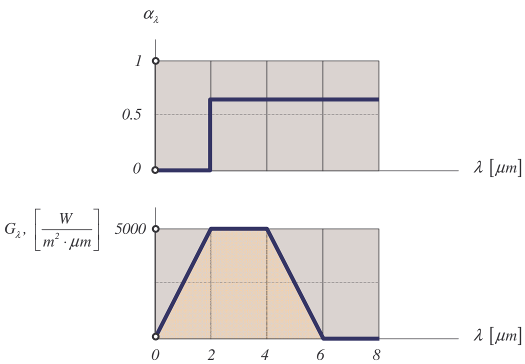
12.50



a

$$G_{\lambda,abs} = \alpha_\lambda \cdot G_\lambda$$

$$G_{abs} = \int_0^\infty G_{\lambda,abs}\, d\lambda = \int_0^\infty \alpha_\lambda G_\lambda d\lambda = \int_0^2 \alpha_\lambda G_\lambda d\lambda + \int_2^4 \alpha_\lambda G_\lambda d\lambda + \int_4^6 \alpha_\lambda G_\lambda d\lambda$$

$$= \int_0^2 (0) G_\lambda d\lambda + \int_2^4 (0.6)(5000)\, d\lambda + \int_4^6 (0.6) G_\lambda d\lambda$$

$$= 0 + (0.6)\cdot(5000)\cdot(2) + (0.6)\cdot\frac{2\cdot 5000}{2} = 9{,}000\ \left[\frac{W}{m^2}\right]$$

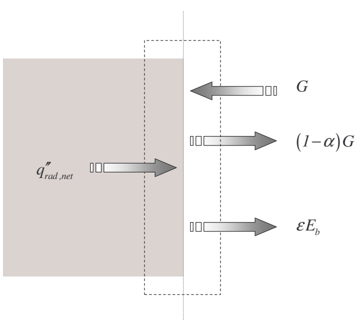
$$G = \int_0^\infty G_\lambda\, d\lambda = \overbrace{\frac{2\cdot 5000}{2} + 2\cdot 5000 + \frac{2\cdot 5000}{2}}^{\text{area under curve}} = 20{,}000\ \left[\frac{W}{m^2}\right]$$

$$\alpha = \frac{G_{abs}}{G} = \frac{9{,}000}{20{,}000} = 0.45$$

b

$$T_s = 1000K$$

$$\varepsilon = \alpha_2 \cdot \left[1 - F_{0\to 2}(T_s)\right] = (0.6)\cdot(1-0.0667) = 0.56$$



c

$$q''_{rad,net} = \varepsilon E_b + (1-\alpha)G - G = \varepsilon E_b - \alpha G$$

$$= (0.56)(5.67e-8)(1000)^4 - (0.45)(20{,}000) = 22{,}750\ \left[\frac{W}{m^2}\right]$$

from the surface