

國立臺北科技大學

九十二學年度工程科技研究所博士班入學考試

材料科學與工程導論（材料及資源組）試題

填准考證號碼

第一頁 共一頁

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注意事項：

1. 本試題共【六】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

1. For a $\text{Na}^+\text{-Cl}^-$ ion pair, attractive and repulsive energies E_A and E_R , respectively, depend on the distance between the ions r , according to

$$E_A = -\frac{1.436}{r} \quad \text{and} \quad E_R = \frac{7.32 \times 10^{-6}}{r^8}$$

Determine

- (a) the equilibrium spacing r_0 between the Na^+ and Cl^- ions. (8%)
 - (b) the magnitude of the bonding energy E_0 between the two ions. (8%)
2. (a) What is recrystallization? (4%)
- (b) What is the driving force for recrystallization? (4%)
 - (c) Would you expect it to be possible for ceramic materials to experience recrystallization? Why or why not? (8%)
3. (a) What is eutectoid reaction? (4%)
- (b) What is the distinction between hypereutectoid and hypoeutectoid alloys? (4%)
 - (c) A hypothetical A-B alloy of composition 60wt%B-40wt%A at some temperature is found to consist of weight fraction of 0.6 for β phase. If the composition of the β phase is 90wt%B-10wt%A, What is the composition of the α phase? (8%)

4. Demonstrate that for a tensile test necking begins when $\frac{d\sigma}{d\varepsilon} = \sigma$.

Where σ and ε are true stress and true strain, respectively. (12%)

5. (a) What is ferroelectricity? (4%)

(b) From the crystal structure point of view, explain why BaTiO_3 possesses ferroelectric behavior. (10%)

(c) Would you expect the physical dimensions of BaTiO_3 to change when it is subjected to an electric field? Why or why not? (6%)

6. (a) Explain why metals are opaque to visible light but transparent to X-rays. (8%)

(b) Why copper appears red-orange color? Explain what determines the characteristic color of a metal. (6%)

(c) Explain why some transparent materials appear colored while others are colorless. (6%)