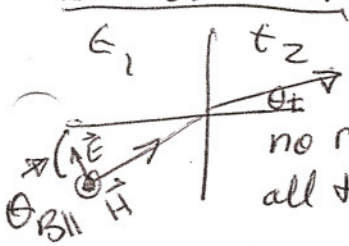
Brewster Angle – Parallel Polarization – non-mag. materials

Linear

$\mu_1 = \mu_2 = \mu_0$



no reflection
all transmission

$$\Gamma_{\parallel} = \frac{\eta_2 \cos\theta_t - \eta_1 \cos\theta_i}{\eta_2 \cos\theta_t + \eta_1 \cos\theta_i}$$

$\theta_i \to \theta_{B\parallel}$ when $\Gamma_{\parallel} = 0$

$$0 = \eta_2 \cos\theta_t - \eta_1 \cos\theta_{B\parallel}, \quad \eta_2 = \sqrt{\frac{\mu_0}{\epsilon_2}}, \ \eta_1 = \sqrt{\frac{\mu_0}{\epsilon_1}}$$

EEL 3473
Chapter 8 Extra handout

$$\frac{1}{\sqrt{\epsilon_2}} \cos\theta_t = \frac{1}{\sqrt{\epsilon_1}} \cos\theta_{B\parallel}$$

$$\frac{\cos^2\theta_t}{\epsilon_2} = \frac{\cos^2\theta_{B\parallel}}{\epsilon_1}$$

$$\frac{1}{\epsilon_2}(1 - \sin^2\theta_t) = \frac{1}{\epsilon_1}(1 - \sin^2\theta_{B\parallel})$$

Snells' Law $\sqrt{\epsilon_1}\sin\theta_{B\parallel} = \sqrt{\epsilon_2}\sin\theta_t$

$\epsilon_1 \sin^2\theta_{B\parallel} = \epsilon_2 \sin^2\theta_t$

$$\frac{1}{\epsilon_2}\left(1 - \frac{\epsilon_1}{\epsilon_2}\sin^2\theta_{B\parallel}\right) = \frac{1}{\epsilon_1}(1 - \sin^2\theta_{B\parallel})$$

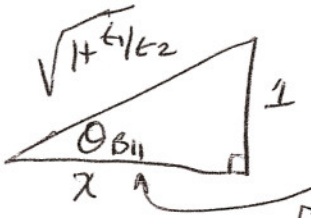
multiply $\times \epsilon_1$:

$$\frac{\epsilon_1}{\epsilon_2} - \frac{\epsilon_1^2}{\epsilon_2^2}\sin^2\theta_{B\parallel} = 1 - \sin^2\theta_{B\parallel}$$

$$\sin^2\theta_{B\parallel}\left(1 - \frac{\epsilon_1^2}{\epsilon_2^2}\right) = 1 - \epsilon_1/\epsilon_2$$

$$\sin^2\theta_{B\parallel} = \frac{1 - \epsilon_1/\epsilon_2}{1 - \frac{\epsilon_1^2}{\epsilon_2^2}} = \frac{(1 - \epsilon_1/\epsilon_2)}{(1 - \epsilon_1/\epsilon_2)(1 + \epsilon_1/\epsilon_2)}$$

$$\sin^2\theta_{B\parallel} = \frac{1}{1 + \epsilon_1/\epsilon_2}, \quad \sin\theta_{B\parallel} = \frac{1}{\sqrt{1 + \epsilon_1/\epsilon_2}}$$



found from this side is: $x^2 + 1^2 = 1 + \epsilon_1/\epsilon_2$

$x = \sqrt{\epsilon_1/\epsilon_2}$

$$\tan\theta_{B\parallel} = \sqrt{\epsilon_2/\epsilon_1}$$

find θ_t from $\sqrt{\epsilon_1}\sin\theta_{B\parallel} = \sqrt{\epsilon_2}\sin\theta_t$