題號： 258
科目： 材料工程學
節次： 6

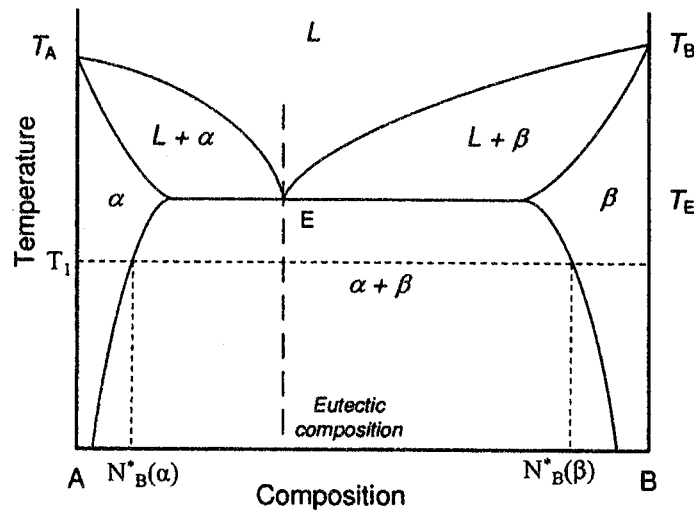國立臺灣大學 108 學年度碩士班招生考試試題

題號：258

共 ２ 頁之第 1 頁

1. Materials Thermodynamics (15%)

Figure below shows an A-B binary phase diagram. The solubility of B in α and β phases at T_I is $N^*_B(\alpha)$ and $N^*_B(\beta)$, respectively. Assume both α and β phases are dilute solutions; thereby, the solute obeys the Henry's law and the solvent obeys the Raoult's law. Find the Henrian activity coefficient of B. (15%)


2. Microstructure & Defects (20%)

(a) Please individually define the following terms in one sentence: (A) crystalline, (B) amorphous, (C) quasicrystal. (6%).

(b) Please individually define the following terms in one sentence: (A) edge dislocation, (B) misfit dislocation, (C) Shockley partial dislocation. (6%)

(c) A metal has BCC crystal structure as shown below. The lattice constant is 0.28 nm. Please calculate the Bragg angle of 1st order diffraction of its slip planes. The X-ray has wavelength of 0.15 nm. (8%)

見背面

題號： 258
科目： 材料工程學
節次： 6

國立臺灣大學 108 學年度碩士班招生考試試題

題號：258
共 2 頁之第 2 頁
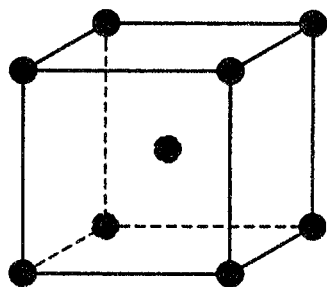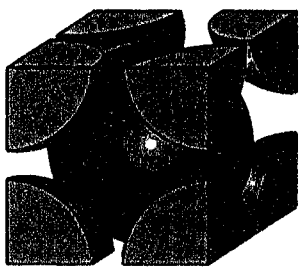
3. Materials Kinetics (10%)

(a) What is Kirkendall effect? (6%)

(b) Kirkendall effect could the most possibly occur in which diffusion couple: (A) Fe-Ni, (B) Cu-Au, (C)Ni-Sn, (D)Si-Ge? (4%)

4. Mechanical Property (15%)

(a) Please try to elucidate the physical meaning of two terms in the equation: $\frac{d\rho}{d\gamma} = \frac{A}{b}\sqrt{\rho} - B\rho$, where ρ is dislocation density, γ is shear strain, b is magnitude of burgers vector, A and B are constants. (6%)

(b) What is the relationship between the above equation and strain hardening? (4%)

(c) A polycrystalline material following the above equation in deformation shows its engineering stress-strain curve below. Which constant is much larger ($\frac{A}{b}$ or B)? How do you know it? (5%)
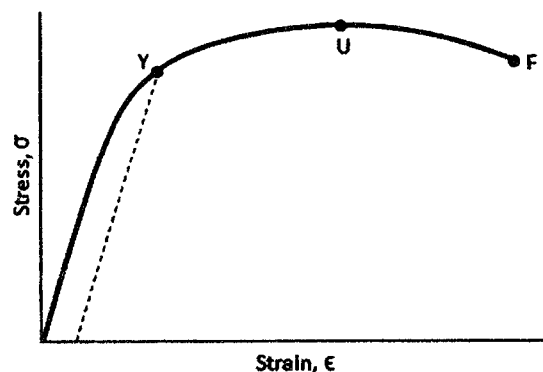
5. Physical Property (15%)

(a) Please write an short essay explaining properties and applications of topological insulator. (10%)

(b) What are the required mechanisms and structures of transparent solar cell? If you know many related technologies, please just write one in details here. (5%)

6. Process & Synthesis (10%)

An example of a ceramic material (product) that has a low Weibull modulus. Explain the relationship among the process, application, and low Weibull modulus of this ceramic material (product). (10%)

7. Applications (15%)

(a) Please shortly compare the applications of steels and aluminum alloys in structure of cars. (5%)

(b) Please shortly compare the properties of Si and GaN in general semiconductor. (5%)

(c) What are critical properties of materials for thermoelectric applications? (5%)

試題隨卷繳回