

國立臺北科技大學 103 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

第三節 材料科學與工程導論 試題 (選考)

第一頁 共一頁

注意事項：

1. 本試題共八題，配分共 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. Your company wishes to produce 300 kg of Ni_3Al intermetallic compound. Determine the amount of nickel and aluminum (in kg) that required for producing the alloy. The atomic masses of pure nickel and aluminum are 58.71 and 26.98 g/mol, respectively. (12%)
2. Zinc has an HCP crystal structure for which the ratio of the lattice parameters c/a is 1.865. If the atoms are thought of as being hard sphere, calculate the atomic packing factor for zinc. (12%)
3. The metal copper has an FCC crystal structure. A second-order diffraction peak occur at a diffraction angle of 46.26° from the (200) plane for the copper when monochromatic x-ray with a wavelength of 0.0711 nm is used. Determine the lattice parameter of copper. (12%)
4. A cylindrical specimen of aluminum having a diameter of 12.8 mm is pulled in tension. Some of the load-elongation data is collected and tabulated below. Calculate (a) the modulus of elasticity, (4%)
(b) the tensile strength of the alloy, (4%)
(c) the approximate ductility of the alloy, (4%)
(d) the true stress with a load of 46200 N. (4%)

Load (N)	0	15100	30400	38400	46200	47500 maximum	44800	36400 fracture
Length (mm)	50.8	50.902	51.003	51.308	53.848	55.880	57.658	59.128

5. A carbon steel containing 0.28% C is heated to 750°C in the $\alpha+\gamma$ region and hold for one hour, then quench the steel to room temperature. The carbon contents of the ferrite and austenite phases are approximately 0.02% and 0.6% respectively at the temperature of 750°C. The carbon content of the cementite is 6.67%. The solubility of carbon in iron is approximately zero at room temperature.
- (a) Determine the microconstituent that will form after quench. (6%)
 - (b) Determine the amount of each microconstituent after quench. (6%)
6. (a) What is slip casting? (6%)
- (b) What is tape casting? (6%)
7. Draw a schematic diagram of the electron energy band structure of a metal, a semiconductor, and an insulator. Use this to discuss reasons for the difference in electrical conductivity between metals, semiconductors, and insulators. (12%)
8. (a) Describe the mechanisms of heat conduction in solid materials. (6%)
- (b) Explain why metals are typically better thermal conductors than ceramic materials. (6%)