※ 考生請注意：本試題 ☑可 ☐不可 使用計算機

I. 解釋名詞 (文字敘述或圖示) : (50 分 每題 2 分)

1. ASTM standard
2. Atomic point defect
3. Biomaterials
4. Bragg's law
5. Corrosion fatigue
6. Creep
7. Crystal
8. Ductile-to-brittle transition
9. Eutectic Phase
10. Fatigue limit
11. Frenkel defect
12. Glass transition
13. HCP structure
14. K_{Ic}
15. Melting spinning
16. Mixed Dislocation
17. Pitting
18. Piezoelectric
19. Poisson's ratio
20. Shear modulus
21. Strain hardening
22. True stress
23. Trans (for polymers)
24. Valence electron
25. van der Waal bond

II. 計算及簡答題 (共 50 分)

1. Magnesium Oxide (MgO) has the rock salt crystal structure and a density of 3.58 g/cm^3 Determine the unit cell edge length. (8%)

2. Calculate the energy for vacancy formation in silver, given that the equilibrium number of vacancies at 800°C (1073 K) is 3.56 × 1023 m^{-3} The atomic weight and density (at 800°C) for silver are, respectively, 107.9 g/mol and 9.5 g/cm^3. (Hint: $N= N_0 \exp(-Q_v/kT)$ where k= 8.62 10 eV/atom-K) (8%)

(背面仍有題目,請繼續作答)

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3. Sketch portions of a linear **polypropylene** molecule that are (a) syndiotactic, (b) atactic, and (c) isotactic. Use two-dimensional schematics. (6%)

4. A single crystal of a metal that has the FCC crystal structure is oriented such that a tensile stress is applied parallel to the [100] direction. If the critical resolved shear stress for this material is 0.5 MPa, calculate the magnitude(s) of applied stress(es) necessary to cause slip to occur on the (111) plane in each of the $[1\bar{1}0]$, $[10\bar{1}]$, and $[0\bar{1}1]$ directions. (10%)

5. The fraction recrystallized–time data for the recrystallization at 350°C of a previously deformed aluminum are tabulated here. Assuming that the kinetics of this process obey the Avrami relationship, determine the fraction recrystallized after a total time of 116.8 min.
(Hint: $1-y=\exp(-kt^n)$ where y: fractional recrystalliztion; t: time) (8%)

Fraction Recrystallized	***Time (min)***
0.30	*95.2*
0.80	*126.6*

6. A lead–tin alloy of composition 30 wt% Sn–70 wt% Pb is slowly heated from a temperature of 150°C.
(a) At what temperature does the first liquid phase form?
(b) What is the composition of this liquid phase?
(c) At what temperature does complete melting of the alloy occur?
(d) What is the composition of the last solid remaining prior to complete melting? (10%)