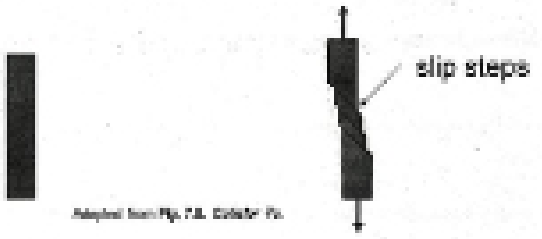
Line Defects

Dislocations:
- are line defects,
- slip between crystal planes result when dislocations move,
- produce permanent (plastic) deformation.

Schematic of Zinc (HCP):
- before deformation
- after tensile elongation



Adapted from Fig. 7.8, Callister 7e.

Imperfections in Solids

Linear Defects (Dislocations)
- Are one-dimensional defects around which atoms are misaligned

Edge dislocation:
- extra half-plane of atoms inserted in a crystal structure
- **b** ⊥ to dislocation line

Screw dislocation:
- spiral planar ramp resulting from shear deformation
- **b** || to dislocation line

Burger's vector, **b**: measure of lattice distortion

*EXAM CHANGE MONDAY Oct 27th

will cover Ch 2, 3 + 4

Imperfections in Solids

Edge Dislocation

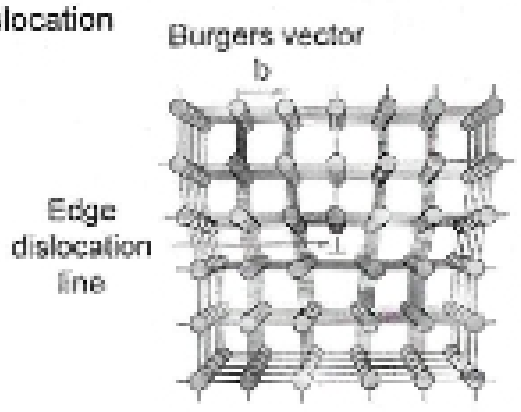
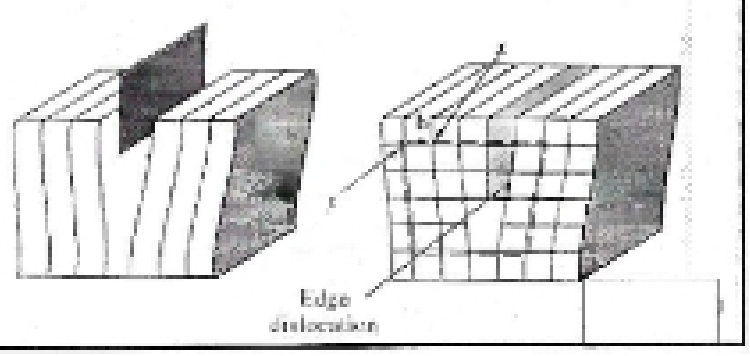


Fig 4.3, Callister 7e.

burgers vector perpendicular to dislocation line

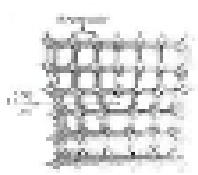
Edge Dislocation

Insertion of an extra plane of atoms
Dislocation line – defined along edge of half plane
Localized lattice distortion around dislocation line
Designation ⊤ or ⊥



Edge Dislocation

- Do not think of an edge dislocation as caused by inserting a plane
- Causes:
  - "Accidental" crystal growth by perhaps an impurity or differential growth
  - Internal tensile and shear stresses in the crystal
  - Plastic deformation of the crystal



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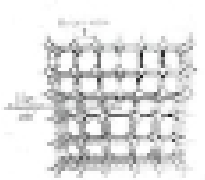
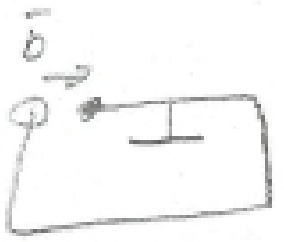




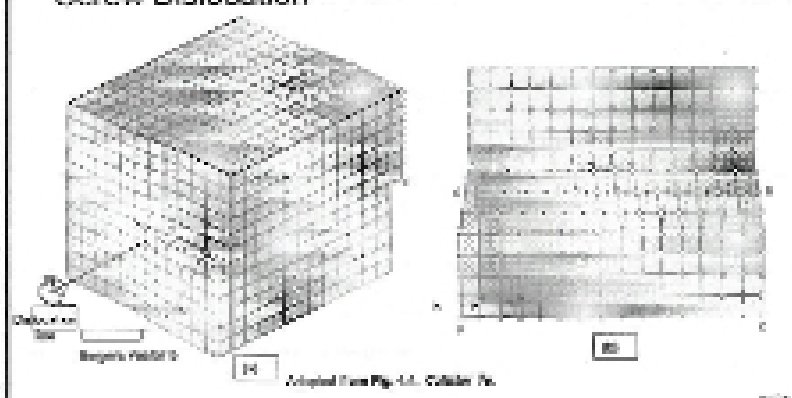
Edge $\Rightarrow \vec{b} \perp$ dislocation line

Screw $\Rightarrow \vec{b} \parallel$ dislocation line

Presence is important for deformation and movement

Imperfections in Solids

Screw Dislocation



can have strength but less deformation

Mixed Dislocation

Most dislocations in crystalline materials are mixed dislocations (neither pure edge or pure screw)