

7.29 We are given the original and deformed cross-sectional dimensions for two specimens of the same metal, and are then asked to determine which is the hardest after deformation. The hardest specimen will be the one that has experienced the greatest degree of cold work. Therefore, all we need do is to compute the %CW for each specimen using Equation 7.8. For the circular one

$$\begin{aligned}\%CW &= \left[\frac{A_0 - A_d}{A_0} \right] \times 100 \\ &= \left[\frac{\pi r_0^2 - \pi r_d^2}{\pi r_0^2} \right] \times 100 \\ &= \left[\frac{\pi \left(\frac{18.0 \text{ mm}}{2} \right)^2 - \pi \left(\frac{15.9 \text{ mm}}{2} \right)^2}{\pi \left(\frac{18.0 \text{ mm}}{2} \right)^2} \right] \times 100 = 22.0\%CW\end{aligned}$$

For the rectangular one

$$\%CW = \left[\frac{(20 \text{ mm})(50 \text{ mm}) - (13.7 \text{ mm})(55.1 \text{ mm})}{(20 \text{ mm})(50 \text{ mm})} \right] \times 100 = 24.5\%CW$$

Therefore, the deformed rectangular specimen will be harder.