Further analysis and extrusion defects

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1.Quiz-Key

1. A certain material with a strength coefficient of 200 MPa and strain hardening exponent of 0.2 is drawn into a wire from an initial diameter of 3 mm to a final diameter of 2mm. The conical die has an angle of 16^{o}. The coefficient of friction for the process can be assumed as 0.05. Calculate the draw force required.

Solution: Given: initial and final dia of the wire, to determine the draw stress.

Strain in the process can be calculated as: $\varepsilon = ln\frac{1}{1-r}$ = 0.916

r = $(A_o-A_f)/A_o$ = 0.6

Average flow stress = k$\frac{\varepsilon^n}{1+n}$= 163.78 MPa

We can use equation 9A to calculate draw stress:

$\sigma_d = \overline{Y}'(1+\frac{\mu}{tan\alpha})\theta \ln(\frac{A_0}{A_f})$

$\theta = 0.88 + 1.2\frac{D}{L_c}$ = 1.713

Average diameter = D = 2.5 mm

Lc = (Do-Df)/2sinα = 3.6 mm

Draw stress = 348.48 MPa

Draw force = Draw stress X Af = 1094 N.

2. What important parameters affect the draw force?

Die angle, reduction, friction, and redundant deformation.

3. What is the maximum reduction that can be obtained in strip drawing?

58%

4. How does the deformation zone geometry affect the draw stress?

As the deformation zone geometry parameter Δ increases – due to larger die angle, the draw stress increases. similarly, for a lower value of die angle, the draw stress is lower due to smaller Δ.