Homework No. 2: Nanotechnology and Materials – Crystal Structures

Due Date: October 1, 2008

---

1. CsCl and NaCl have different crystal structures. Draw the unit cell of those structures, and explain why they have different structures. (20 points)

2. Calculate the atomic packing factor (APF) of BCC and diamond structures. Explain why the APF of diamond structure is only half of the one of BCC? (20 points)

3. In the last homework, you determined the number of broken bonds per unit area for (100), (110), and (111) planes of diamond structure. Based on these, explain why the cleavage plane of Si is (111). You should calculate and compare the surface energy of three planes listed above, again. Even though GaAs has zinc blende structure, the cleavage plane of GaAs is (110), different with the one of Si. Draw the unit cell and (110) projection of GaAs structure, and explain why the cleavage plane of GaAs is (110) by considering the bonding nature. (40 points)

4. In the lecture notes, you can find the crystal structures of $CdCl_2$ and CaF_2. Draw the unit cell and the (110) projection of these structures. What is the stacking sequence of these structures? (30 points)