دانشگاه صنعتی اصفهان ، دانشکده مهندسی مواد

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1. Determine the draw stress to produce a 20% reduction in a 10-mm stainless steel wire. The flow stress is given by $\bar{\sigma} = 900\bar{\varepsilon}^{0.3}$ (MPa). The die angle is 12 degree and μ= 0.1. Determine the largest possible reduction.

2. An efficiency of 65% was found in a rod-drawing process with a reduction of 0.2 and a semi-die angle of 6 ◦.
a) Using Sachs' analysis, find the coefficient of friction.
b) Using the value of η found in (a), what value of efficiency should be predicted from the Sachs' analysis for r = 0.4?
c) The actual value of η found for the conditions in (b) was 0.80. Explain why.

3. A material with a true stress-true strain curve of $\bar{\sigma} = 9500\bar{\varepsilon}^{0.5}$ psi is used in wire drawing. Assuming that friction and redundant work comprise a total of 40% of the ideal work of deformation, calculate the maximum reduction in cross-sectional area per unit pass that is possible.

4. A billet of an aluminum alloy is being hot extruded from a 4 inch diameter to a 1 inch diameter in a single stroke. If the yield stress of the metal remains constant at 10 ksi (i.e., no work hardening) during the operation and the process efficiency, η, is 50%.
a. What is the magnitude of the pressure needed to perform the operation?
b. Calculate the lateral pressure felt by the wall of the container.
c. What is the minimum wall thickness, t, needed to prevent yielding of the container walls if the container is made of a metal with yield strength 100 ksi?

5. Plot the force versus reduction in height curve in open die forging of a cylindrical annealed copper specimen 1 in high and 1 in. in diameter, up to a reduction of 75% for the case of:
(a) no friction between the flat dies and the specimen,
(b) μ = 0.2
(c) μ = 0.4.
Ignore barreling. For annealed copper, it is given that for a power law material model
K = 315 MPa=46, 000 psi and n = 0.54.