

國立臺灣科技大學

九十學年度碩士班招生考試試題

系所組別：工程技術研究所材料科技學程

科目：材料導論

共 100 分

1. (a) How many atoms are there in the unit cell of the diamond cubic lattice? [5 分]
 (b) What is the coordination number of the zinc blende structure? [5 分]
 (c) Draw the atom locations on a (110) plane of the bcc unit cell. [5 分]
2. Polypropylene (PP) and polymethyl methacrylate (PMMA) were irradiated with 2.45 GHz microwave. Which absorb more energy? Why? [15 分]
3. Show the effect of temperature on the modulus of elasticity for amorphous, semi-crystalline and cross-linked polystyrene (PS) in a figure. Also indicate possible transition temperature in the figure. [15 分]
4. Mixtures of copper and nickel form a continuous range of solid solutions. The melting points of copper and nickel are 1083 °C and 1452 °C, respectively.
 (a) Draw the equilibrium phase diagram of the copper-nickel system. [8 分]
 (b) Draw cooling curves of 100% Cu, 40%Cu-60%Ni and 100%Ni, starting from liquid to solid phase. [7 分]
5. Colors of several pure semiconductors are listed in following table.
 (a) Which material can act as phosphor to emit blue light while being properly doped? Why? [7 分]
 (b) What color is HgS upon an intense pressure? Why? [8 分]

Material	Color
ZnO	Colorless
CdS	Yellow-orange
HgS	Red
GaAs	Black
Si	Metallic Grey

6. Zirconium tungstate, ZrW_2O_8 , has negative thermal expansion coefficient from 0.5 K to 1050 K. Compare and explain its X-ray diffraction results at 300 K and 700 K. [10 分]
7. (a) Show the effect of temperature on electrical resistivity for a normal metal and a superconducting material in a figure. [10 分]
 (b) Which of the following material is a superconductor? Si, $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$, or MgB_2 ? [5 分]



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