

科目	材料科學導論	適用 系別	材料系三年級	時間	80分鐘
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※ 請務必在答案卷作答區內作答 ※ 共 1 頁第 1 頁
(可使用計算機，但不可使用英文字典)

- (a) Describe the characteristics for three major types of primary chemical bonding types, namely, metallic, covalent, and ionic bonding. (b) How can you use the “lattice constants” and symmetry operations to define seven crystal systems and fourteen Bravais lattices? (c) Which compound has higher melting point, KCl or Al_2O_3 ? Explain why. (d) Which compound has higher thermal coefficient of expansion (TCE), KCl or Al_2O_3 ? Explain why. (15%)
- (a) What are the purposes of annealing? (b) What are the purposes of sintering? (c) For instance, a certain oxide with melting point at 1950°C , estimate the reasonable sintering temperature range for such oxide material. (d) How do we calculate the porosity of a material if we know its theoretic density and apparent density? (15%)
- (a) Describe the microstructure of a material. (b) How do you identify whether a material has glassy (amorphous) phase? Explain why. (c) State at least two methods you have learned in analyzing the microstructure of a material. Make sure to briefly give the basic principles behind the analytic methods that you mention here. (10%)
- (a) Define the term “electron mobility” (b) Under the same temperature, which is higher, electron mobility (μ_n) or hole mobility (μ_p)? (c) Calculate the electrical resistivity of intrinsic germanium (Ge) at 300 K. For Ge at 300K, $n_i = 2.4 \times 10^{19}$ carriers/cm³, $q = 1.6 \times 10^{-19}$ coul, $\mu_n = 0.39 \text{ m}^2/(\text{V}\cdot\text{s})$, and $\mu_p = 0.19 \text{ m}^2/(\text{V}\cdot\text{s})$ (10%)
- Consider the conductivity (or resistivity) of a (a) metal, (b) intrinsic silicon, and (c) extrinsic semiconductor, draw curves and discuss the temperature effect (5% each)
- Consider a eutectoid carbon steel, (a) describe its eutectoid reaction, (b) draw its TTT curve and write down all the phases in the TTT diagram. (c) describe the hardenability. (5% each)
- Describe briefly five different methods that can be used for mechanical testing. (10%)
- Describe briefly five different types of corrosion. (10%)