ME254: Materials Engineering Homework 3 Due: Wednesday, October 15, 2014

1st semester 1435-1436 H Instructor: Dr. Hamad F. Alharbi

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1. Tantalum has a BCC crystal structure with an atomic weight of 180.948 g/mol. If the density of Tantalum is 16.6826 g/cm^3, calculate the radius of its atom in nanometer?

2. Determine whether Rhodium has an FCC or BCC crystal structure if it has an atomic radius of 0.1345 nm, a density of 12.41 g/cm^3, and an atomic weight of 102.9055 g/mol.

3. Sketch the following directions within a cubic unit cell (you can draw more than one unit cell to indicate the directions):

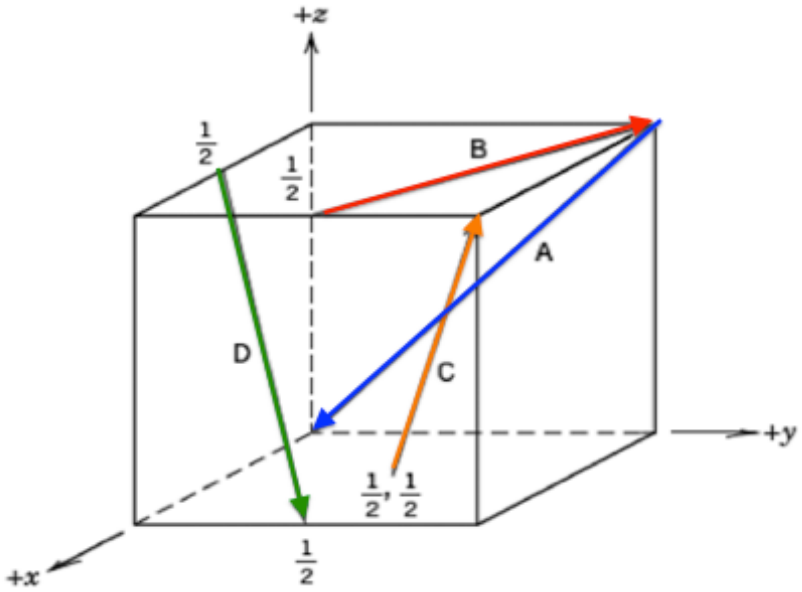
   (a) $[\bar{1}10]$, (e) $[\bar{1}\bar{1}1]$,

   (b) $[\bar{1}\bar{2}1]$, (f) $[\bar{1}22]$,

   (c) $[0\bar{1}2]$, (g) $[1\bar{2}\bar{3}]$,

   (d) $[1\bar{3}3]$, (h) $[\bar{1}03]$

4. Determine the indices for the following directions shown in the cubic unit cell:



5. Sketch within a cubic unit cell the following planes:

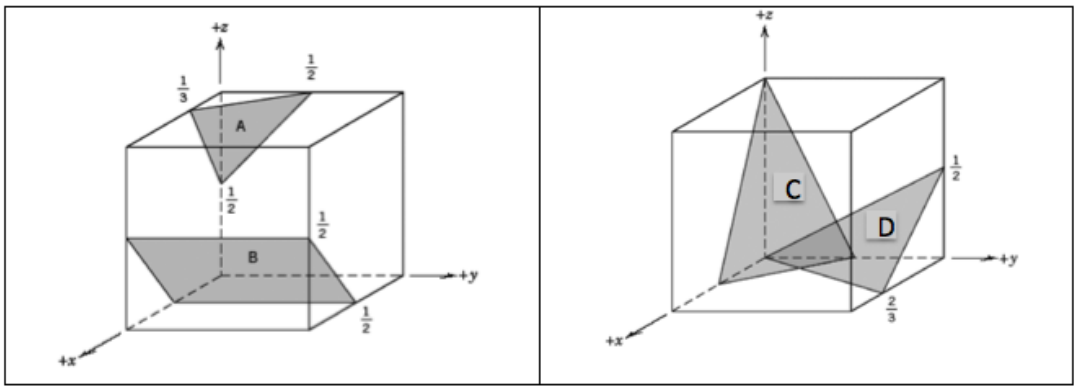
(a) $(0\bar{1}\bar{1})$, (e) $(\bar{1}1\bar{1})$,

(b) $(11\bar{2})$, (f) $(1\bar{2}\bar{2})$,

(c) $(10\bar{2})$, (g) $(\bar{1}2\bar{3})$,

(d) $(1\bar{3}1)$, (h) $(0\bar{1}\bar{3})$

6. Determine the Miller indices for the planes shown in the following unit cell:



7. Sketch the following planes and directions in HCP unit cell:
$(1\bar{1}01), [11\bar{2}0], (0001), [\bar{2}110], and\ [1\bar{2}10].$

8. Calculate the atomic radius for aluminum given that Al has an FCC crystal structure and a planar density of $1.412\ x\ 10^{17}\ m^{-2}$ for the (111) plane. What are the values of the linear density for the [100], [110], and [111] directions.