

國立臺北科技大學九十八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（選考）試題

第一頁 共一頁

注意事項：

1. 本試題共 6 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%】

1. Fatigue endurance limit (6%)
2. Critical radius of a homogeneous nucleus (6%)
3. Fick's second law of diffusion (6%)
4. 0.2 percent offset yield strength (6%)
5. strain hardening (cold work) (6%)

二. 【16%】

A silicon wafer is doped with $7.0 \cdot 10^{21}$ phosphorus atoms/m³. Calculate (a) the electron and hole concentrations after doping and (b) the resultant electrical resistivity at 300 K. [Assume $n_i = 1.5 \cdot 10^{16}/\text{m}^3$ and $\mu_n = 0.1350 \text{ m}^2/(\text{V} \cdot \text{s})$]. (每小題各 8 分)

三. 【14%】

A stress of 1000 psi is applied to an elastomer at 27°C, and after 25 days the stress is reduced to 750 by stress relaxation. When the temperature is raised to 50°C, the stress is reduced from 1100 to 400 psi in 30 days. Calculate the activation energy for this relaxation process using an Arrhenius-type rate equation.

四. 【10%】

Determine the critical crack length (mm) for an internal through crack in a thick 2024-T6 alloy plate that has a fracture toughness $K_{IC} = 23.5 \text{ MPa} \sqrt{\text{m}}$ and is under a stress of 300 MPa. Assume $Y = 1$.

五. 【16%】

An x-ray diffractometer recorder chart for an element that has either the BCC or the FCC crystal structure showed diffraction peaks at the following 2 theta angles: 36.191°, 51.974°, 64.982°, and 76.663°. (The wavelength of the incoming radiation was 0.15405 nm.)

- a) Determine the crystal structure of the element. (8%)
- b) Determine the lattice constant of the element. (8%)

六. 【14%】

- a) What is Schmid's law (use graph and equation)? (6%)
- b) What is critical resolved shear stress? Explain whether FCC metals or BCC metals have lower critical resolved shear stress. (8%)