水平極化

$$\tilde{E}_{or} = \frac{\alpha-\beta}{\alpha+\beta}\tilde{E}_{oi}$$

$$\tilde{E}_{ot} = \frac{2}{\alpha+\beta}\tilde{E}_{oi}$$

$$\alpha = \frac{\cos\theta_t}{\cos\theta_i}$$

$$\beta = \frac{\mu_1}{\mu_2}\frac{v_1}{v_2} = \frac{\sqrt{\mu_1}}{\sqrt{\mu_2}}\frac{\sqrt{\mu_2\epsilon_2}}{\sqrt{\mu_1\epsilon_1}} = \frac{\eta_1}{\eta_2}$$

for non-magnetic, $\mu_1 = \mu_2 = \mu_0$

$$\beta = \frac{v_1}{v_2} = \frac{n_2}{n_1}$$

$$\frac{\tilde{E}_{or}}{\tilde{E}_{oi}} = \frac{\frac{\cos\theta_t}{\cos\theta_i} - \frac{\eta_1}{\eta_2}}{\frac{\cos\theta_t}{\cos\theta_i} + \frac{\eta_1}{\eta_2}} = \frac{\eta_2\cos\theta_t - \eta_1\cos\theta_i}{\eta_2\cos\theta_t + \eta_1\cos\theta_i} = \frac{n_1\cos\theta_t - n_2\cos\theta_i}{n_1\cos\theta_t - n_2\cos\theta_i}$$

$$\frac{\tilde{E}_{ot}}{\tilde{E}_{oi}} = \frac{2}{\frac{\cos\theta_t}{\cos\theta_i} + \frac{\eta_1}{\eta_2}} = \frac{2\eta_2\cos\theta_i}{\eta_2\cos\theta_t + \eta_1\cos\theta_i} = \frac{2n_1\cos\theta_i}{n_1\cos\theta_t + n_2\cos\theta_i}$$

$$I_I = \frac{1}{2}\epsilon_1 v_1 E_{oi}^2\cos\theta_i$$

$$I_R = \frac{1}{2}\epsilon_1 v_1 E_{or}^2\cos\theta_r$$

$$I_T = \frac{1}{2}\epsilon_2 v_2 E_{ot}^2\cos\theta_t$$

$$R = \frac{I_R}{I_I} = \frac{E_{or}^2}{E_{oi}^2} = \frac{\alpha^2-2\alpha\beta+\beta^2}{(\alpha+\beta)^2}$$

$$T = \frac{I_T}{I_I} = \frac{\epsilon_2 v_2\cos\theta_t}{\epsilon_1 v_1\cos\theta_i}\frac{E_{ot}^2}{E_{oi}^2}$$

$$= \frac{\sqrt{\epsilon_2}}{\sqrt{\epsilon_1}}\frac{\sqrt{\epsilon_1/\mu_1}}{\sqrt{\epsilon_2/\mu_2}}\alpha\frac{E_{ot}^2}{E_{oi}^2} = \alpha\beta\frac{E_{ot}^2}{E_{oi}^2}$$

$$= \frac{4\alpha\beta}{(\alpha+\beta)^2}$$

$$I = \vec{S}_{av}\cdot\hat{z}$$

$$\vec{S}_{av} = \frac{1}{2}\epsilon_1 v_1 E_{oi}^2\hat{k}_i$$

$$R+T = \frac{\alpha^2+2\alpha\beta+\beta^2}{(\alpha+\beta)^2} = 1$$

垂直極化

$$\tilde{E}_{or} = \frac{1-\alpha\beta}{1+\alpha\beta}\tilde{E}_{oi}$$

$$\tilde{E}_{ot} = \frac{2}{1+\alpha\beta}\tilde{E}_{oi}$$

$$\frac{\tilde{E}_{or}}{\tilde{E}_{oi}} = \frac{1-\frac{\cos\theta_t}{\cos\theta_i}\times\frac{\eta_1}{\eta_2}}{1+\frac{\cos\theta_t}{\cos\theta_i}\times\frac{\eta_1}{\eta_2}} = \frac{\eta_2/\cos\theta_t - \eta_1/\cos\theta_i}{\eta_2/\cos\theta_t + \eta_1/\cos\theta_i} = \frac{n_1\cos\theta_i - n_2\cos\theta_t}{n_1\cos\theta_i + n_2\cos\theta_t}$$

$$\frac{\tilde{E}_{ot}}{\tilde{E}_{oi}} = \frac{2}{1+\frac{\cos\theta_t}{\cos\theta_i}\times\frac{\eta_1}{\eta_2}} = \frac{2\left(\eta_2/\cos\theta_t\right)}{\eta_2/\cos\theta_t + \eta_1/\cos\theta_i} = \frac{2n_1\cos\theta_i}{n_1\cos\theta_i + n_2\cos\theta_t}$$

$$R = \left(\frac{\tilde{E}_{or}}{\tilde{E}_{oi}}\right)^2 = \frac{1-2\alpha\beta+\alpha^2\beta^2}{1+2\alpha\beta+\alpha^2\beta^2}$$

$$T = \alpha\beta\left(\frac{\tilde{E}_{ot}}{\tilde{E}_{oi}}\right)^2 = \frac{4\alpha\beta}{1+2\alpha\beta+\alpha^2\beta^2}$$

$$R+T = 1$$