P4.1

假设波的频率为 ω

$$\varepsilon_c = \overline{\overline{\varepsilon}} + i\frac{\overline{\overline{\sigma}}}{\omega} = \begin{bmatrix} \varepsilon+i\frac{\sigma}{\omega} & 0 & 0 \\ 0 & \varepsilon+i\frac{\sigma}{\omega} & 0 \\ 0 & 0 & \varepsilon_z+i\frac{\sigma_z}{\omega} \end{bmatrix}$$

$\because k^2 = \omega^2\mu\varepsilon$

$\therefore$ ~~$k^2=\omega^2$~~ $\therefore$ 在x和y方向，$k_1^2 = \omega^2(\varepsilon+i\frac{\sigma}{\omega})\mu_0$

在z方向，$k_2^2 = \omega^2(\varepsilon_z+i\frac{\sigma_z}{\omega})\mu_0$

$k_z = \omega\sqrt{\mu_0\varepsilon_z}\sqrt{1+i\frac{\sigma_z}{\omega\varepsilon_z}}$

当 $\frac{\sigma_z}{\omega\varepsilon_z}>>1$ 时，z方向的偏振会极大地衰减，只留下y方向的偏振，所以起到偏振效果.

P4.2

(1) ① $\because$ $\vec{E_i}$ 是圆偏振

$\therefore$ $\alpha=1$

又 $\because$ $\vec{E_i}$ 是左旋偏振

$\therefore$ $\varphi=\frac{\pi}{2}$

(2)

在x方向上，$\varepsilon_x=4\varepsilon_0$，$\mu_x=\mu_0$

$\therefore$ $k_{y_x} = \omega\sqrt{\varepsilon_x\mu_x} = 2\omega\sqrt{\mu_0\varepsilon_0} = 2k_0$

(3) $k_{y_z} = \omega\sqrt{\varepsilon_z\mu_z} = 3\omega\sqrt{\mu_0\varepsilon_0} = 3k_0$

$\therefore$ $(k_{y_z}-k_{y_x})d = \pi+2n\pi$ $\therefore$ $d=(\frac{1}{2}+n)\lambda_0$

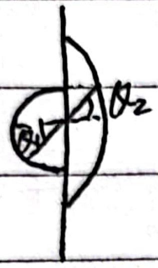
$\therefore$ $d_{min} = \frac{1}{2}\lambda_0$

P2.1

$\vec{S} = \vec{E} \times \vec{H}$

对于o光，$\vec{S}$与$\vec{k}$同方向

对于e光，



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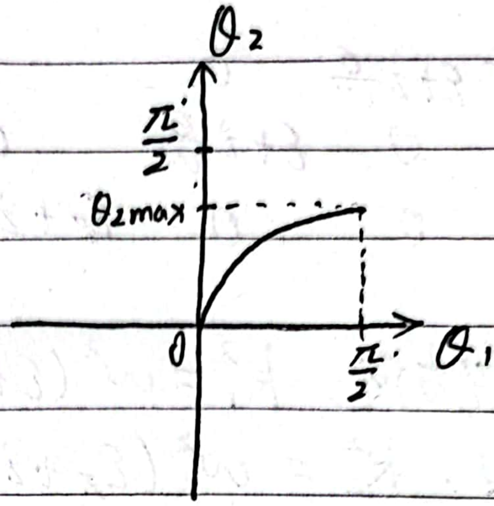

P2.2

(1) $\hat{z}$不能为ω方向：假设$\hat{z}$与ω同向，由于d足够厚，且$\varepsilon_{z} = \varepsilon_z + i$

则$\vec{E}$会衰减，无透射波

∴ $\hat{z}$只能沿u/v方向，在该方向的偏振会衰减，导致透射波为另一方的线偏

(2)

$$k_z = \omega\sqrt{\mu_0\varepsilon_z}\cdot\sqrt{1+i\frac{\sigma_z}{\omega\varepsilon_z}} = 2\omega\sqrt{\mu_0\varepsilon_0}\cdot\sqrt{1+i\frac{0.2\varepsilon_0\omega}{4\varepsilon_0\omega}}$$

$$= 2\omega\sqrt{\mu_0\varepsilon_0}\cdot\sqrt{1+0.05i}$$

$$\therefore k_I \approx 2\omega\sqrt{\mu_0\varepsilon_0}\cdot\frac{1}{2}\cdot 0.05 = 0.05\,\omega\sqrt{\mu_0\varepsilon_0} = \frac{0.1\pi}{\lambda}$$

$$\therefore d_p = \frac{1}{k_I} = \frac{20}{\omega\sqrt{\mu_0\varepsilon_0}} \approx 3.18\lambda$$

(3) $\hat{z}$应沿着ω的方向，x, y方向无所谓

由于入射光线偏，则可令 $\vec{E}_{in} = \hat{x}E_0\cos(k_0 z - \omega t) + \hat{y}E_0\cos(k_0 z - \omega t)$

$\because k_x = \omega\sqrt{\mu_x\varepsilon_x} = 2\sqrt{3}k_0$，$k_y = \omega\sqrt{\mu_y\varepsilon_y} = k_0$

$\therefore (2\sqrt{3}k_0 - k_0)d = \frac{\pi}{2} + 2n\pi$ $\quad\therefore d_{min} = \frac{\lambda}{4(2\sqrt{3}-1)}$

此时在$z=d$处，圆偏振为左旋

P3.2

$n_e = 1.49 \quad n_o = 1.66$

$\therefore \ n_o > n > n_e$

对于o光: $\sin 19° = n_o \sin\theta_1 \quad \therefore \theta_1 \approx 11°$

在树脂面~~至方解石~~面的入射: $\theta_2 = 360° - \theta_1 - 161° - 30.5° = 67.5°$

而全反射角: $n_o \sin\theta_c = n \sin 90° \quad \therefore \theta_c \approx 67°$

$\therefore \theta_2 > \theta_c$

∴ o光会在树脂面发生全反射

而因为 $n > n_e$ ∴ e光会正常通过树脂面

∴ o光会从下方射出, e光会从右侧射出,起到起偏作用.