Example 5.3.1

Calculate the transmittance, reflectance and absorptance of a single glass cover 1.3mm thick at an angle of 60°. The extinction coefficient of the glass is $32\,m^{-1}$.

Solution

At an incidence angle of 60°, the extinction coefficient optical pathlength product is

$$\frac{KL}{\cos\theta_2} = \frac{32 \times 0.0023}{\cos 34.58} = 0.0894$$

where 34.58 is the refraction angle calculated in $\theta_2 = \sin^{-1}\left(\frac{\sin 60}{1.526}\right)$

The transmittance τ_a from

$$\tau_a = \frac{I_{transmitted}}{I_{incident}} = \exp\underbrace{\left(-\frac{KL}{\cos\theta_2}\right)}_{0.0894}$$

$$\tau_a = \exp(-0.0894) = 0.915$$

The approximate equations can also be used to find these properties.

From $\tau \cong \tau_a \cdot \tau_r$, $\tau_r = \frac{1}{2}\left(\frac{1-r_{\parallel}}{1+r_{\parallel}} + \frac{1-r_{\perp}}{1+r_{\perp}}\right)$

$$\tau = \frac{0.915}{2}\left(\frac{1-0.185}{1+0.185} + \frac{1-0.001}{1+0.001}\right) = 0.771$$

From $\alpha \cong 1 - \tau_a$, the absorptance is

$$\alpha = 1 - 0.915 = 0.085$$