※ 考生請注意：本試題 ☑可 ☐不可 使用計算機

2009 Biomedical Engineering Master Entrance Exam—Materials Science

(可用計算機)

I. 解釋名詞: (50 分 每題 2 分)

1. Annealing
2. Alloy
3. Cold working
4. CRSS
5. Viscoelasticity
6. Electric dipole
7. Phase diagram
8. FCC
9. Fracture toughness
10. Frenkel and Schottky defects
11. Grain
12. Dislocation line
13. Stress relaxation
14. Slip system
15. Recrystallization
16. Fatigue life
17. Stoichiometry
18. Syndiotactic
19. Unit cell
20. Interdiffusion and interstitial diffusion
21. Ductility vs brittle
22. Resilience vs toughness
23. True stress, corrected stress, and engineering stress
24. Yield strength vs. tensile strength
25. Tran and Cis structure

(背面仍有題目,請繼續作答)

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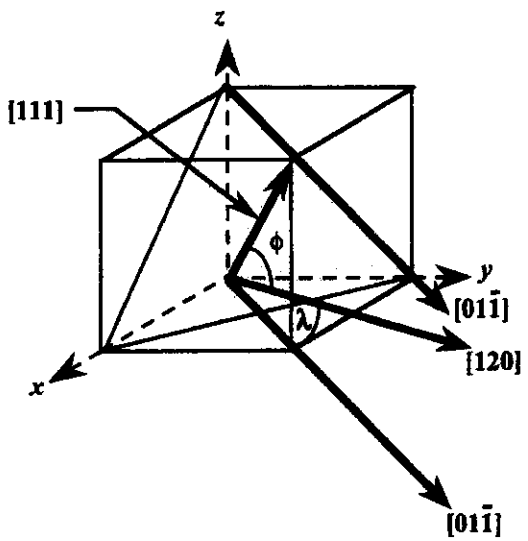
II. 計算及簡答題 (50 分，每題 10 分)

1. Determine the magnitude of the Schmid factor (resolved shear stress) for an FCC single crystal oriented with its [120] direction parallel to the loading axis. Slip Plane (111) Slip direction [01-1]



2. Some aircraft component is fabricated from an aluminum alloy that has a plane strain fracture toughness of 43 MPa m . It has been determined that fracture results at a stress of 290 MPa when the maximum (or critical) internal crack length is 3.5 mm. For this same component and alloy, will fracture occur at a stress level of 320 MPa when the maximum internal crack length is 7.5 mm? Why or why not?

3. A three-point bending test is performed on a spinel ($MgAl_2O_4$:the elastic modulus (E) for spinel is 260 GPa) specimen having a rectangular cross section of height d = 3.8 mm and width b = 9 mm; the distance between support points is 25 mm. (a) **Compute the flexural strength** if the load at fracture is 350 N.
(b) The point of maximum deflection Δy occurs at the center of the specimen and is described by

$$\Delta y = FL^3/48EI$$

where E is the modulus of elasticity and I is the cross-sectional moment of inertia. **Compute Δy at a load of 310 N.**

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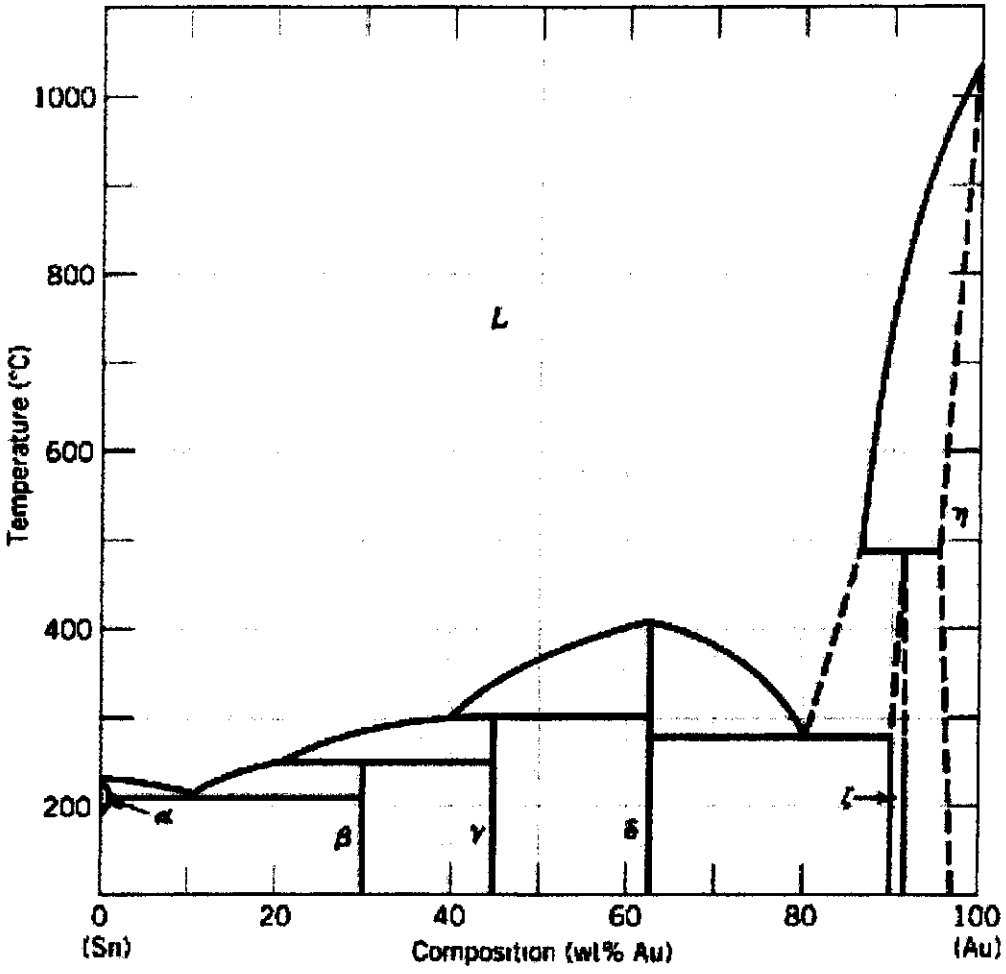
4. Next figure is the tin–gold phase diagram, for which only single-phase regions are labeled. Specify temperature–composition points at which all eutectics, eutectoids, peritectics, and congruent phase transformations occur. Also, for each, write the reaction upon cooling.



5. Please draw the repeat unit (monomer) of the following common polymers.

(1) Poly(vinly chloride)

(2) Poly (propylene)

(3) Poly(methyl methacrylate)

(4) Polystyrene

(5) Poly(dimethyl siloxane)