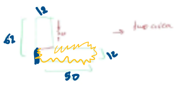
questions

Wednesday, May 1, 2024 9:53 PM

17.29 An L-shaped structural section is direct extruded from an aluminum billet in which initial $L = 500$ mm and initial $D = 100$ mm. Dimensions of the cross section are given in Figure P19.29. Die angle = 90°. Determine (a) extrusion ratio, (b) shape factor, and (c) length of the extruded section if the butt remaining in the container at the end of the ram stroke is 25 mm.

$L = 500\,mm \quad D_o = 100\,mm$

$\alpha = 90^\circ$



a) $r_x = \dfrac{A_o}{A_f}$ (A_o → لما كانت اسطوانة ; A_f → L لما صارت)

$A_o = \frac{\pi}{4} \times 100^2 = 7854\,mm^2.$

$A_f = 12 \times 50 + 50 \times 12 = 1200\,mm^2$

$r_x = \frac{7854}{1200} = 6.545$

b) $K_x = 0.98 + 0.02 \times \left(\frac{C_x}{C_c}\right)^{2.25}$

(C_x → محيط الشكل الطالع ; C_c → محيط دائرة بنفس مساحة الشكل.)

$C_x = 2 \times 12 + 50 + (50 - 12) \quad + 50 \times 2 + 12 = 224\,mm$

$C_c = 2\pi \times R = 2\pi \times 19.54 = 122.8\,mm.$

$\pi R^2 = 1200$ (A_f)

$R = 19.54$

$K_x = 0.98 + 0.02\left(\frac{224}{122.8}\right)^{2.25} = 1.057.$

c) $V_{billet} = V_{extruded} + V_{butt}.$

$V = \text{area} \times \text{length}.$

$7853 \times 500 = 1200\,L_x + 7853 \times 25$ (500 = L_o)

$L_x = 3108.48\,mm.$

17.30 The flow curve parameters for the aluminum alloy of Problem 19.29 are: $K = 240$ MPa and $n = 0.16$. If the die angle in this operation = 90°, and the corresponding Johnson strain equation has constants $a = 0.8$ and $b = 1.5$, compute the maximum force required to drive the ram forward at the start of extrusion.

$K = 240\,MPa.$

$n = 0.16. \quad a = 0.8 \quad b = 1.5$

$F = p A_o$

$A_o = 7854\,mm^2.$

$p = K_x \bar{Y}_f \left(\epsilon_x + \frac{2L}{D_o}\right)$

$\varepsilon_x = a + b \ln r_x$

$0.8 + 1.5 \times \ln 6.545 = 3.62.$

$\bar{Y}_f = \frac{K \varepsilon^n}{1+n} = \frac{240 \times 1.88^{0.16}}{1 + 0.16} = 228.89 \text{ MPa}.$

الـ ε العادية مش εx

$\varepsilon = \ln \frac{A_o}{A_f} ; \ln 6.545 = 1.88$

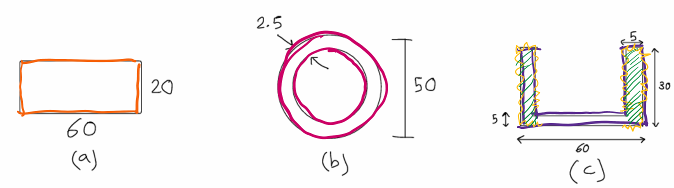
$K_x = 1.057$

$p = 1.057 \times 228.89 \times \left(3.62 + \frac{2 \times 500}{100}\right) = 3295 \text{ MPa}$

$F = 3295 \times 7854 = 25879834.83 \text{ N}.$

Question (19.32) in the book

Determine the shape factor for each of the extrusion die orfice shapes below:-



$C_x = 20 \times 2 + 60 \times 2 = 160$

$C_c = 2\pi R = 2\pi \times 19.55 = 123$

$\pi R^2 = 1200$

$R = 19.55$

$K_x = 0.98 + 0.02 \times \left(\frac{160}{123}\right)^{2.25} = 1.016$

$C_x = \text{outer} + \text{inner}.$

$C_x = 50\pi + 45\pi = 298.45$

$C_c = 2\pi R = 2\pi \times 10.9 = 68.47$

$\pi R^2 = \pi \times 25^2 - \pi \times 22.5^2$

$R = 10.9.$

$K_x = 0.98 + 0.02 \times \left(\frac{298.45}{68.47}\right)^{2.25} = 1.52.$

$C_x = (30 + (30-5) + 5 \times 2) \times 2 +$

$(60 - 10) \times 2 = 230$

$C_c = 2\pi R = 2 \times \pi \times 13.23 = 83.14$

$\pi R^2 = (30 \times 5) \times 2 + 50 \times 5 =$

$R = 13.23$

$K_x = 0.98 + 0.02 \left(\frac{230}{83.14}\right)^{2.25}$

$= 1.17$