

# 國立成功大學

## 112學年度碩士班招生考試試題

編 號：86

系 所：資源工程學系

科 目：材料科學導論

日 期：0206

節 次：第 3 節

備 註：可使用計算機

※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Make the spin diagrams that describe the electronic structures of atomic iron (Fe), and the ionic states,  $\text{Fe}^{2+}$ 、 $\text{Fe}^{3+}$ . (10%)
2. Plot the electronic band structures of insulators, n-type semiconductors, p-type semiconductors, and conductors. Explain the difference between them. (10%)
3. Assuming FeO (AX-type compound) with the following radii,  $r(\text{O}) = 1.40 \text{ \AA}$ ,  $r(\text{Fe}) = 0.77 \text{ \AA}$ , then (a) Determine the coordination numbers of Fe and O; and (b) Plot the coordination geometry. (15%)
4. Calculate the number of Schottky defects per cubic meter in potassium (atomic weight: 39.10 g/mol) chloride (atomic weight: 35.45 g/mol) at  $500^\circ\text{C}$ . The energy required to form each Schottky defect is 2.6 eV, while the density for KCl (at  $500^\circ\text{C}$ ) is  $1.955 \text{ g/cm}^3$ . (Avogadro's number:  $6.023 \times 10^{23}$  atoms/mol; Boltzmann's constant:  $8.62 \times 10^{-5} \text{ eV/K}$ ) (10%)
5. (a) Plot the unit cell geometries for the seven crystal systems and list their lattice parameters (axial and interaxial angles) (b) Explain how the idea of unit cell expands to 14 Bravais Lattice. (15%)
6. For BCC iron, compute the interplanar spacing, and the diffraction angle for the (220) set of planes. The lattice parameter for Fe is 0.2866 nm. Also, assume that monochromatic radiation having a wavelength of 0.1790 nm is used, and the order of reflection is 1. (10%)
7. What is the difference between the spinel and inverse spinel crystal structures? (10%)

8. (a) Explain the curve A, line B, point  $T_{le}$ ,  $T_{si}$ , E and P. (b) Qualitatively determine the mineral composition during the mineral X cooling pathway at 1700°C, 1400°C, 1100°C, 980°C and 900°C. (20%)

