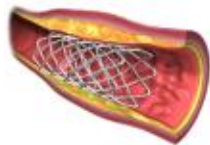


Class 3: Defects



Vascular stent made of memory metal
www.endovasc.com

PRIME Modules
Project-based Resources for Introduction to Materials Engineering

No crystal structure in nature is perfect.

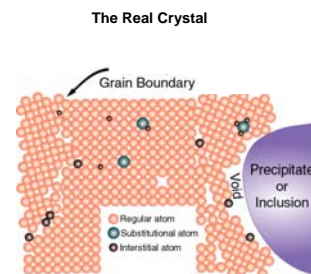
Defects in the lattice are categorized by the volume you take up:

Point defects: spot such as an atom

Line defects: such as a plane of atoms

Interfacial/surface/bulk/volume defects: such as a surface or precipitate

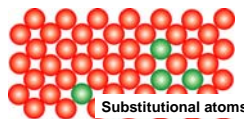
Defects play THE CRITICAL role in controlling the mechanical and electrical properties of a material.



Interstitial, vacancy, and substitutional atoms are examples of point defects.

A point defect is a lattice irregularity that is associated with one or two atomic positions. There are three different types:

- (a) vacancies,
- (b) interstitial atoms
- (c) substitutional atoms



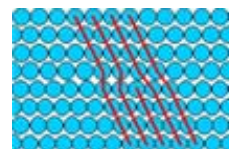
An example of a line defect is a dislocation.

A dislocation is an extra half plane of atoms that form during solidification or deformation.

There can be edge, screw, or mixed dislocations.

The motion of dislocations is what causes permanent deformation of a sample (plastic deformation).

Stopping dislocations from moving is the key component in making a material stronger.



http://www.msm.cam.ac.uk/doitpoms/tplib/BD2/dislocations_in_2D.php

true-glide.mov

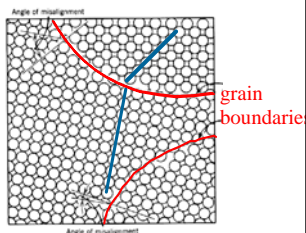
More complicated defects exist at surfaces and interfaces

More complicated defects exist that have a great influence on the material properties

Surfaces: broken bonds influence chemical reactivity and mechanical properties

Precipitates and voids: These are 3-D bulk versions of clumps of atoms or clumps of missing atoms

Grain boundaries separate regions of single crystal material in a polycrystalline sample



Adapted from Fig. 4.7, Callister 6e.

All real crystals have defects

All real crystals have defects that have a large influence on the material's properties.

Point defects include interstitials, vacancies, and substitutional atoms.

A dislocation is an example of a line defect.

Bulk defects exist such as surfaces, interfaces, grain boundaries, precipitates, and voids.

