



Materials Science and Engineering

Laboratory Session I: Crystalline Structures.

AIM

Construction of closed packed and non compact crystalline structures. X-ray diffraction pattern indexing. Determination of lattice parameters of crystalline pure solids and mixtures.

MATERIALS

31 steel spheres

51 magnetic washers

Several diffraction patterns

Graduated ruler

EXPERIMENTAL method

a) Crystalline structures using rigid spheres.

a.1.- Making use of 31 small spheres, build the following packings:

(i) face-centered cubic and simple cubic and (ii) hexagonal close packing and non compact hexagonal .

a.2.- Draw the unit cell of each structure.

a.3- Search and draw the octahedral and tetrahedral positions of the close packed structures (hexagonal or cubic).

b) Using the corresponding diffraction pattern set:

b.1-Pure substance: metal

b.1.1- Index the diffraction pattern and identify what substance is using the given ASTM cards. Say to which crystallographic plane corresponds each reflection in the diffraction pattern and mark them on the diffraction pattern.

b.1.2.- In the case of the diffraction pattern of a metal, calculate the unit cell parameters and once its symmetry is identified, calculate the ion radius. In addition, calculate the volume, the packing factor and the unit cell density. Draw in the unit cell the four families of planes whose intensities are maximum.

b.2.- Mixture of two metals:

b.2.1- Index the diffraction pattern and using the given ASTM cards and identify which metals are; calculate also the unit cell parameters for each metal.

