

Assignment-1  
Fundamentals of Materials Processes

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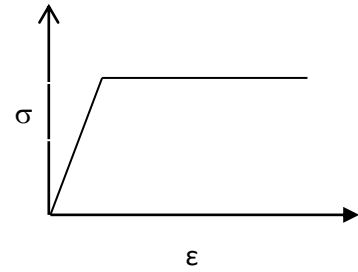
1. A new yield criteria is defined as  $\sigma_1^2 - \sigma_3^2 = C$ . In terms of  $Y$  (uniaxial yield strength),  $C$  is given by
  - a.  $Y$
  - b.  $2Y$
  - c.  $Y^2$
  - d.  $Y^3$
2. Which of the following is true regarding plastic strain and the path through which it has been given the deformation
  - a. **Plastic strain is path dependent**
  - b. Plastic strain is path independent
  - c. It depends on the deformation configuration, whether plastic strain is path dependent
  - d. Nothing can be said about plastic strain with regard to the path of deformation
3. The term  $\sqrt{\frac{1}{2}[(\sigma_1 - \sigma_2) + (\sigma_2 - \sigma_3) + (\sigma_3 - \sigma_1)]}$ , represents
  - a. Effective stress under Tresca criterion
  - b. **Effective stress under Von-Mises criterion**
  - c. Tensile strength of a material
  - d. Yield strength of a material
4. The two relations  $d \bar{\epsilon} = \sqrt{\frac{2}{3}(d \epsilon_1^2 + d \epsilon_2^2 + d \epsilon_3^2)}$  and  $\bar{\epsilon} = \sqrt{\frac{2}{3}(\epsilon_1^2 + \epsilon_2^2 + \epsilon_3^2)}$  are equivalent in Von-Mises criterion under following circumstances
  - a. Only when strains are very small
  - b. Under all conditions
  - c. Only when strains are very large
  - d. **Only when  $d \epsilon_1 : d \epsilon_2 : d \epsilon_3$  is maintained constant throughout the deformation process**
5. In uniaxial tensile test of a sample with rectangular cross-section, if uniform strain along loading direction is  $\epsilon_1$ , then strains along plane of cross-section ( $\epsilon_2, \epsilon_3$ ) are given by
  - a.  $\epsilon_2=0; \epsilon_3=0$
  - b.  **$\epsilon_2=-\epsilon_1/2; \epsilon_3=-\epsilon_1/2$**
  - c.  $\epsilon_2=\epsilon_1/2; \epsilon_3=\epsilon_1/2$
  - d.  $\epsilon_2=\epsilon_1; \epsilon_3=\epsilon_1$

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6. If the stress-strain plot for a material is given as below, which statement is true:

- a. Stress strain behavior is given by  $\sigma = K\varepsilon$
- b. Plastic strain is zero
- c. Elastic strain is zero
- d. **There is no strain hardening in the material**



7. In wire drawing operation, if area reduction ratio ( $= \frac{A_0 - A_f}{A_0}$ ) is given as 0.3, what is Y.S. of the rolled material if its plastic behavior is expressed as  $\bar{\sigma} = 500\bar{\varepsilon}^{0.5}$
- a. 500 MPa
  - b. 250 MPa
  - c. **299 MPa**
  - d. 200 MPa
8. Which of the following is NOT true regarding power law behavior ( $\sigma = K\varepsilon^n$ )
- a. **Describes flow stress behavior for all strains**
  - b. Describes flow stress behavior only until UTS
  - c. Describes flow stress behavior beyond a certain minimum strain
  - d. Flow stress increases with increasing strain
9. A material has yield strength of 420 MPa at a strain rate of  $10^{-3} \text{ s}^{-1}$ . If material behavior is given by  $\sigma = C\dot{\varepsilon}^m$ , where  $m=0.01$ . Find yield strength if the same material was given same strain at a strain rate of  $10^4 \text{ s}^{-1}$
- a. **493 MPa**
  - b. 420 MPa
  - c. 220 MPa
  - d. 100 MPa
10. Which of the following is NOT true regarding Zener Hollomon parameter
- a. Combines effect of strain-rate  $\dot{\varepsilon}$  and Temperature T.
  - b.  $\ln(\dot{\varepsilon})$  versus  $1/T$  is a straight line
  - c. If different combination of  $\dot{\varepsilon}$  and T give same Z, then these will also produce same flow stress.
  - d.  **$Z = \dot{\varepsilon}\exp(-Q/RT)$**