

## 國立臺灣科技大學 108 學年度碩士班招生試題

系所組別：材料科學與工程系碩士班丙組

科目：材料導論

(總分為 100 分)

- (1) Explain why color of copper (Cu) is red-orange not bright silvery? (4%)
  - (2) Explain Fick's second law. (3%)
  - (3) Explain antiferromagnetism. (3%)
- (1) Explain Hall effect (4%).
  - (2) Give two properties of semiconductor can be measured in Hall effect experiment. (6%)
- (1) Discuss the relationship between temperature and electrical conductivity of metal (5%) and (2) explain its mechanism. (5%)
- (1) Give two dominated diffusion mechanism in metal (4%),
  - (2) Which one is faster (3%)? and (3) explain the answer. (3%)
- (1) Determine the diffusion flux of zinc atoms in a solid solution of zinc in copper between two A and B, 20 micrometer, at 500 °C.  $C_a=10^{26}$  atoms/m<sup>3</sup> and  $C_b=10^{24}$  atoms/m<sup>3</sup>. At 500 °C, diffusivity for zinc in copper is  $4 \times 10^{-18}$  m<sup>2</sup>/s (5%)
  - (2) If 500 g of a 40 wt % Ag-60 wt % Cu alloy is slowly cooled from 1000 °C to just below 780 °C. How many grams of liquid and proeutectic alpha are present at  $780^\circ\text{C} + \Delta T$ ? (5%)



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6. X-ray diffraction is one of important techniques to determine the crystallographic structure of materials. Please write down the question of Bragg's law (6%) and (2) define all the symbols (4%). (3) X-ray can be classified into two types of hard X-ray (wavelength of  $\sim 0.1\text{nm}$ ) and soft X-ray (wavelength of  $\sim 1\text{nm}$ ). Which type of X-ray can be used for X-ray diffraction (4%)? (4) And, please explain why (6%)? (hint: using the Bragg's law).
7. (1) A metal bar 100 mm long and having a square cross section 20 mm on an edge is pulled in tension with a load of 44,000 N, and experiences an elongation of 0.10 mm. Assuming that the deformation is entirely elastic, calculate the elastic modulus of the metal (10%) (2) Please choose the possible metal below for this test bar (5%). (Elastic modulus values of metal are listed below. Tungsten: 407GPa; Steel: 207GPa; Copper: 110GPa; Brass: 97GPa; Aluminum: 69GPa; Magnesium: 45GPa)
8. Explain the following terms (1) Pauli exclusion principle (5%), (2) Glasses (5%), and (3) Twin boundary (5%)

