國立臺北科技大學 101 年度產業碩士專班招生考試

系所班別：材料科學與工程研究所電子材料產業碩士專班

310 材料科學導論 試題（選考）

注意事項：

1. 本試題共八題，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、What are the three types of primary bonds in engineered materials? Fully explain these bonds in terms of

(a) the nature of the bond. (9%)

(b) the ductility and electrical conductivity of the materials bonded in these ways. (6%)

二、A metal having a FCC crystal structure with a lattice constant a = 0.408 nm.

(a) Calculate the atomic radius in cm. (6%)

(b) Calculate the planar density for the (110) plane in atom/cm^2. (6%)

三、Explain the following terms: (a) strain hardening; (b) grain-size strengthening; and (c) solid-solution strengthening. (12%)

四、Derive the expression $\varepsilon = ln\,(1 + e)$, which is valid before the onset of necking in a tensile test, where ε is the true strain and e is the engineering strain. (12%)

五、The yield strength of Al-4%Cu alloy can be improved substantially using precipitation hardening. Fully explain the three steps in the precipitation hardening heat treatment. (15%)

六、(a) What is the meaning of sintering? (4%)

(b) What is the driving force for sintering? Explain. (6%)

七、The electrical conductivity of materials is affected by the temperature. State and explain the change in electrical conductivity of a pure metal and an intrinsic semiconductor as a function of temperature. (12%)

八、Define the following terms: (a) electrostriction; (b) piezoelectricity; and (c) ferroelectricity. (12%)