Forming

Module -1: Fundamental concepts relevant to metal forming technology

Lecture -4: Mechanical behavior of crystalline materials-2

Quiz - Answers

1. What is the need for plane strain compression test?

It is used for determination of flow stress of thin sections like sheets.

2. During compression test on a cylinder of initial height of 50 mm, the final height obtained is 25 mm. During the process, the speed of the compressing platens is 100 mm/s. Calculate the initial and final strain rate of deformation of the material.

We know that strain rate = velocity of platen / height.

Initial strain rate = 100/50 = 2 s^{-1}

Final strain rate = 100/25 = 4s^{-1}

As seen from the result, the strain rate increases as the test specimen gets compressed more and more. In order to keep strain rates constant, the velocity of cross-head has to be reduced, This is done using cam plastometer.

3. What is ductile to brittle transition?

Normal ductile materials loose their ductility as temperature is reduced. This is called ductile to brittle transition.

4. A metal has the strain hardening exponent of 0.3, strength coefficient of 700 MPa. This material, when subjected to uniaxial tensile test, it underwent elongation from initial gage length of 100 mm to 140 mm. Calculate the material's flow stress at final length and also its average flow stress.

Flow stress is given by the expression:

$$\sigma = k\varepsilon^n$$

Here $\varepsilon = \ln(h_f/h_o) = 0.336$

Therefore flow stress at end of deformation = 784 MPa.

Average flow stress is given by the formula:

$\bar{\sigma} = \frac{k\varepsilon^n}{1+n}$ = 603 MPa.