

國 立 宜 蘭 大 學

1 0 6 學 年 度 研 究 所 碩 士 班 考 試 入 學

## 材料科學試題

(化學工程與材料工程學系碩士班)

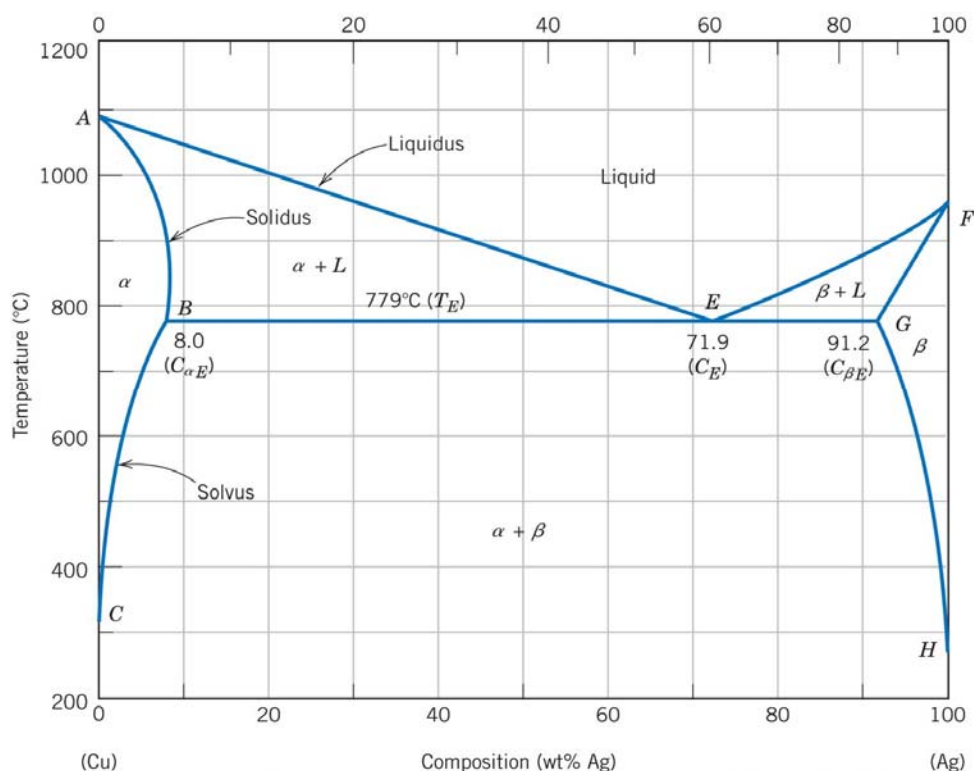
准考證號碼：

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### 《作答注意事項》

- 1.請先檢查准考證號碼、座位號碼及答案卷號碼是否相符。
- 2.考試時間：100 分鐘。
- 3.本試卷共有 5 題大題，一題 20 分，共計 100 分。
- 4.請將答案寫在答案卷上。
- 5.考試中禁止使用手機或其他通信設備。
- 6.考試後，請將試題卷及答案卷一併繳交。
- 7.本試卷採雙面影印，請勿漏答。
- 8.本考科可使用非程式型（不具備儲存程式功能）之電子計算機。

1. (20%) Define (a) Strain hardening (10%)  
 (b) Dislocation (10%)
2. (20%) (a) Sketch (110) plane within a cubic unit cell. (10%)  
 (b) Derive the atomic packing factor for a face-centered cubic (FCC) structure. (10%)
3. (20%) For a copper–silver alloy of composition 30 wt% Ag–70 wt% Cu and at 775 °C (1048 K):  
 (a) Determine the mass fractions of  $\alpha$  and  $\beta$  phases. (10%)  
 (b) Determine the mass fractions of primary  $\alpha$  and eutectic microconstituents. (10%)



4. (20%) (a) To form a stable structure for ceramic materials, does the coordination number increase with the ratio of cationic radius to anionic radius? Draw the unit cell of the NaCl crystal structure as an example. (10%)  
 (b) The diffusion coefficient ( $D$ ) and activation energy ( $Q_d$ ) at 300°C for Cu in Si are  $7.8 \times 10^{-11} \text{ m}^2/\text{s}$  and 41.5 kJ/mol, respectively. What is the diffusion coefficient at 350°C? (Gas constant,  $R$ : 8.314 J/mol-K) (10%)

5. (20%) (a) Briefly plot typical stress-strain curves for natural rubber (NR, elastomer) and polyethylene (PE, plastic) under a tensile test and describe their difference through this plot. (10%)
- (b) Which of the above polymers (natural rubber and polyethylene) has a higher crystallinity? How do you measure the crystallinity? (10%)