

國立臺灣科技大學

九十四學年度碩士班招生考試試題

系所組別：材料科技研究所碩士班

科目：材料導論

共 100 分

- A two-layer film stack, which is made of a piece of semiconductor and a piece of ceramic, is heated to a high temperature then cooled down to room temperature. Assume thermal expansion coefficients of the semiconductor and the ceramic are $1 \times 10^{-6} \text{ K}^{-1}$ and $2 \times 10^{-6} \text{ K}^{-1}$, respectively.
 - How will this film stack deform? [5 分]
 - How will the band gap of this semiconductor change? [5 分]
- Draw resistivity-temperature ($\rho - T$) curves of a pure copper sheet and a cold-worked copper sheet. [8 分]
 - Why are the resistivities of above copper sheets different? [7 分]
- Zirconia, ZrO_2 , is often stabilized with yttrium to produce an important solid electrolyte. The basic cell is ZrO_2 with 2 Y^{3+} ions present for every 10 Zr^{4+} ions.
 - Will the vacant sites be anion or cation? [5 分]
 - What percentage of the total number of all sites will be vacant? [5 分]
 - How does oxygen pass through this zirconia electrolyte? [5 分]
- The chemical formula of calcium titanate is CaTiO_3 . The calcium and oxygen ions make up a FCC box with a titanium ion at the center.
 - Draw the unit cell of CaTiO_3 . [9 分]
 - What are the Bravais lattice and crystal system of CaTiO_3 ? [6 分]
- What charge carriers are there in an intrinsic semiconductor? [6 分]
 - Draw a block of a p-type semiconductor and demonstrate the Hall measurement. [9 分]
- Draw dielectric constant-temperature ($\epsilon_r - T$) curve of a polarizable crystalline polymer from solid to liquid state. [8 分]
 - Explain the reason for the variation of the dielectric constant in above question. [7 分]
- What phases will be present at point 1, 2 and 3 in the isothermal section of a ternary phase diagram as shown in Fig. 1? [9 分]
 - What is the composition of the ternary alloy at point 4 in Fig. 2? [6 分]

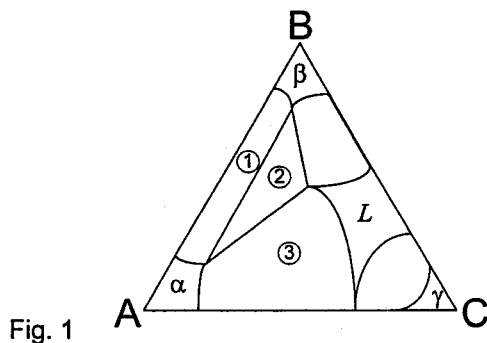


Fig. 1

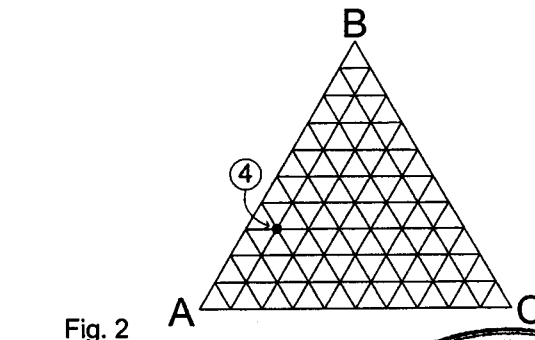


Fig. 2

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