

## 國立台灣科技大學九十八學年度碩士班招生試題

系所組別：機械工程系碩士班戊組

科目：材料原理

(總分為 100 分)

1. Please schematically describe the temperature effect on the conductivities of metal and semi-conductor. (10 points)
2. Illustrate the effect of temperature on the hysteresis loops of soft magnet and hard magnet schematically. (10 points)
3. What is LEDs? How does it work? Is it similar to LCD? If so, in which aspect? (10 points)
4. A protective coating of ceramic enamel is applied to a steel plate. When the steel plate is quenched into cold water from a high temperature would cause cracking of the ceramic coating. Why? List all factors that would affect this phenomenon. (10 points)
5. List all the techniques that are used to combat electrochemical corrosion. (10 points)
6. (a) Beryllium and magnesium, both in the 2A column of the periodic table, are lightweight metals. Which would you expect to have the higher modulus of elasticity? Explain, considering binding energy and atomic radii and using appropriate sketches of force versus interatomic spacing. (b) Would you expect MgO or magnesium to have the higher modulus of elasticity? Explain. (10 points)
7. A single crystal of an FCC metal is oriented so that the [001] direction is parallel to an applied stress of 5000 psi. Calculate the resolved shear stress acting on the (111) slip plane in the [110], [011], and [101] slip directions. Which slip system(s) will become active first? (10 points)
8. (a) What is the "Hall-Petch equation"? Please explain the meaning of this equation. (b) If the Hall-Petch equation is valid, answer the following question. The yield strength of mild steel with an average grain size of 0.05mm is 20,000 psi. The yield stress of the same steel with a grain size of 0.07 mm is 40,000 psi. what will be the average grain size of the same steel with a yield stress of 30,000 psi? (10 points)
9. Not all alloys are age-hardenable. Please itemize conditions that must be satisfied for an alloy to have an age-hardening response during heat treatment. Can you draw a phase diagram showing the general characteristics of the age-hardenable alloys? Give an example. (20 points)

