1 Lámina de material polar de espesor d sobre un sustrato metálico infinito

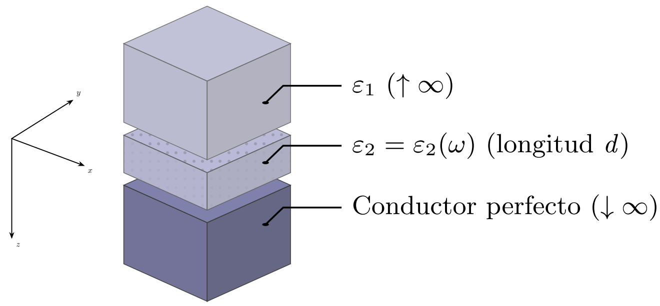

Figure 1: Lámina polar (medio 2) de espesor d sobre metal perfecto; superstrate ϵ_1.

Descripción. L´amina de material polar de espesor d sobre un sustrato met´alico infinito, que supondremos que se comporta como un conductor perfecto. Estudiar el caso l´ımite d → .

Ecuación característica . Ecuación dada:

$$-\epsilon_1 + \epsilon_{\infty,2}\frac{\omega_{L2}^2 - \omega^2}{\omega_{T2}^2 - \omega^2} \; + \; e^{2dk_x}\left(\epsilon_1 + \epsilon_{\infty,2}\frac{\omega_{L2}^2 - \omega^2}{\omega_{T2}^2 - \omega^2}\right) = 0.$$

$$\Longrightarrow \quad \boxed{\epsilon_2(\omega) = -\,\epsilon_1 \,\tanh\!\Big(\frac{dk_x}{2}\Big)}.$$

Relación de dispersión Sea $t := \tanh\!\big(\frac{dk_x}{2}\big)$. Resolver $\epsilon_{\infty,2}\frac{\omega_{L2}^2-\omega^2}{\omega_{T2}^2-\omega^2} = -\epsilon_1 t$ para $u = \omega^2$ da

$$\boxed{\omega^2(k_x)_{Polar-d} = \frac{\epsilon_{\infty,2}\,\omega_{L2}^2 + \epsilon_1\,t\,\omega_{T2}^2}{\epsilon_{\infty,2} + \epsilon_1\,t}\,, \qquad t = \tanh\!\Big(\frac{dk_x}{2}\Big).} \tag{1}$$

O bien de forma que nos será más útil en el futuro:

$$\boxed{\omega^2(k_x)_{Polar-d} = \frac{\epsilon_{\infty,2}\,\omega_{L2}^2 C + \epsilon_1\;\omega_{T2}^2}{\epsilon_{\infty,2}C + \epsilon_1}\,, \qquad C = \coth\!\Big(\frac{dk_x}{2}\Big).} \tag{2}$$

Definición y uso de la frecuencia de interfase. Definimos la frecuencia de interfase (límite $t \to 1$, i.e., $k_x \to \infty$ o $d \to \infty$):

$$\boxed{\omega^2_{(2|1)} := \frac{\epsilon_{\infty,2}\,\omega^2_{L2} + \epsilon_1\,\omega^2_{T2}}{\epsilon_{\infty,2} + \epsilon_1}} \tag{3}$$

Límites $k_x \to 0$ ($t \to 0$):

$$\omega^2(k_x)_{Polar-d} \;\to\; \frac{\epsilon_{\infty,2}\,\omega^2_{L2}}{\epsilon_{\infty,2}} = \omega^2_{L2} \quad \Rightarrow \quad \boxed{\omega(k_x)_{Polar-d} \to \omega_{L2}}.$$

$k_x \to \infty$ ($t \to 1$):

$$\omega^2(k_x)_{Polar-d} \;\to\; \omega^2_{(2|1)} \quad \Rightarrow \quad \boxed{\omega(k_x)_{Polar-d} \to \omega_{(2|1)}}.$$

$d \to \infty$ (a k_x fijo): $t \to 1$ y de nuevo $\omega \to \omega_{(2|1)}$.

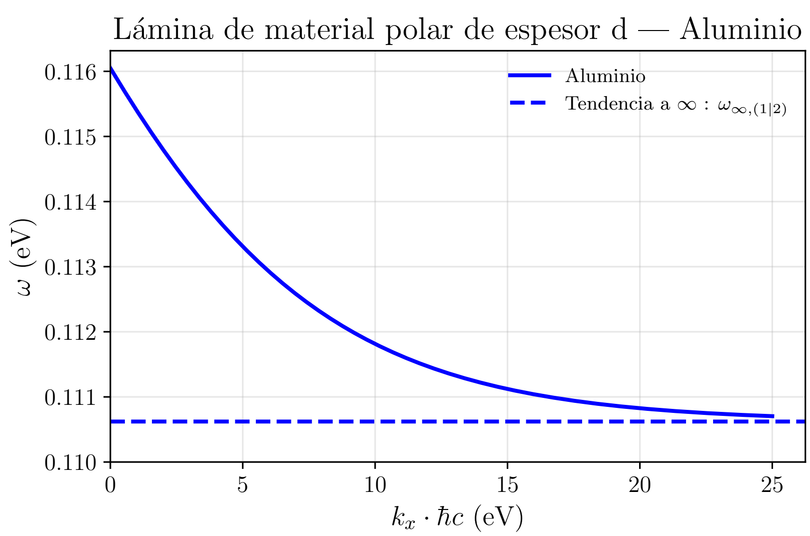

Figure 2: Aluminio

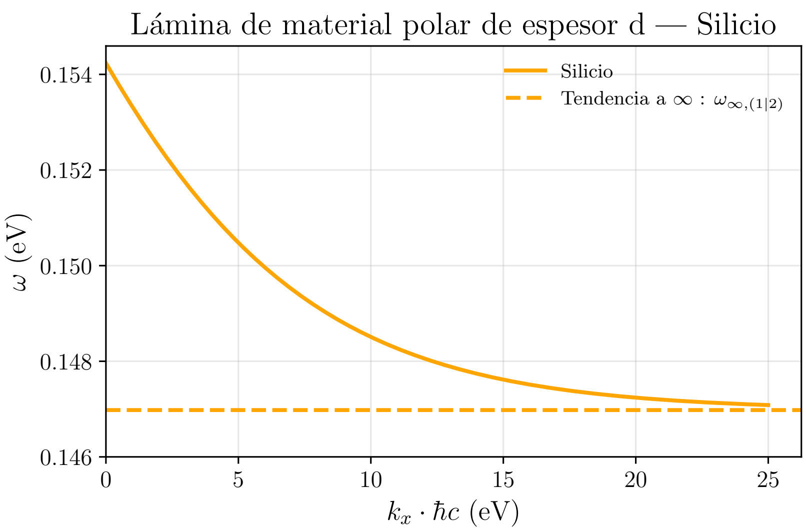

Figure 3: Silicio