

# 國立臺北科技大學 102 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 7 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 or give an example): **【30%, 每小題 6 分】**

1. Interstitial solid solution
2. Frenkel imperfection
3. Extrinsic semiconductor (n-type and p-type)
4. Yield strength (0.2 percent offset yield strength)
5. Craze (in brittle or ductile fracture of polymeric materials?)

二. **【14%】**

Calculate the intrinsic electrical conductivity of InSb at 27°C and at 60°C. [ $E_g = 0.17$  eV; at 27°C:  $\mu_n = 8.0$  m<sup>2</sup>/(V·s);  $\mu_p = 0.045$  m<sup>2</sup>/(V·s);  $n_i = 1.35 \cdot 10^{22}$  m<sup>-3</sup>.]

三. **【10%】**

Draw a typical creep curve for a metal under constant load and at a relatively high temperature, and indicate on it all three stages of creep. Give explanation.

四. **【12%, 每小題 6 分】**

X rays of an unknown wavelength are diffracted by a gold sample. The  $2\theta$  angle was 64.582° for the {220} planes.

- a) Determine the inter-planar d-spacing of {220} plane of gold.
- b) Determine the wavelength of the X rays used?

(The lattice constant of gold = 0.40788 nm; assume first-order diffraction,  $n = 1$ .)

五. **【12%】**

Which equipment can you use to observe dislocations (line defects) and grain boundaries, respectively? Explain why or how to use the equipment for the observation of these defects.

六. **【10%】**

The diffusivity of manganese atoms in the FCC iron lattice is  $1.50 \cdot 10^{-14}$  m<sup>2</sup>/s at 1300°C and  $1.50 \cdot 10^{-15}$  m<sup>2</sup>/s at 400°C. Calculate the activation energy in kJ/mol for this case in this temperature range.  $R = 8.314$  J/(mol·K).

七. **【12%, 每小題 4 分】**

A hydrogen atom exists with its electron in the  $n = 4$  state. The electron undergoes a transition to the  $n = 3$  state.

Calculate (a) the energy of the photon emitted, (b) its frequency, and (c) its wavelength in nanometers (nm).  $1 \text{ eV} = 1.6 \cdot 10^{-19} \text{ J}$

$h = 6.63 \cdot 10^{-34} \text{ J} \cdot \text{s}$