

國立臺北科技大學 106 學年度碩士班招生考試

系所組別：3301 材料科學與工程研究所

第二節 材料科學與工程導論 試題 (選考)

第一頁 共一頁

注意事項：

1. 本試題共九題，共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Nickel has the FCC crystal structure with a lattice parameter $a = 0.35167$ nm,
 - (a) What is the coordination number for each Ni atom? (3%)
 - (b) What is the radius of the Ni atom? (3%)
 - (c) Calculate the atomic packing factor of Ni? (6%)
2. The results of an X-ray diffractometer experiment using Cu $K\alpha$ (wavelength = 0.15405 nm) for an element that has either the BCC or the FCC crystal structure showed diffraction peaks at the following 2θ angles: 40.663° , 47.314° , 69.144° , and 83.448° .
 - (a) Determine the crystal structure of the element. (8%)
 - (b) Determine the lattice constant of the element. (5%)
3.
 - (a) Describe a Schottky defect for an ionic compound ZrO_2 . (4%)
 - (b) Describe a Frenkel defect for an ionic compound Na_2O . (4%)
4.
 - (a) Why does slip in metals usually take place on the close-packed planes? (6%)
 - (b) List three slip systems for FCC metals? (6%)
5. When a cold-worked metal is heated into the recovery state, how are the following affected:
 - (a) internal residual stresses, (3%)
 - (b) strength, (3%)
 - (c) electrical conductivity, (3%)
 - (d) microstructure? (5%)

6. When a tensile load of 36000 N is applied to a 40-mm-long rod with a diameter of 12 mm. The rod will be deformed homogeneously. If the diameter decreases to 10 mm, determine
 - (a) the engineering stress and strain at this load, (8%)
 - (b) the true stress and strain at this load. (8%)
7. Write the three invariant reactions that take place in the Fe-Fe₃C phase diagram. (9%)
8.
 - (a) What is a tempered glass? (4%)
 - (b) How to produce tempered glasses? (4%)
9. Draw energy-band diagrams showing donor or acceptor levels for
 - (a) n-type silicon semiconductors, (4%)
 - (b) p-type silicon semiconductors. (4%)