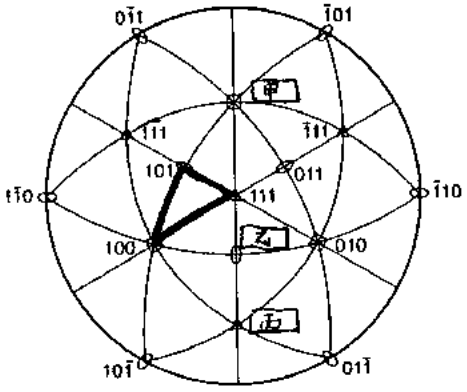
一、

Explain why grain boundaries will move towards their center of curvature during grain growth but away from their center of curvature during recrystallinzation. (10%)

二、

(a) 請問右圖之名稱爲何？並敘述其功能及重要性。(3%)
(b) 右圖中有三個空格(甲、乙、丙)，請問其應有之 Miller Indice 爲何？(3%)
(c) 右圖中有一粗線描出之三角形，請問其名稱爲何？並敘述其重要功能。(3%)
(d) 請根據右圖，在答案紙上另繪圖，並標出 (123) 及 (211) 平面所應有之位置。(3%)



三、

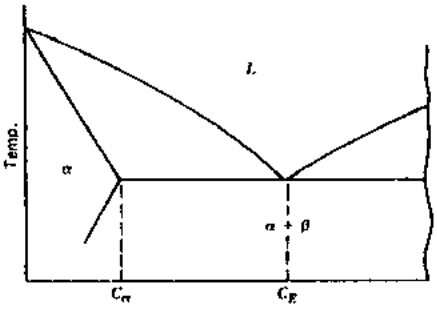
Would a high angle grain boundary or a coherent boundary be more effective at stopping the dislocation motion? Explain why? (10%)

四、

The following equation is known as the "consitituional supercooling criterion" which has been used to estimate the solid/liquid interface shape during a solidification process of an alloy.

$$G_{cr} = m_l R C_o (1-k) / k D_l$$

(a) Please define and describe each of the parameter used in this equation.(5%)
(b) Please describe what kind of interface will be at the following conditions. (5%)
  i. $G_l > G_{cr}$
  ii. G_l slightly less than G_{cr}
  iii. $G_l << G_{cr}$
(c) Please indicate on an eutectic binary phase diagram (as shown on the right), what range of composition the above equation is valid? Please explain why. (5%)



A eutectic phase diagram defining compositions C_α and C_E.

五、

(a) Please define CRSS and describe its physical meaning? (5%)

(b) Between the yield stress for a single crystal and a polycrystalline material , which one will has a higher yield stress? Explain why? (5%)

六、

(i) 光學顯微鏡、(ii)穿透式電子顯微鏡、(iii)掃描式電子顯微鏡等爲三種材料組織觀察研究常用之儀器。請敘述這三種儀器之

(a) 英文全名及縮寫。 (3%)

(b) 試片準備時之特殊要求及尺寸大小。 (3%)

(c) 放大倍率範圍及解析度。 (3%)

(d) 如果具有化學分析之功能，其所附加之儀器名稱及功能爲何？(6%)

七、

在鋼鐵材料中，依其成分及不同之熱處理方法，可以形成不同之微觀組織。請敘述下列五種組織之(a)成分，(b)熱處理方法，(c)微觀組織(可繪一簡圖並標示之)，(d)材料特性。

1. Martensite (4%)
2. Pearlite (4%)
3. Grey Cast Iron (4%)
4. Nodular Cast Iron (4%)
5. Dual Phase Steel (4%)

八、

已知銅結晶之晶格常數(lattice constant)爲 3.615 埃(Angstrom), 氣體常數爲 8.314 J/mole, 銅空孔(vacancy)之莫耳形成熱爲 83,000 J/mole 。

(a) 請計算銅(Cu)結晶中之原子空孔體積(atomic volume of a vacancy)。(4%)

(b) 請計算銅結晶在 700 K 時之平衡空孔濃度(equilibrium concentration of vacancy)。(4%)