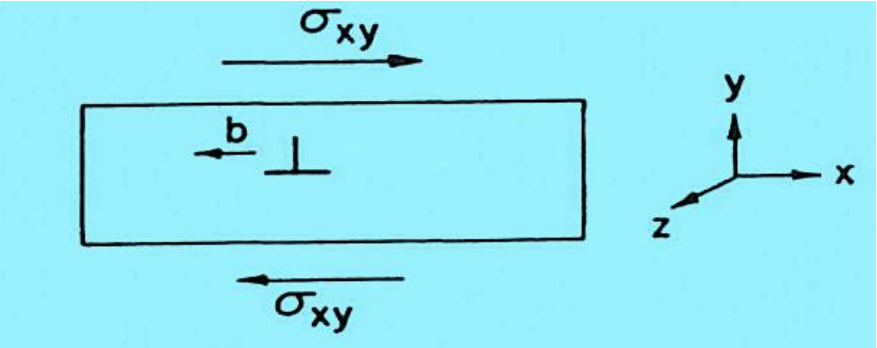
Assignment 07

1. Choose the direction of force per unit length acting on the edge dislocation due to externally applied stress. σ_{xy} is the shear stress and b is the burger vector along –x direction. The dislocation line is along – z direction.



a. $F = \sigma_{xy} . b \hat{i}$

b. $F = \sigma_{xy} . b \hat{j}$

c. $F = - \sigma_{xy} . b \hat{i}$

d. $F = - \sigma_{xy} . b \hat{j}$

Solution : F = G X u

$b = - \hat{i}$

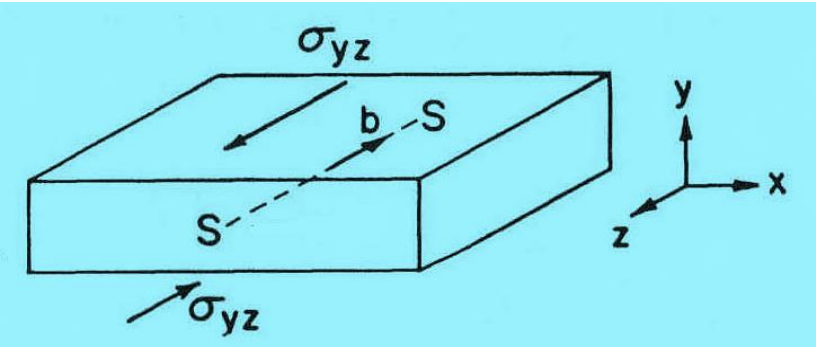
G= iGx + jGy + kGz

$Gy = \sigma xy . b (- \hat{j})$

$u = - k$

$F = \sigma xy . b (- \hat{j} x - k) = \sigma xy . b \hat{i}$

2. Choose the direction of force per unit length acting on the screw dislocation due to externally applied stress. σyz is the shear stress and b is the burger vector along -z direction. The dislocation line is along z direction.



a. F = σyz . b î

b. F = - σyz . b î

c. F = σyz . b ĵ

d. F = - σyz . b ĵ

Solution : F = G X u

b = - k

G= iGx + jGy + kGz

Gy = σyz . b (- j)

u = k

F = σyz . b (- ĵ x k) = - σyz . b î

3. Identify all the correct statements:

(a) **Interstitial type substitutional atoms reside in the region of the dislocation where tensile stresses are present**.

(b) Interstitial atoms reside in the region of the dislocation where compressive stresses are present.

(c) Vacancy type substitutional atoms reside in the region of the dislocation where tensile stresses are present.

(d) Vacancy type substitutional atoms reside in the region of the dislocation where compressive stresses are present.

4. Identify all the wrong answers

(a) **The core energy of a screw dislocation depends on the long range elastic stress field**
(b) The core energy of a screw dislocation depends on the long range elastic strain field
(c) The core energy of an edge dislocation depends on the Poisson's ratio of the material.
(d) The core energy of an edge dislocation is independent of the long range elastic strain field

5) Application of external tensile stresses generates the following defects in the material during deformation due to which of the following reason?

(a) Vacancies when edge dislocations are present
(b)Interstitials when only screw dislocations are present
(c) Interstitials when edge dislocations are present
(d) Both interstitials and vacancies when edge dislocations are present.

6. The Burgers vector of the screw dislocation is along x – direction. The correct choices regarding the displacements around the stationary screw dislocation are.

a. Displacements only in the x direction.
b. Displacements only in y direction.
c. Displacements only in z direction.
d. Displacements in both y and z directions.

7. Identify all the correct choices regarding the stress field around the stationary screw dislocation lying along y direction.

a. The stress field exhibits radial symmetry in the xy plane.
b. The stress field exhibits radial symmetry in the xz plane
c. Dilatational stresses are present along x, y and z directions.
d. The strain $\boldsymbol{\varepsilon}_{yy}$ is present.

8. The Burger vector of the stationary edge dislocation is along the x-direction and line direction is along the z-axis.
Identify the correct answers regarding the stress field around the stationary edge dislocation.

a. The displacement and strain along z direction are zero.

b. The displacement and strain along x direction are zero.

c. The stress field has shear component only.

d. The stress field has both dilatation and shear components.

9. The stress component σ_{yy} around the edge dislocation is given by the following equation,

$$\sigma_{yy} = -\frac{Gb}{2\pi(1-\nu)}\frac{y\,(x^2-y^2)}{(x^2+y^2)^2}$$

Choose the correct region of compressive stress around the edge dislocation,

a. X=0, y= + ve

b. X=0, y= - ve

c. Y=0, x = + ve

d. Y=0, x = - ve

10. In the force balance equation for dislocations, which of these mentioned conditions are applicable, when a stationary dislocation is considered?

$$\rho\frac{\partial^2 u}{\partial t^2} = (2G+\lambda)\frac{\partial^2 u}{\partial x^2} + G\left[\frac{\partial^2 v}{\partial y^2} + \frac{\partial^2 w}{\partial z^2}\right] + (G+\lambda)\left[\frac{\partial^2 v}{\partial x \partial y} + \frac{\partial^2 w}{\partial x \partial z}\right]$$

1 2 3 4

a. 2 becomes zero

b. 3 and 4 become zero

c. Either 3 or 4 become zero.

d. 1 becomes zero