

7.12 This problem calls for us to determine whether or not a metal single crystal having a specific orientation and of given critical resolved shear stress will yield. We are given that $\phi = 60^\circ$, $\lambda = 35^\circ$, and that the values of the critical resolved shear stress and applied tensile stress are 6.2 MPa (900 psi) and 12 MPa (1750 psi), respectively. From Equation 7.2

$$\tau_R = \sigma \cos \phi \cos \lambda = (12 \text{ MPa})(\cos 60^\circ)(\cos 35^\circ) = 4.91 \text{ MPa} \quad (717 \text{ psi})$$

Since the resolved shear stress (4.91 MPa) is less than the critical resolved shear stress (6.2 MPa), the single crystal will not yield.

However, from Equation 7.4, the stress at which yielding occurs is

$$\sigma_y = \frac{\tau_{\text{crss}}}{\cos \phi \cos \lambda} = \frac{6.2 \text{ MPa}}{(\cos 60^\circ)(\cos 35^\circ)} = 15.1 \text{ MPa} \quad (2200 \text{ psi})$$