國立臺北科技大學100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）

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. Solid-solution hardening (strengthening)
2. Fracture toughness, K_{IC}
3. Extrinsic semiconductor
4. 0.2 percent offset yield strength
5. Critical radius of a homogeneous nucleus

二. (12%)

The electrical resistivity of pure germanium is 0.46 Ω · m at 300 K. Calculate its electrical conductivity at 425°C. For germanium, the band energy gap, Eg = 0.67 eV

k = 8.62x 10^{-5}eV/K

三. (12%)

The diffusivity of copper atoms in the aluminum lattice is 7.50 · 10^{-13} m^2/s at 600°C and 2.50 · 10^{-15} m^2/s at 400°C.

Calculate the activation energy for this case in this temperature range. [R = 8.314 J/(mol ·K)]

四. (18%, each 9%)

A 0.505-in -diameter aluminum alloy test bar is subjected to a load of 25,000 lb. If the diameter of the bar is 0.490in. at this load, determine (*a*) the engineering stress and strain and (*b*) the true stress and strain.

五. (12%, each 6%)

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

六. (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: 41.069°, 47.782°, 69.879°, and 84.396°. (The wavelength of the incoming radiation was 0.15405 nm.)

a) Determine the crystal structure of the element.

b) Determine the lattice constant of the element.