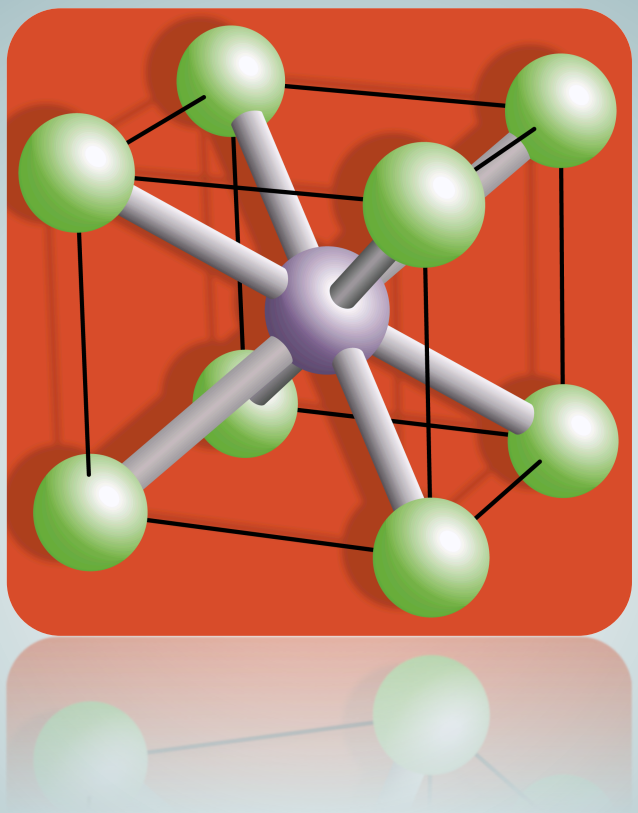
Materials

Exercises Topic 3. Crystalline structure



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Subject: MATERIALS
Degree: GRADO en INGENIERÍA MECÁNICA. 2nd Grade

Crystalline structure

1. Chrome's elemental cell is a body-centered cubic (BCC) type, its atomic weight is 52.01 g/mol and its density 7.19 g/cm^3. Calculate:

a) Weight of an atom.
b) Number of atoms in a milligram.
c) Number of atoms and moles in a m^3.
d) Weight of an elemental cell.
e) Number of cells in a grame of metal.
f) Volumen and longitude of one edge (arista).
g) Atomic radious and rate R_a/a
h) Packing factor.
i) Atomic linear density in the directions <1 0 0>, <1 1 0> y <1 1 1>
j) Atomic superficial density in the planes {1 0 0}, {1 1 0} y {1 1 1}

2. A unitary FCC cell has a reticular constant a = 4.0 Å. Determine:

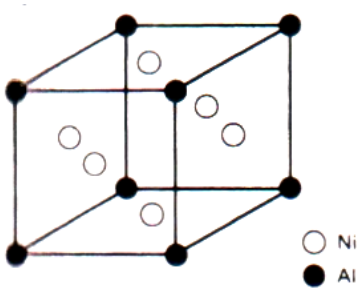
a) Number of atoms per unit area in the planes (1 1 0) y (1 1 1).
b) Atoms density per unit length in the directions [1 1 0] y [1 1 1].
c) The packing factor of this structure.

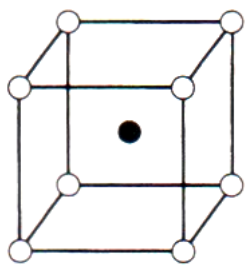
3. Nickel, which atomic radius is 1.24 Å, has a crystalline structure of the type FCC.

a) Determine its atomic weight if its density is 8.9 g/cm^3.
b) Assuming the rigid spheres model, estimate the minimum distance between the surfaces of the atoms whose centers are located in the positions (0, 1/2, 1/2) y (1, 1, 1).
c) Identify the Miller indices of the direction that goes through those points and estimate its linear density.
d) Calculate and order from highest ot lower the planar densities of the families of planes {100}, {110} y {111}.

4. Nickel (Ni) and Aluminum (Al) alloy in different proportions originates two different intermetallic compounds (A and B) having the ordered structures shown in the figure. Determine:

Intermetallic compound A (FCC)





Intermetallic compound B (BCC)

Data: M_{Al}=26.7 g·mol^{-1} M_{Ni}=58.8 g·mol^{-1}

1. Stoichiometry of both compounds.
2. Atomic radius of both metals (r_{Al} and r_{Ni}) and net parameter of compound B (a_B) knowing that the net parameter of compound A is a_A = 3.77 Å and the relationship between both atomic radius is r_{Al}/r_{Ni} = 1.153.
3. Packing factor of compound A.
4. Atomic and weight percentages of both metals (Ni and Al) in compound A.
5. Planar density of the atoms of Ni and Al in the plane (1 1 0) for compound B.