淡江大學九十四學年度碩士班招生考試試題 16-1

系別：化學工程與材料工程學系　科目：材　料　科　學

准帶項目請打「V」	
✓	簡單型計算機

本試題共 1 頁

1. In terms of electron energy band structure, discuss reasons for the difference in electrical conductivity between metals, semiconductors, and insulators. [15 pts]

2. Relative to electrons, electron orbitals, and electron energy, what does each of the four quantum numbers specify? [10 pts]

3. Distinguish between single crystalline and polycrystalline materials. Explain why the properties of polycrystalline materials are most often isotropic. [10 pts]

4. What information can you obtain by examining the x-ray diffraction pattern of an unknown specimen? [15 pts]

5. Do the following simple calculations or drawings: (5 pts for each problem)

   i. Calculate the radius of the largest atom can exist interstitially in fcc iron without crowding. (Note: The radius of *Fe* atom in fcc is 0.127 nm.)

   ii. Calculate the theoretical density of NaCl.
   (Note: $r_{Na} = 0.186nm, r_{Na^+} = 0.097nm, r_{Cl} = 0.101nm, r_{Cl^-} = 0.181nm$)

   iii. Calculate the coulombic force of attraction between Ca^{2+} and O^{2-} in CaO, which has NaCl-type structure.
   (Note: $r_{Ca^{2+}} = 0.099nm$ and $r_{O^{2-}} = 0.140nm$)

   iv. Sketch three of four possible isomers of butanol (C_4H_9OH).

6. 請以中文說明下列文章之內容： [30 pts]

From a microstructural standpoint, the first process to accompany a phase transformation in solids is ***nucleation*** *– the formation of very small (often submicroscopic) particles, or nuclei, of the new phase, which are capable of growing. Favorable positions for the formation of these nuclei are imperfection sites, especially grain boundaries. The second stage is* ***growth****, in which the nuclei increase in size; during this process, of course, some volume of the parent phase disappears. The transformation reaches completion if growth of these new phase particles is allowed to proceed until the equilibrium fraction is attained.*