

# 國立聯合大學 107 學年度碩士班考試招生

## 材料科學工程學系 入學考試試題

科目： 材料科學導論 第 1 頁共 2 頁

### A. 選擇題(單選)，每題5分，共100分

1. For FCC metal, the number of slip system is (a) 3 (b) 6 (c) 9 (d) 12 (e) 8
2. The group of dielectric materials exhibiting spontaneous polarization is called (a) insulator (b) ferromagnetic materials (c) ferroelectric materials (d) transistor (e) paramagnetic materials
3. The Orthorhombic crystal system shows (a)  $a \neq b \neq c, \alpha = \beta = \gamma = 90^\circ$  (b)  $a = b = c, \alpha = \beta = \gamma = 90^\circ$  (c)  $a = b \neq c, \alpha = \beta = \gamma = 90^\circ$  (d)  $a = b = c, \alpha = \gamma = 90^\circ \neq \beta$
4. The screw dislocation has (a) Burger vector  $\perp$  slip direction (b) Burger vector  $\perp$  dislocation line (c) Burger vector //dislocation line (d) dislocation line  $\perp$  slip direction
5. Which direction lies in the (111) plane in FCC crystal? (a)  $[1\bar{1}1]$  (b)  $[110]$  (c)  $[12\bar{1}]$  (d)  $[\bar{1}01]$  (e)  $[001]$
6. Polymer are: (a) Brittle, strong (b) Brittle, weak (c) Ductile, strong (d) Ductile, weak (e) Tough, weak
7. What is the Schottky defect? (a) cation-anion vacancy pair (b) cation vacancy (c) interstitial ion and a vacancy (d) anion vacancy
8. The number of tetrahedral interstitial site in FCC structure is (a) 2 (b) 4 (c) 6 (d) 8.
9. The structural role for  $\text{Na}_2\text{O}$  in soda-lime silicate glass is (a) network former (b) network modifier (c) intermediate (d) impurity (e) colorant.
10. The number of bridging oxygen per polyhedron for a pure  $\text{SiO}_2$  glass is (a) 1 (b) 0 (c) 3 (d) 4 (e) 5.
11. The endurance limit (a) is relative to a creep test (b) exists for all metals (c) is reduced by surface defects (d) is increased by corrosive environment.
12. Which of the following statements is false? Creep deformation is (a) a thermally activated process (b) interface-controlled process (c) diffusion-controlled process (d) involving dislocation climb
13. An electromagnetic radiation having a wavelength of 380 nm is (a) X-ray (b) visible light (c) infrared ray (d) ultraviolet ray
14. The corundum crystal structure, found for  $\text{Al}_2\text{O}_3$ , consists of an HCP arrangement of  $\text{O}^{2-}$  ions; and  $\text{Al}^{3+}$  ions occupy (a) All octahedral sites (b)  $\frac{1}{2}$  fraction of octahedral sites (c)  $\frac{1}{4}$  fraction of tetrahedral sites (d)  $\frac{2}{3}$  fraction of octahedral sites (e)  $\frac{1}{2}$  fraction of tetrahedral sites.
15. Thermal energy can be conducted through a solid material by two mechanisms: one is the motion of free electrons and the other is (a) cations (b) phonons (c) photons (d) anions
16. The void volume in the body-centered cubic structure is about (1) 48% (b) 32% (c) 26% (d) 54% (e) 68%
17. The ability to form interstitial solid solutions depends on the same factors that apply for substitutional solid solution, except for (a) size factor (b) valency factor (c) structure type (d) chemical affinity.

18. The phenomenon of intergranular corrosion in the Austenitic stainless steels is called (a) activation (b) passivation (c) sensitization (d) stimulation (e) nitridation.
19. The method to determine the hardenability of a steel is (a) hardness testing (b) Charpy impact testing (c) fatigue testing (d) Jominy end-quench testing (e) Ultrasonic transmission testing
20. When a material system undergoes an adiabatic expansion, which of the following statement is true? (a) The temperature of the system does not change (b) The internal energy of the system does not change (c) The pressure of the system increases (d) The temperature of the system decreases (e) The heat transfers into the system.

**B. 問答及計算題，每題20分，共100分**

1. Describe the strengthening mechanisms for the materials.
2. Calculate the density of FCC Aluminum (in  $\text{g/cm}^3$ )? The atomic mass of Al is 26.98 and the atomic radius of Al atom is 0.143 nm.
3. An FCC crystal slips on the (111) plane in the  $[\bar{1}\bar{1}0]$  direction when 3.5 MPa are applied in the direction  $[2\bar{1}1]$ . Calculate the critical resolved shear stress..
4. The conductivity of an intrinsic semiconductor is doubled when the temperature increases from  $50^\circ\text{C}$  to  $100^\circ\text{C}$ . Calculate the band gap of the semiconductor. (Boltzmann's constant =  $8.62 \times 10^{-5}$  eV/K)
5. Consider a sample of MgO containing 0.2 mol%  $\text{Li}_2\text{O}$  which create anion vacancies for charge balance. Calculate the fraction of vacancy that arises because of the presence of the impurity.