大同大學 105 學年度(寒)轉學入學考試試題

考試科目:材料導論　　系別:材料工程學系　　第1/2頁

註:本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 不可以使用計算器。

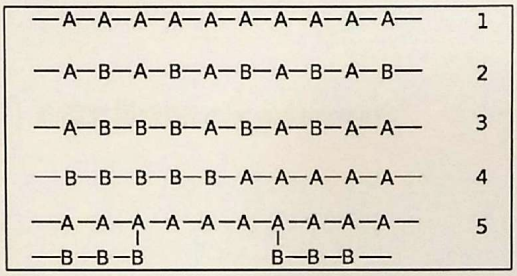
1. The properties of polycrystalline materials are most often isotropic or anisotropic? **Explain** why. (4%)

2. Determine whether one item is **more likely to crystallize** than the other (3%)
   (1) linear polymer or branching polymer
   (2) small molecular weight or large molecular weight
   (3) syndiotactic polymer or atactic polymer

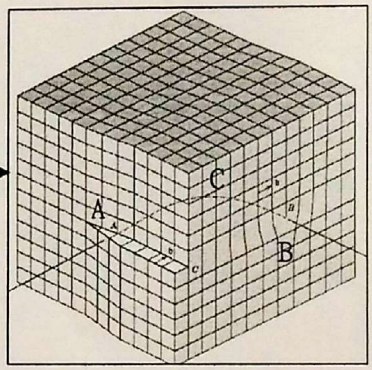
3. Determine whether its **crystal structure** is FCC, BCC, or SC and then justify your determination. (7%)

Atomic Weight (g/ mol)	*Density (g/ cm^3)*	*Atomic Radius (nm)*
107.6	13.42	0.133

4. **Match** (a)-(f) with (1)-(5). (2*6%)
   (a) Homopolymer
   (b) Copolymer
   (c) Graft polymers
   (d) Block polymers
   (e) Random polymer
   (f) Alternating polymers



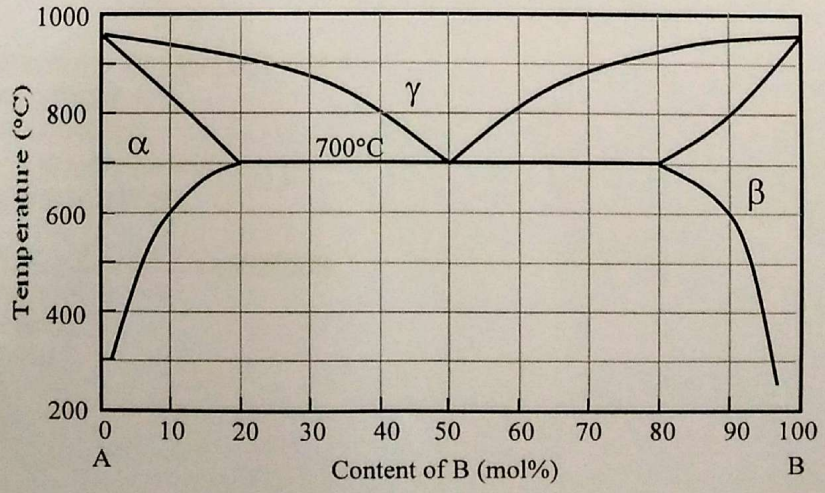
5. Identify the A, B, C defect in right figure. (6%)



6. (a) The surface energy of a single crystal depends on crystallographic orientation. Does this surface energy increase or decrease with an increase in planar density? Why? (4%)
   (b) What point defects are possible for MgO as an impurity in Al_2O_3? How many Mg^{2+} ions must be added to form each these defects? (4%)

7. (　　) What factors affect the diffusion rate in solid metal crystals? (a) type of diffusion mechanism, (b) temperature of diffusion, (c) concentration of the diffusion species (concentration gradient), (d) type of crystal structure, (e) Type of crystal imperfections present. (10%)

8. Consider the following phase diagram. An alloy of composition 60 mol% A – 40 mol% B is slowly cooled from 1000°C.
   a) Determine the compositions of phases at 700°C. (5%)
   b) Determine the relative amounts (in terms of molar fractions) of phases at 600°C. (5%)
   c) Make a schematic sketche of the microstructure at 600°C. (5%)



9. Plot a typical engineering stress-strain behavior to show (a) modulus of elasticity, (b) yield strength at a strain offset of 0.2%, (c) tensile strength, (d) fracture strength, (e) ductility expressed by percent elongation. (2 * 5%)
10. Explain why (a) grain-size reduction and (b) plastic deformation may strengthen a metal. (2 * 5%)
11. Define (a) fatigue and (b) creep. (2* 5%)
12. Consider the solidification of a pure material at a temperature T (< melting temperature T_m). Make a schematic plot showing the curve for overall transformation rate versus T. (5%)