Solutions

2.1

- $A = \pi(0.010)^2 = 3.142 \times 10^{-4}$ m^2; $\sigma = 40 \times 10^3/(3.142 \times 10^{-4}) =$ **127.3** MPa.
- $\delta = PL/(AE) = 80\,000/(6.283 \times 10^7) =$ **1.27** mm.

2.2

- $\varepsilon = \sigma/E =$ **0.000637**.
- $\varepsilon_{lat} = 0.30 \times 0.000637 =$ **0.000191**; $\Delta d = 20 \times 0.000191 =$ **3.82** μm thinning.

2.3

- $\sigma_T = E\alpha\Delta T = 200 \times 10^9 \times 12 \times 10^{-6} \times 50 =$ **120.0** MPa compression.

2.4

- Free expansion just lengthens the rod - no internal force, so no stress.
- Held ends block the expansion; the constraint supplies the reaction force, and force over area is stress.

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