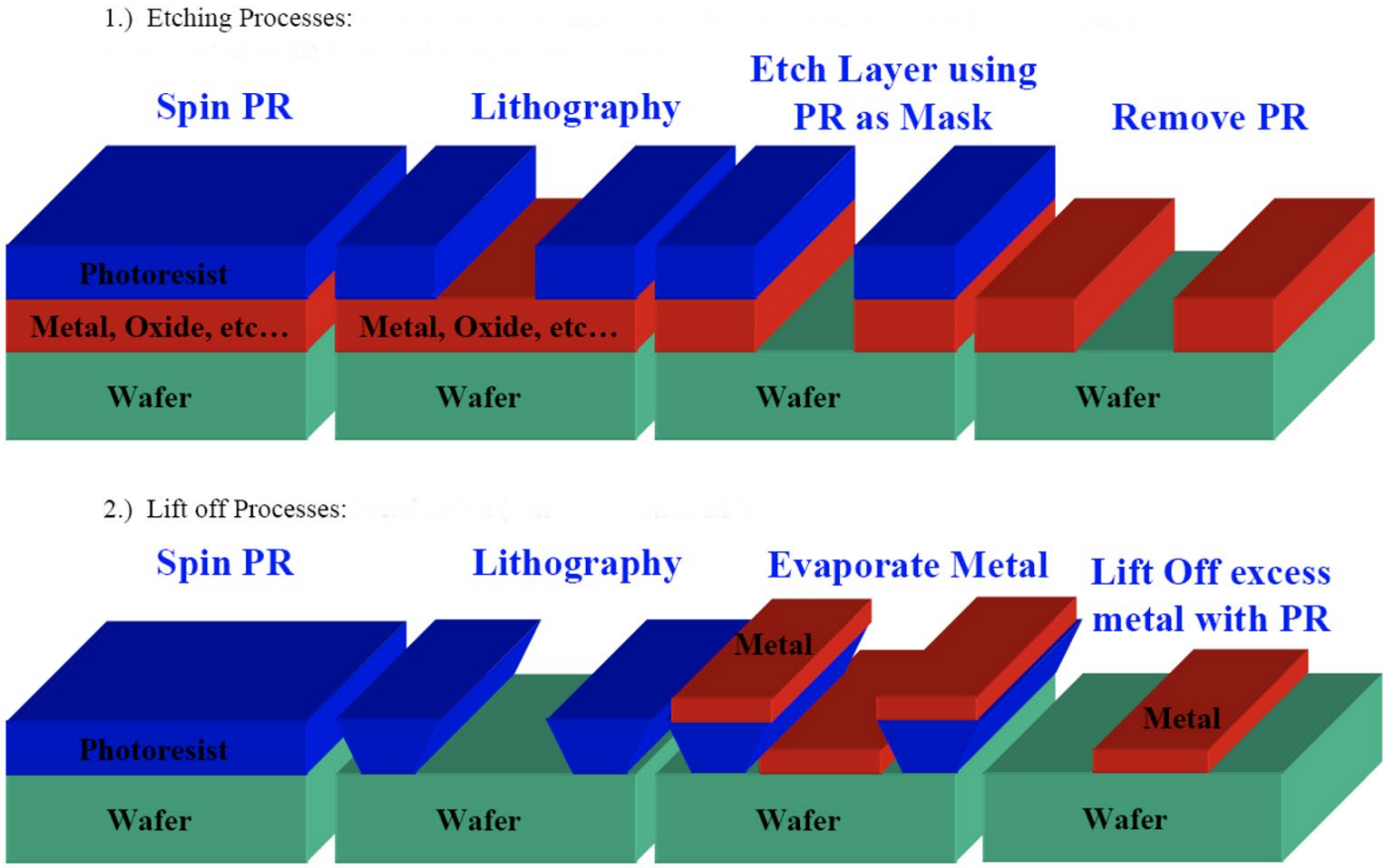
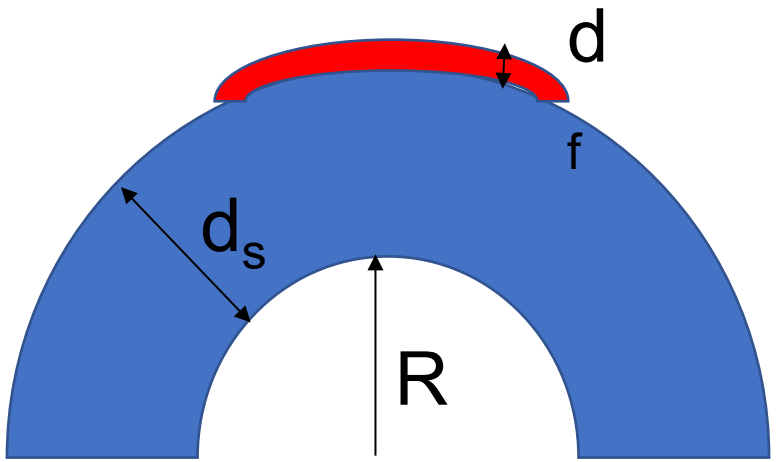
Photolithography



Etching vs Lift-Off



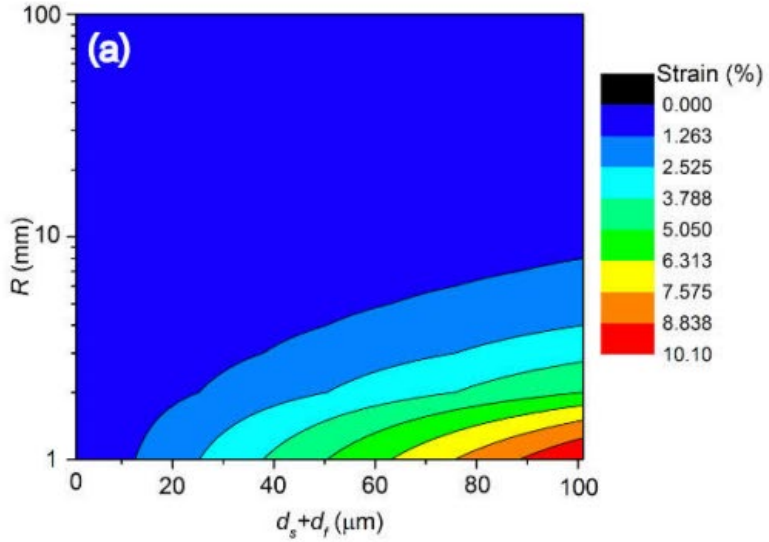
Bending of plastic foils

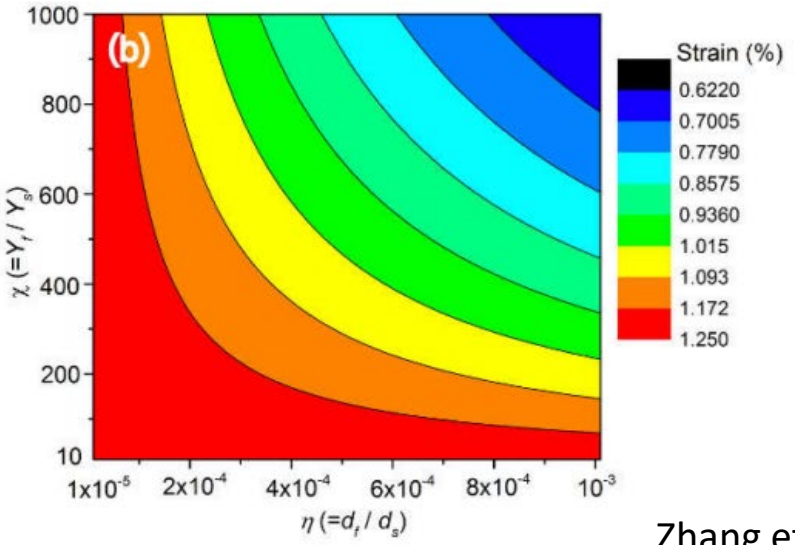


$$\varepsilon = \frac{d_s + d_f}{2R}$$

For thin films $d_s >> d_f$

$$\varepsilon = \frac{d_s}{2R}$$

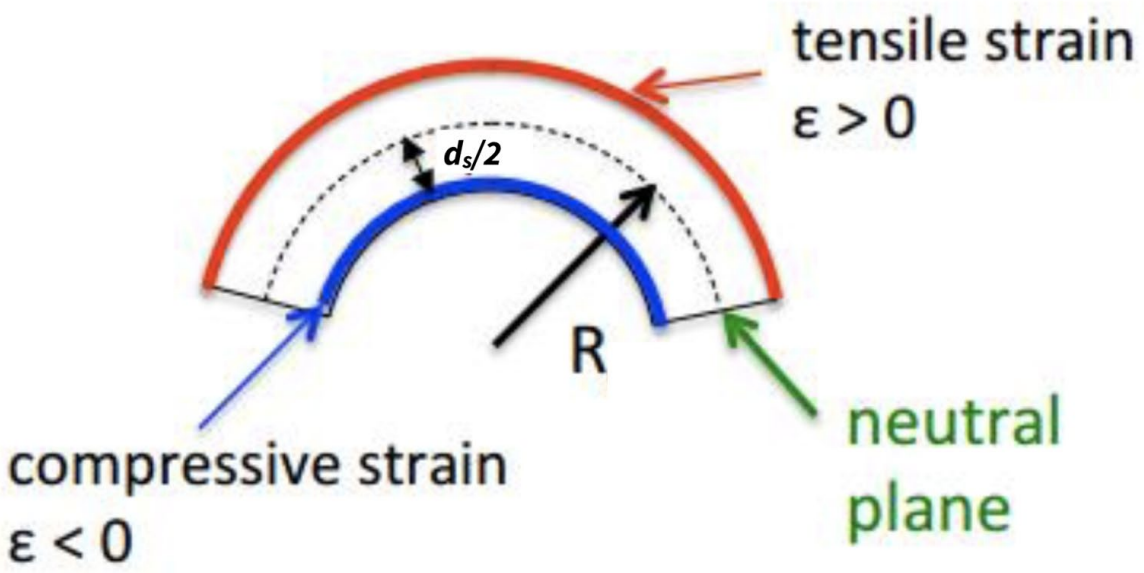


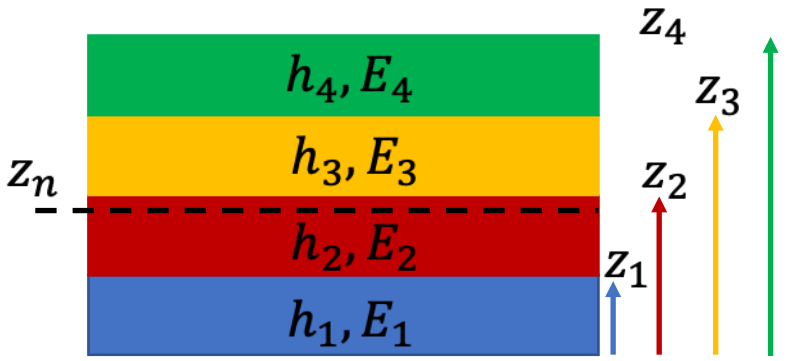


Y_f = film Young's modulus
Y_s = substrate Young's modulus
d_f = film thickness
d_s = substrate thickness

Zhang et al. 2017
DOI: 10.1088/1674-1056/26/4/047307

Neutral plane and bending in multilayers





$$\varepsilon_i = \frac{z_i - z_n}{R}$$

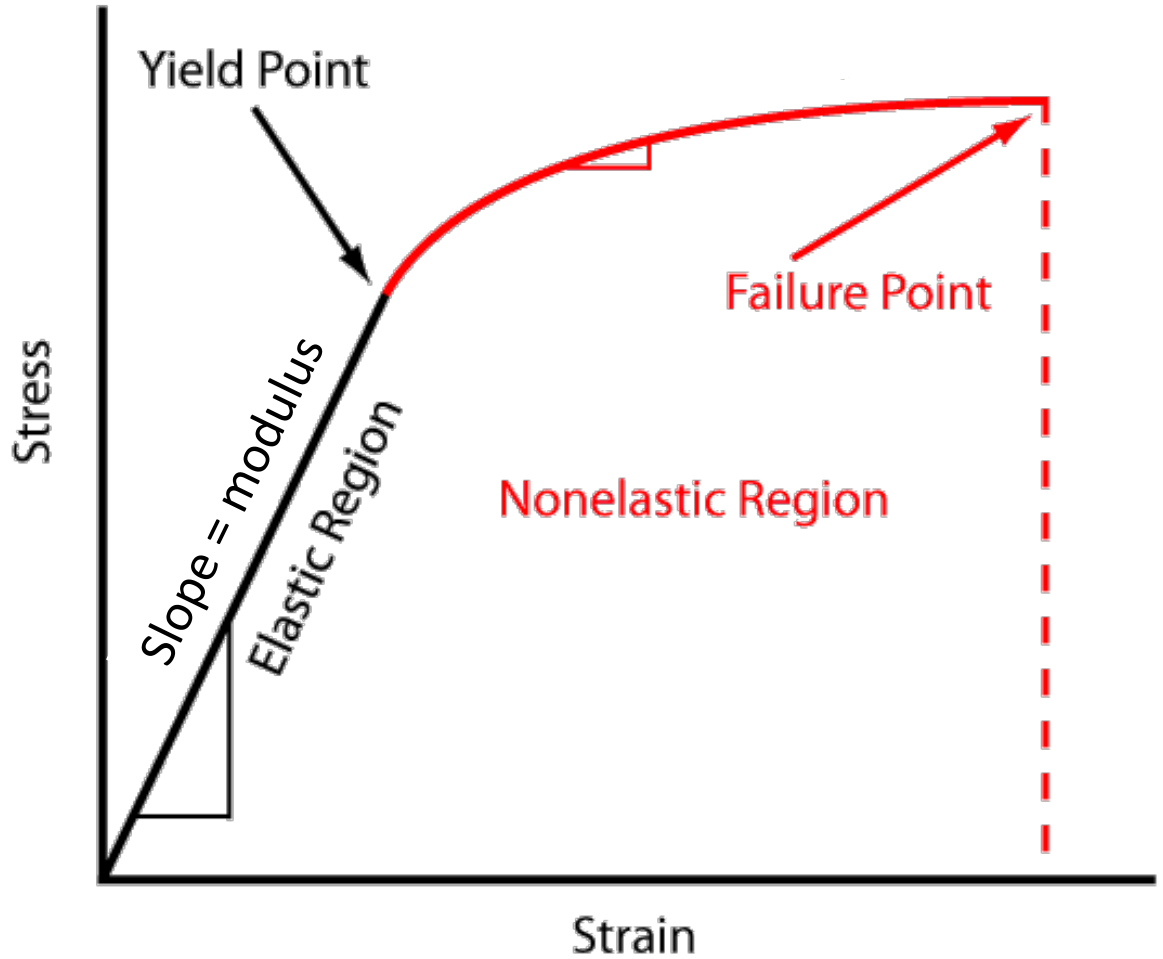
$$\sigma_i = E_i \varepsilon_i$$

$$z_n = \frac{\sum_{i=1}^{N} \bar{E}_i h_i \bar{z}_i}{\sum_{i=1}^{N} \bar{E}_i h_i}$$

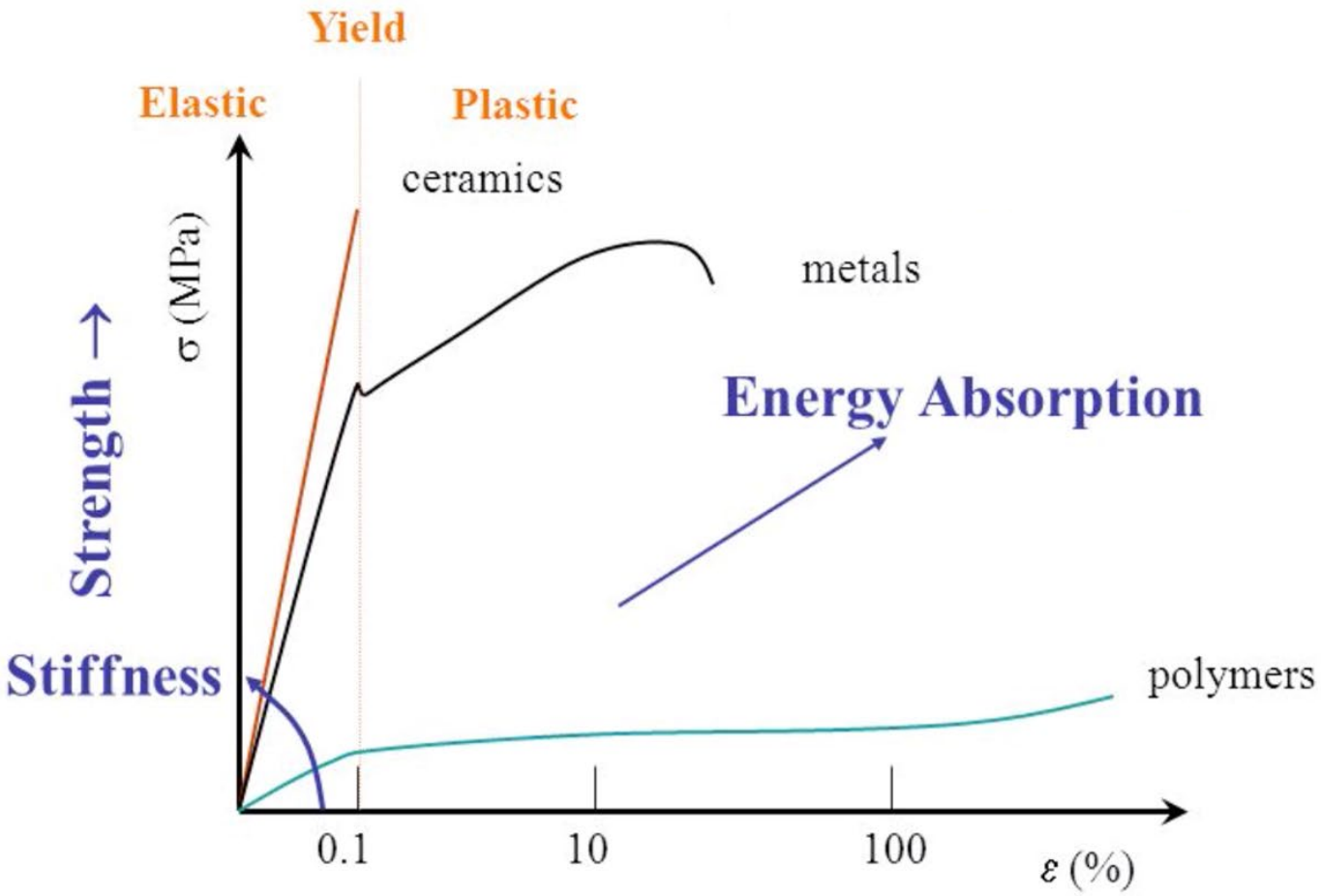
$$\bar{E}_i = \frac{E_i}{(1-\nu^2)}$$

E_i = Young's modulus
h_i = layer thickness
ν_i= Poisson ratio
$\bar{E}$ = plane-strain modulus
$\bar{z}_i$ = position of middle of layer I
z_i= position of top of layer i
ε_i = strain in layer i
σ_i= stress in layer i

Tensile test on materials



Tensile test on materials



Slope:

Stiff ⟷ Soft

Ultimate strength:

Strong ⟷ Weak

Plastic deformation:

Brittle ⟷ Ductile