

國立台灣科技大學九十七學年度碩士班招生試題

系所組別：機械工程系碩士班戊組

科目：材料原理

總分100分

1. Explain why the modulus of elasticity of simple thermoplastic polymers, such as polyethylene and polystyrene, is expected to be very low compared with that of metals and ceramics. [10分]
2. The density of potassium (K), which has the BCC structure and one atom per lattice point, is 0.855 g/cm^3 . The atomic weight of potassium is 39.09 g/mol . Calculate (a) the lattice parameter; and (b) the atomic radius of potassium. [10分]
3. Suppose we introduce the following point defects. What other changes in each structure might be necessary to maintain a charge balance? Explain. [共10分]
 - (a) Mg^{2+} ions substitute for yttrium atoms in Y_2O_3 [3分]
 - (b) Fe^{3+} ions substitute for magnesium ions in MgO [3分]
 - (c) Li^{1+} ions substitute for magnesium ions in MgO [2分]
 - (d) Fe^{2+} ions replace sodium ions in NaCl [2分]
4. Suppose 1 at% of the following elements is added to copper (forming a separate alloy with each element) without exceeding the solubility limit. Which one would be expected to give the higher strength alloy? Is any of the alloying elements expected to have unlimited solid solubility in copper? (a) Au (b) Mn (c) Sr (d) Si (e) Co [The atomic radius (r): $r_{\text{Cu}}=0.1278 \text{ nm}$, $r_{\text{Au}}=0.1442 \text{ nm}$, $r_{\text{Mn}}=0.1120 \text{ nm}$, $r_{\text{Sr}}=0.2151 \text{ nm}$, $r_{\text{Si}}=0.1176 \text{ nm}$, $r_{\text{Co}}=0.1253 \text{ nm}$] [10分]
5. 相同成分及相含量完全相同的兩材料，晶體缺陷(如差排、晶界、裂口)愈多的材料，其：(a) 導電率、(b) 透光度、(c) 導熱性(K值)、(d) 磁性(Br、Hc)，相對於較少晶體缺陷的材料，將會有何變化並請說明其原因。[各5分，共20分]
6. 圖1為A-B、A-C、A-D二元系統之相平衡圖。請問A-B、A-C、A-D何者的鍵結最強？並請說明您的判斷理由。[10分]

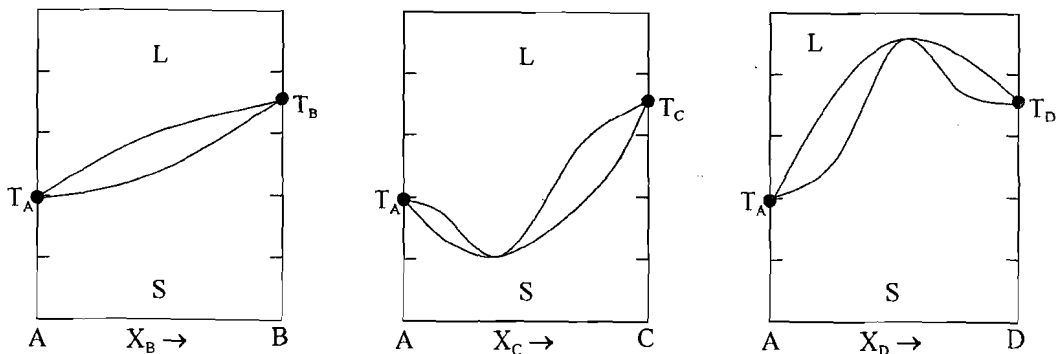


圖1 A-B、A-C、A-D二元系統之相平衡圖。



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7. 在腐蝕行為中，什麼是活性極化(activation polarization)? 什麼是濃度極化(concentration polarization)? 並請各舉一例。[10分]
8. 圖2是某個不銹鋼的金相。如果二選一，您認為此不銹鋼會是肥粒體系的410不銹鋼? 還是沃斯田體系的304不銹鋼? 請說明您的判斷理由。[10分]

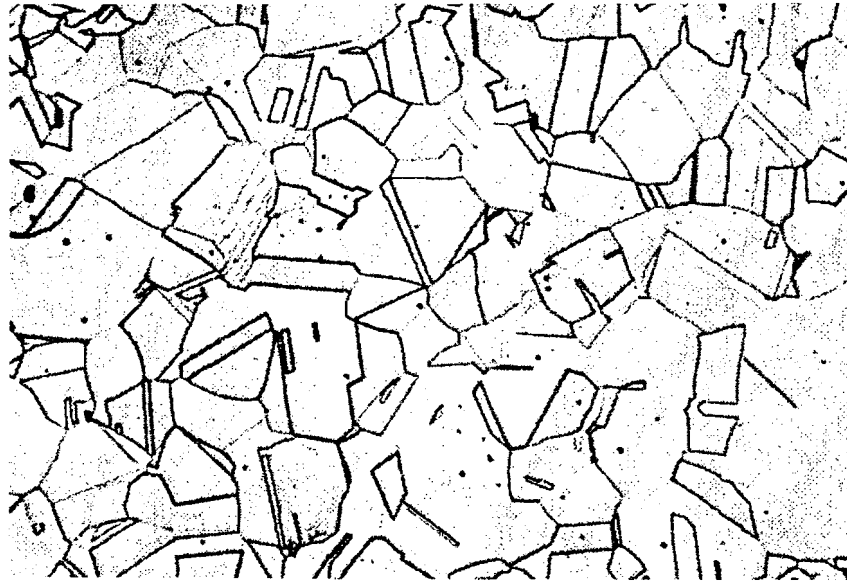


圖2

9. 在相同的溫度，將純鎳各以BCC及FCC的方式排列；假設此純鎳為完美狀態沒有任何晶體缺陷，請分別說明降伏強度(YS)及抗拉強度(UTS)在哪一種晶體結構狀態會較高? 為什麼? [10分]