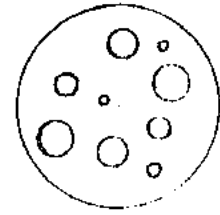


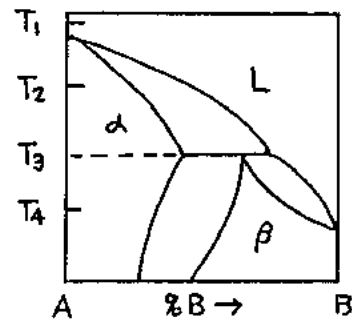
1. 右圖所示者係由光學顯微鏡所獲得的二度空間組織，在組織的基地中含有一些析出物。請問 (a) 此析出物在三度空間是何種形狀，(b) 如何定量析出物之 volume fraction, (c) 如何定量析出物與析出物之間的 mean inter-particle distance?



2. BCC 材料有 48 個 slip system, 而 FCC 則祇有 12 個, 然而何以 BCC 材料通常其延性低於 FCC 材料?
3. (a) 在平衡條件下為何材料含有 vacancy, (b) 同一溫度下, 熔點較高之材料與低熔點材料相較, 何者含較高之 vacancy, 何故, (c) 你如何證明 vacancy 存在?
4. (a) 敘述兩種金屬容易形成固溶體 (solid solution) 之條件, (b) 固溶體中的溶質元素為何具有阻止差排移動的能力?

5. 右圖所示者為 Binary phase diagram.

(a) What reaction happens at T_3 ? Write an equation to describe the reaction.



(b) Draw the free energy - composition diagrams that exhibits the phase equilibriums (relations) among L, α and β phases at T_1 , T_2 , T_3 and T_4 .

6. 在第一題中之析出物, 經過在高温保持一段時間後發現有 Coarsening 之現象。

(a) 解釋此現象發生之機構,
 (b) Coarsening 發生之速率與那些材料物理因素有關?



7. 有一 diffusion couple, 經於高溫保持一段時間後發現其界面兩邊之原子產生相互擴散現象。試說明發生此現象之原因(或驅動力)。

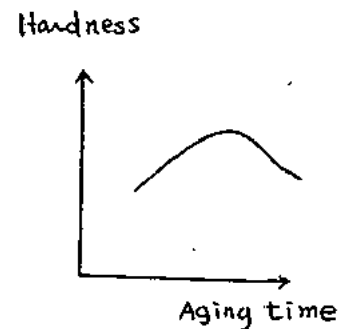
8. 雜質元素對再結晶溫度有何影響? 其影響機構為何?

9. Consider the precipitation of Al - 4% Cu system.

The hardness of the alloy after solutionizing and aging at 150°C was found as shown in the figure.

(a) Write a general expression of Gibbs free energy change (ΔG) during the homogeneous nucleation process. Define each term and terminologies used.

(b) Explain why there exist a maximum in the figure (sometimes there could be more than one maximum but this is ignored).



10. 敘述金屬凝固時成長中的固體為何形成 dendrite 之形狀?

(以上共 10 題, 每題 10%)