國立交通大學 101 學年度碩士班考試入學試題

科目：材料科學(3171)　　考試日期:101 年 2 月 17 日 第 1 節

系所班別：材料科學與工程學系奈米科技碩士班　　第 / 頁, 共 / 頁

【可使用計算機】＊作答前請先核對試題、答案卷(試卷)與准考證之所組別與考科是否相符！！

1. (a) Design an experiment for measurement ductile-to-brittle transition. Explain how you can measure if a material has ductile-to-brittle transition. (b) Explain why some steels experience this transition. (*15 pts*)

2. Compare the temperature dependence of the conductivity for metals and intrinsic semiconductors. Explain the difference in behavior in details. (*15 pts*)

3. (a) Define glass transition temperature for polymers and ceramics materials. (b) List three properties that can changes significantly when the materials are heated above glass transition temperature. (10 points)

4. List three factors that influence the melting temperature of polymers and explain how they affect the temperature. (10 points)

5. Please write down the Hall-Petch equation and define each term carefully. Please explain under what conditions that Hall-Petch equation become inapplicable. (5+5 points)

6. Mo adopts a BCC structure at room temperature. Please calculate the planar densities for (100) and (110), respectively (using R=atomic radius). Between these two planes, which plane has a larger surface energy and why? What is the unit of surface energy? Do you expect surface energy to increase with temperature or decrease with temperature and why? (10+3+2+5 points)

7. What are the reasons that nanoparticles tend to demonstrate different chemical and physical properties as compared to their bulk materials. (5+5 points)

8. Please calculate the resolved shear stress on the (111) $[0\bar{1}1]$ slip system in a FCC unit cell if a stress of 13.7 MPa is applied in the [001] direction. (10 points)