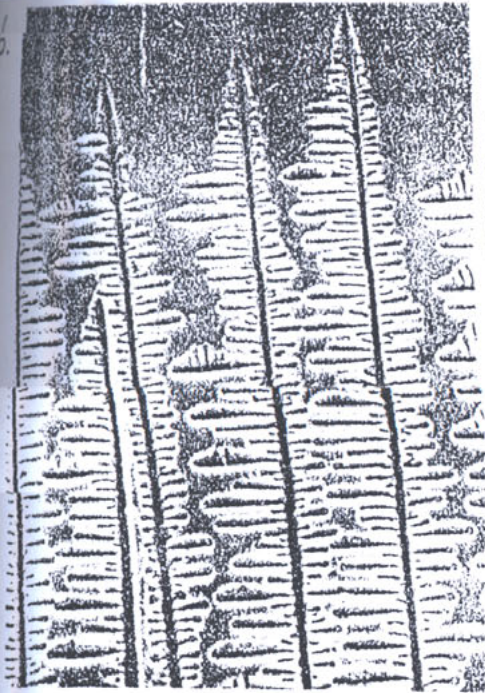


\* 請務必依題目順序作答

1. (i) For all types of bonding, we find a similar relationship of potential energy vs. atom separation distance. Please discuss the effects of bonding type and temperature on the thermal expansion in terms of the potential energy well.(5%)  
(ii) Please use molecular orbital concept to explain why diamond and graphite have different structures and properties.(5%)
2. What do you expect to happen when a high-speed electron strikes a crystal? Please discuss them in detail.(10%)
3. (i) Please explain why the tetrahedral void in BCC crystals is not simply considered as a portion of the octahedral void. Please sketch the structure and discuss.(5%)  
(ii) A majority of ceramic structures can be viewed as linked polyhedra. Polyhedra can link together via corners, edges, and faces. Please explain why the tetrahedra with a high-charge ion inside usually link with corners.(5%)

4. (i) Please describe the procedure for evaluating the activation energy and frequency factor of self-diffusion coefficient of a solid.(6%)
- (ii) Please explain the following terms.(4%)
- (a) Self-diffusion coefficient
  - (b) Chemical diffusion coefficient
  - (c) Apparent diffusion coefficient
  - (d) Defect diffusion coefficient
5. (i) Please discuss factors that would inhibit grain growth of materials in detail.(5%)
- (ii) Please discuss the possible factors affecting the solubility of a solid solution.(5%)



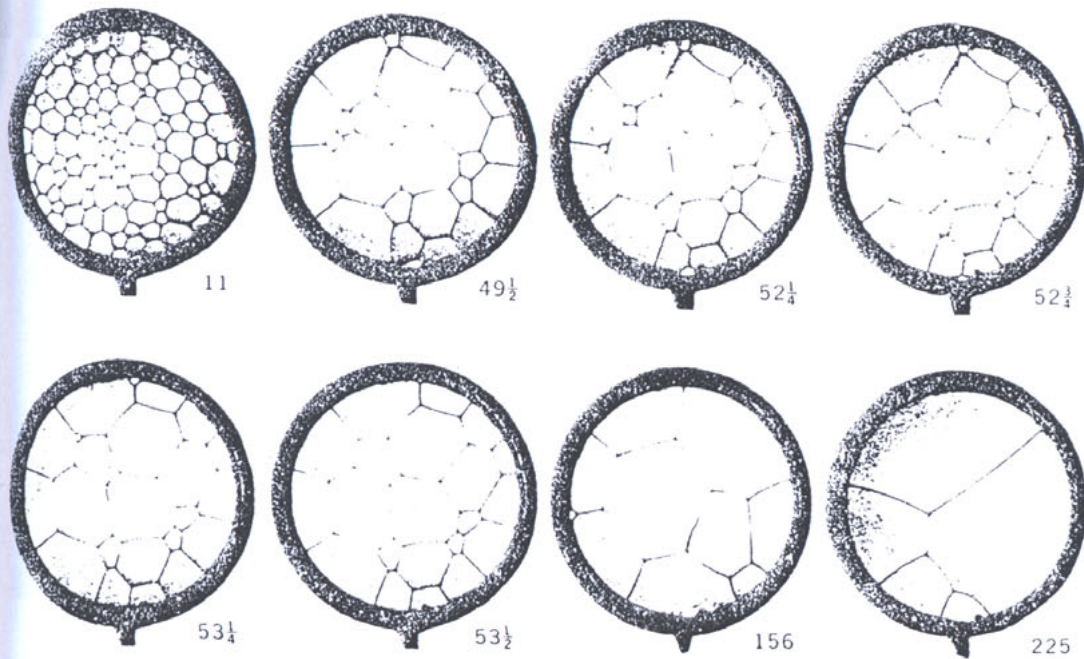


(a)



(b)

請問 (a), (b) 兩圖所示之凝固組織有何相同處及相異處? 請說明造成這些相同處及相異處的原因。(10%)



左列各圖為氣泡被框於圓框內 11 分鐘至 225 分鐘所拍攝的照片。請問這些照片顯示氣泡有那些變化? 為什麼會有這些變化?(10%)



150 $\mu$ m

(a)



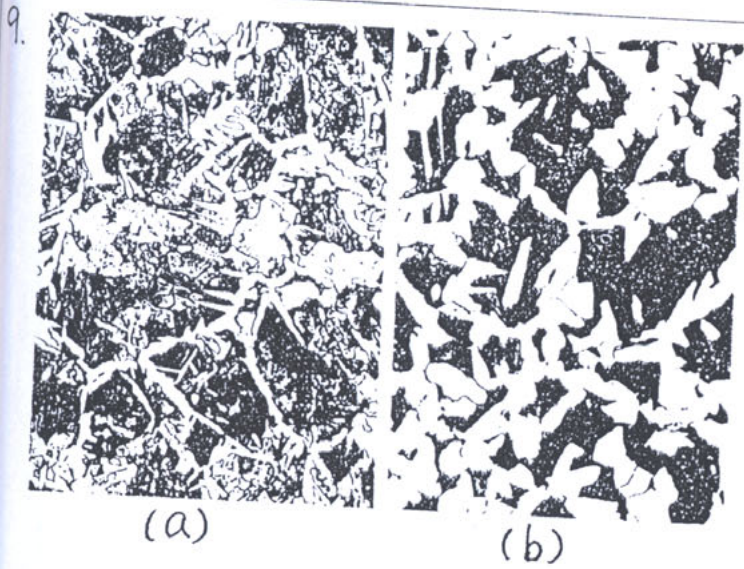
30 $\mu$ m

(b)

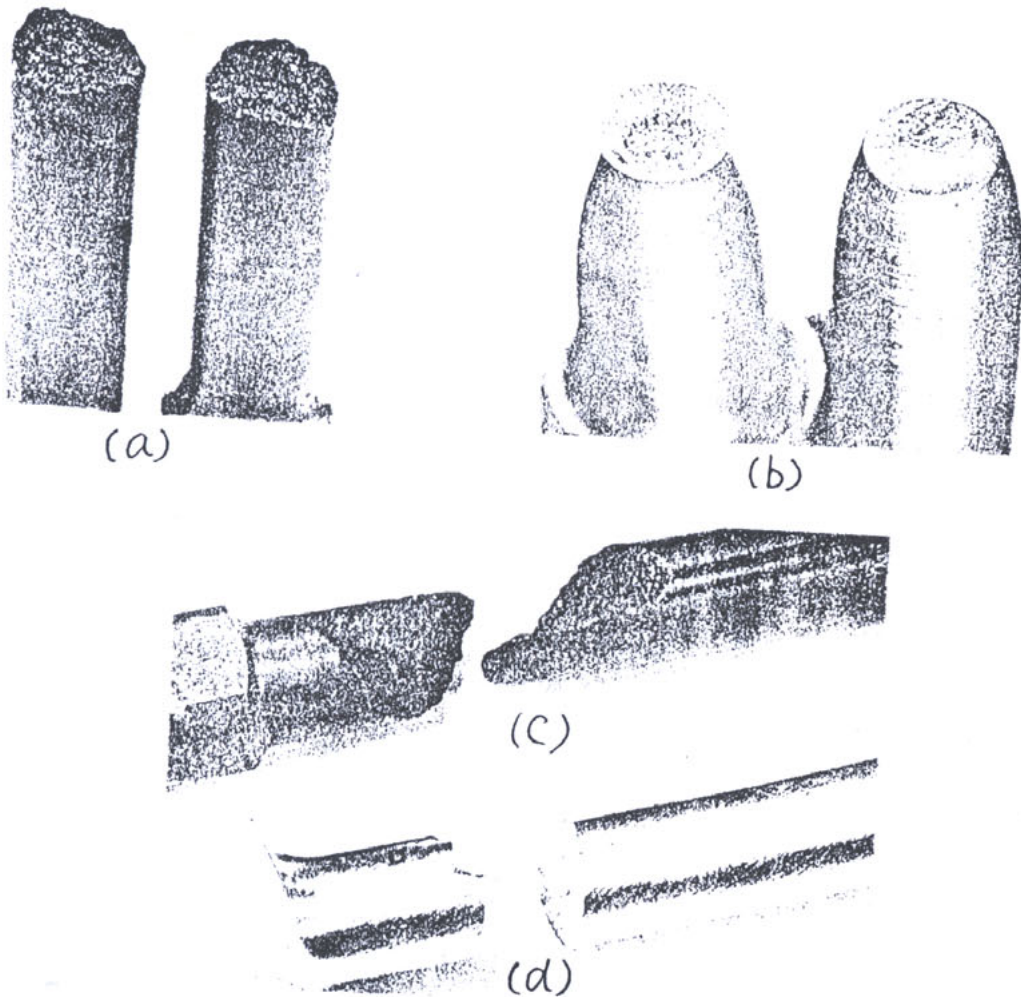
(a), (b) 兩圖分別顯示某低碳鋼及某鐵-鎳合金的麻田散件 (martensitic) 金相組織。請詳細闡述並比較此兩麻田散件。(10%)

(背面仍有題目, 請繼續作答)





9. (a), (b) 兩圖顯示相同放大倍數的鐵-0.4wt% 碳合金之金相組織，其中白色區域為肥粒鐵 (ferrite)，黑(灰)色區域為波氏鐵 (pearlite)。請問此兩金相組織有什麼共通點及差異點？為什麼會有這些共通點及差異點？ (10%)



10. (a) 及 (b) 顯示兩種拉伸 (tension) 試棒之形貌；(c) 及 (d) 顯示兩種扭轉 (torsion) 試棒之形貌。請解釋並比較這些形貌。 (10%)