**動機系材導第二次習題**

**106年3月27日繳交**

3.83 Assuming that the volume of a HCP metal cell (larger cell) is 0.09130 nm3 and the *c*/*a* ratio is 1.856, determine (*a*) the values for *c* and *a,* and (*b*) the radius, R, of the atom. (*c*) If you were told that the metal is titanium, would you be surprised? How do you explain the discrepancy?

3.86 The unit cell structure of the ionic solid, CsI, is similar to that in Fig. 2.18*a.* Determine (*a*) its packing factor, and (*b*) compare this packing factor with that of BCC metals. Explain the difference, if any.

3.90 Calculate the center-to-center distance between adjacent atoms of gold along the following directions: (*a*) [100], (*b*) [101], (*c*) [111], and (*d*) [102]. Speculate as to why such information may be important in understanding the behavior of the material.

3.94 A plane in a hexagonal crystal intersects at the *a*1 axis at −1, the *a*2 axis at 1 and the *c* axis at infinity? What are the Miller indices for this plane? Draw this plane in a hexagonal unit cell and show all key dimensions.

3.97 Name as many carbon allotropes as you can, and discuss their crystal structure.

4.47 It is easier for the iron lattice to house carbon atoms at temperatures higher than 912oC than slightly lower temperatures (Consult section 3.10 on polymorphism). Use the results in example problem 4.3 and problem 4.38 (solve this problem first if you have not already done so) to explain why.

4.50 Iron oxide, FeO, is an ionic compound made up of Fe2+ cations and O2- anions. However, when available, a small number of Fe3+ cations may replace Fe2+ cations. How will this substitution affect the atomic structure of the compound if at all? (Consult section 2.5.1 related to packing of ionic compounds)

4.52 The following pairs of elements can form solid solution alloys. Predict which ones will form substitutional and which ones interstitial alloys? Justify your answers.

1. Copper and tin (Bronze)
2. Aluminum and silicon
3. Iron and nitrogen
4. Titanium and hydrogen

4.56 (a) Estimate the density of a 75 wt% copper-25 wt% Ni alloy (use appendix II for density data). (b) What will be the most probable crystal structure for this alloy? (c) Determine the mass in grams of the atoms inside a unit cell of this alloy. (c) Determine the lattice constant for this alloy.

4.63 The image below is an optical micrograph of 1018 steel (200X) made of mostly iron and a small amount of carbon (only 0.18 wt%). Describe all the features that you observe in this micrograph. What do you think the different colors represent?

