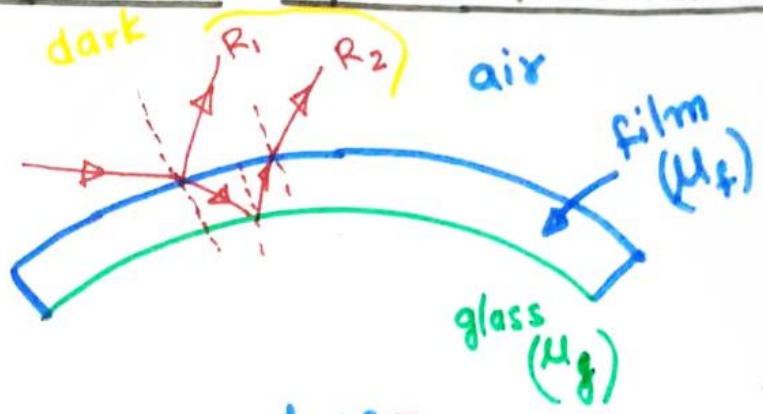
Antireflection Coating or antireflection films

(A) Phase condition : Expression for thickness



air - film - glass [rarer - denser — more denser]

$\mu_a < \mu_f < \mu_g$

∴ for reflected system

$\delta = 2\mu t \cos r \left(\pm \frac{\lambda}{2}\right)$? → No

$\delta = 2\mu_f t_f \cos r$ → (1)

$\delta = (2n \pm 1)\frac{\lambda}{2}$ → (2)

∴ from (1) and (2)

$2\mu_f t_f \cos r = (2n \pm 1)\frac{\lambda}{2}$

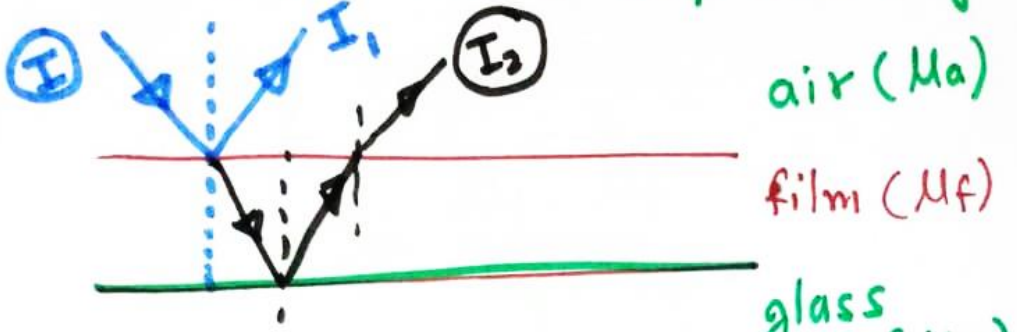
$$t_f = \frac{(2n \pm 1)\lambda}{4\mu_f \cos r}$$

for normal incidence $r = 0$, min order $(2n \pm 1) = 1$

$$t_f = \frac{\lambda}{4\mu_f}$$

(β) Amplitude condition

Relation between μ_f and μ_g



$I \rightarrow \mu_a \rightarrow \mu_f \rightarrow I_1$

$$I_1 = I\left(\frac{\mu_f - \mu_a}{\mu_f + \mu_a}\right)^2 \longrightarrow (1)$$

$I \rightarrow \mu_f \rightarrow \mu_g \rightarrow I_2$

$$I_2 = I\left(\frac{\mu_g - \mu_f}{\mu_g + \mu_f}\right)^2 \longrightarrow (2)$$

for interference $I_1 = I_2 \longrightarrow (3)$

from (1), (2) and (3)

$$I\left(\frac{\mu_f - \mu_a}{\mu_f + \mu_a}\right)^2 = I\left(\frac{\mu_g - \mu_f}{\mu_g + \mu_f}\right)^2$$

$$\left(\frac{\mu_f - 1}{\mu_f + 1}\right)^2 = \left(\frac{\mu_g - \mu_f}{\mu_g + \mu_f}\right)^2$$

Taking square root

$$\frac{\mu_f - 1}{\mu_f + 1} = \frac{\mu_g - \mu_f}{\mu_g + \mu_f}$$

$$\cancel{(\mu_f)(\mu_g)} - (\mu_g) + (\mu_f)^2 = \cancel{(\mu_f)(\mu_g)} + (\mu_g)$$

$$\cancel{-(\mu_f)} \qquad -(\mu_f)^2 - \cancel{(\mu_f)}$$

$$-(\mu_g) + (\mu_f)^2 = (\mu_g) - (\mu_f)^2$$

$$2\mu_f^2 = 2\mu_g$$

$$\mu_f^2 = \mu_g$$

$$\boxed{\mu_f = \sqrt{\mu_g}}$$