

國立臺北科技大學九十九學年度碩士班招生考試

系所組別：3722 有機高分子研究所乙組

第二節 材料科學與工程 試題 (選考)

第一頁 共一頁

注意事項：

1. 本試題共六題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

一. Explain following term (use graph if possible): 【30%, each 6%】

1. Fracture toughness, K_{IC}
2. Schmid's law
3. Poisson's ratio
4. Slip system (give an example of FCC crystal structure)
5. The mass action law

二. 【12%】

Calculate the size (radius) of the critical nucleus for pure iron when nucleation takes place homogeneously.

For iron, melting temperature, $T_m = 1808$ K. Heat of fusion = 2098 J/cm³, Surface energy =

204×10^{-7} J/cm². Assume undercooling = $0.2T_m$.

三. 【14%】

Calculate the equilibrium concentration of vacancies per cubic meter in pure silver at 750°C .

Assume that the energy of formation of a vacancy in pure silver is 1.10 eV.

Density of silver = 10.5×10^6 g/m³, at. Mass of silver = 107.87 g, $k = 8.62 \times 10^{-5}$ eV/K.

四. 【15%, each 5%】

1. What is Fick's second law of diffusion?
2. What is the solution of the Fick's second law?
3. Give an industrial application of Fick's second law of diffusion.

五. 【17%】

1. Diffraction from (2 2 0) plane of a gold metal was obtained at $2\theta = 64.582^\circ$ using X-ray of wavelength = 0.1541 nm. What is the interplanar d-spacing of (2 2 0) and lattice constant, a, for this metal? (Assume first-order diffraction, $n = 1$). 【11%】

2. Draw in unit cube the crystal plane that have Miller index (2 2 0). 【6%】

六. 【12%】

A semiconductor is made by adding boron to silicon to give an electrical resistivity of 1.90 $\Omega \cdot \text{m}$. Calculate the concentration of carriers per cubic meter in the material.

[Assume $\mu_n = 0.1350$ m²/(V · s), $\mu_p = 0.048$ m²/(V · s).]