

# 國立臺北科技大學 101 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 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 or give an example) 【30%】 (Each 6%)

1. Gas carburizing
2. Schottky imperfection
3. Intrinsic semiconductor
4. Recovery of cold-worked metal
5. Schmid's law

二. 【14%】

An arsenic-doped silicon wafer has an electrical resistivity of  $7.50 \times 10^{-4} \Omega \cdot \text{cm}$  at  $27^\circ\text{C}$ .

Assume complete ionization. [Assume  $\mu_n = 0.1350 \text{ m}^2/(\text{V} \cdot \text{s})$ ,  $\mu_p = 0.048 \text{ m}^2/(\text{V} \cdot \text{s})$ ]

What is the majority-carrier concentration (carriers per cubic centimeter)?

三. 【12%】

The critical stress intensity ( $K_{IC}$ ) for a material for a component of a design is  $23.0 \text{ ksi} \sqrt{\text{in}}$ .

What is the critical stress that will cause fracture if the component contains an internal crack  $0.13 \text{ in.}$  long? Assume  $Y = 1$ .

四. 【16%】 (Each 8%)

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:

$38.60^\circ$ ,  $55.71^\circ$ ,  $69.70^\circ$ ,  $82.55^\circ$ ,  $95.00^\circ$ , and  $107.67^\circ$ . (The wavelength of the incoming radiation was  $0.15405 \text{ nm}$ )

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

五. 【12%】

Calculate a value for the density of FCC platinum in grams per cubic centimeter from its lattice constant  $a$  of  $0.39239 \text{ nm}$  and its atomic mass of  $195.09 \text{ g/mol}$

六. 【16%】 (Each 8%)

(a) In the solidification of a pure metal, what are the two energies involved? Write the equation for the total free-energy change involved in the homogeneous nucleation.

(b) Illustrate graphically the energy changes associated with the formation of a nucleus during solidification vs radius of a homogeneous nucleus or embryo. Mark critical radius of a homogeneous nucleus in the graph.