國立聯合大學 105 學年度

材料科學工程 (院)學系轉學生招生考試試題紙

科目：材料科學導論 第____頁共____頁

1. Fig1 is called diamond structure, what is the Bravais lattice of this structure: (a) Simple Cubic, (b) Face-Centered Cubic, (c) Body-Centered Cubic, (d) Hexagonal Close-Packed

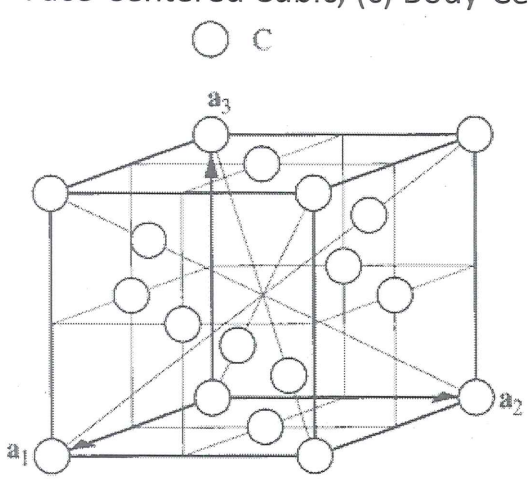


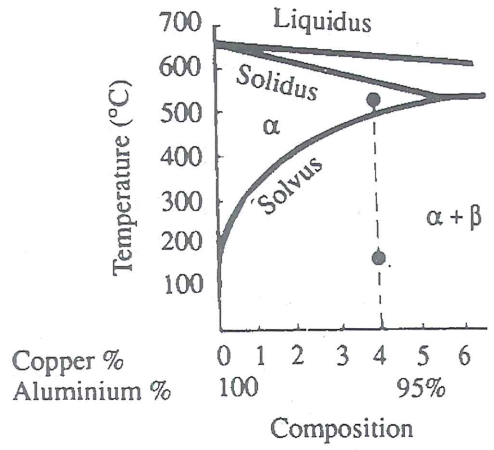
Fig 1 Diamond

2. Several factors that affect the creep characteristics of supperalloys. In the followings which is not the properties of this alloys: (a) fine grain size, (b) high melting temperature, (c) high Young's Modulus, (d) solid-solution strengthened.
3. Which one of the following explanations is not the hexagonal close-packed structure: (a) the coordination of number of 12, (b) the packing factor of 0.74, (c) having two lattice points per cell, (d) the basis of 2.
4. Which one of following metals is influenced by temperature changes: (a) Magnesium, (b) Aluminum, (c)Nickle (d) Iron
5. Two designs of an aircraft wing: In Design A the allowable flaw size is 9mm and failure stress is 112 MPa while in Design B using the same material (with its fracture toughness of K_{Ic} = 26 MPa-$m^{0.5}$) its allowable flaw size is 4mm. and What is the critical failure stress of Design B: (a) 168 (b) 252 (c) 108 (d) 117 (MPa).
6. Compute the planar density values for (110) planes of vanadium, given that V has a BCC crystal structure, a density of 5.96 g/cm^3, and an atomic weight of 50.9 g/mol. (Note: Avogadro's number= 6.02×10^{23} atoms/mol): (a) 7.6 (b) 15.2 (c) 22.8 (d) 21.5 (nm^{-2})
7. Germanium and silicon are completely soluble in each other in both the liquid and solid states. What is the possible the solidus temperatures for the alloy composition of 45%Si, 55%Ge: (a) 1050°C (b) 1070°C (c)1250°C (d) 1270°C.

Alloy		*Liquidus temperature*	*Solidus temperature*
Germanium %	*Silicon %*	*(°C)*	*(°C)*
100	0	958	958
80	20	1115	990
60	40	1227	1050
40	60	1315	1126
20	80	1370	1230
0	100	1430	1430

8. The relevant part of the aluminum-copper thermal equilibrium diagram is given in the following figure. For a 4%Cu-96%Al alloy after it has been heated 530°C, held at that temperature for a few hours, and this sample then cooled (a) at the furnace to room temperature, (b) at water to room temperature and (c) at air to room

temperature or (d) at oil to room temperature, and then reheat at 100°C for 6 hours after rapid cooling respectively. For the above four cooling methods what is the most tensile strength.



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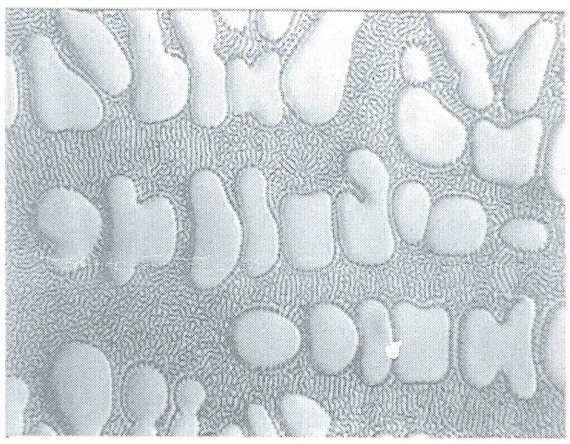
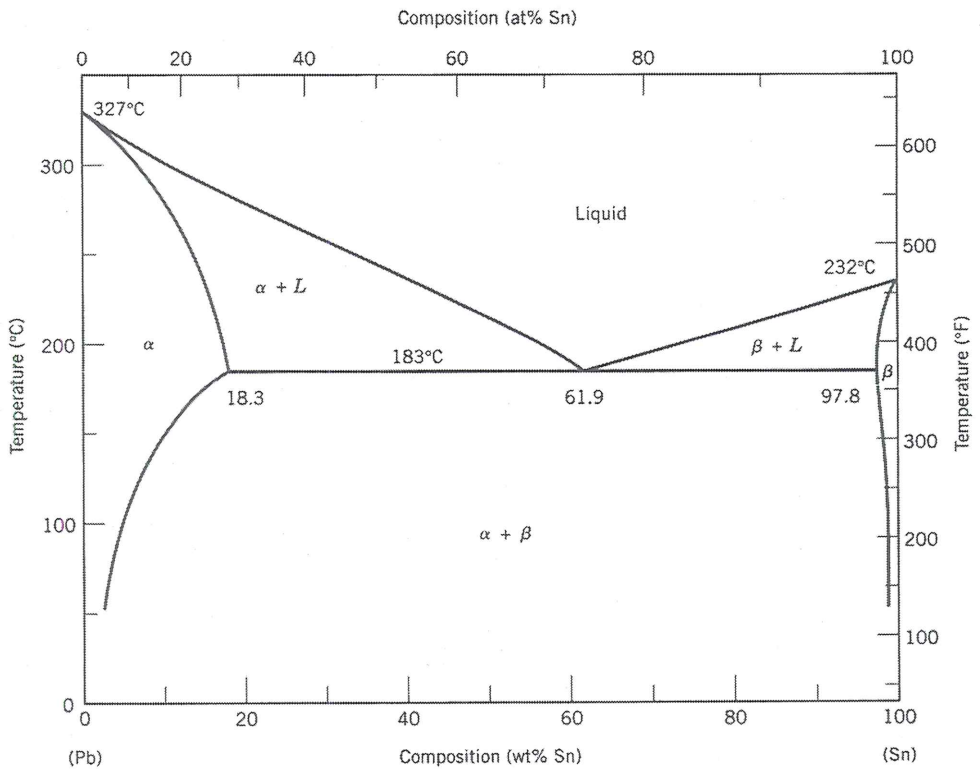
第 2 頁

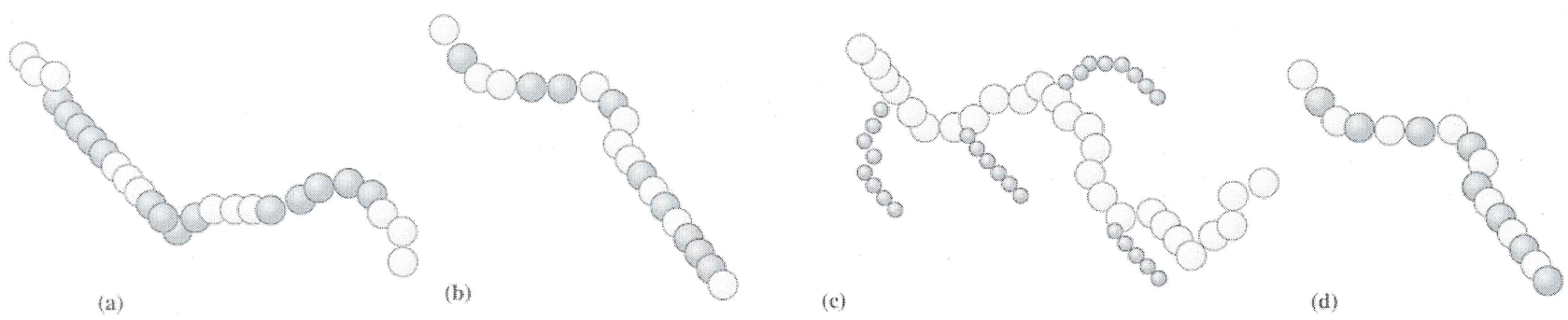
9. What is the possible composotion of the fllowoing microstructure for Lead-Tin two phase alloys: (a) 38.1 wt%Pb, (b) 64.7 wt%Pb, (c) 15.5 wt% Pb, (d) 1.2 wt% Pb.



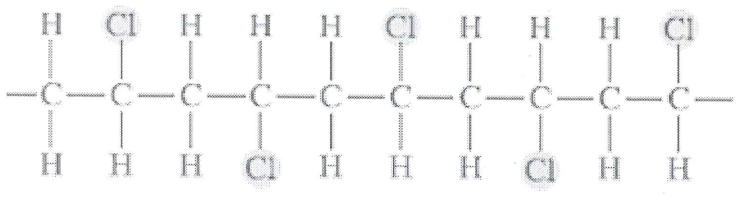
Note: The Light and dark phases are tin-rich and lead-rich solid solutions, respectively



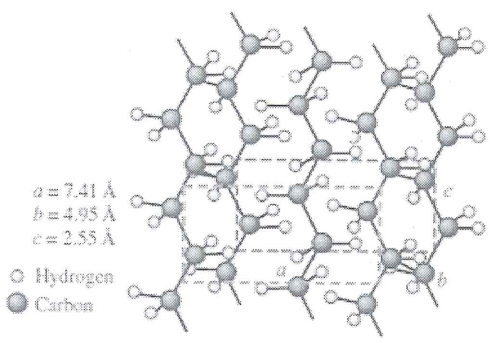
10. In Iron-Carbon equibrieum phase diagram which of the following three-phase reactions does not exist: (a) peritetoid, (b) eutectioid, (c) eutectic, and (d) peritectic reactions.
11. What is the block coplymers in the following four types of coploymers:



12. What is the followoing arragngment of nonsymmetrical monomers: (a) biotactic, (b) atactic, (c) isotactic, (d) syndiotactic.



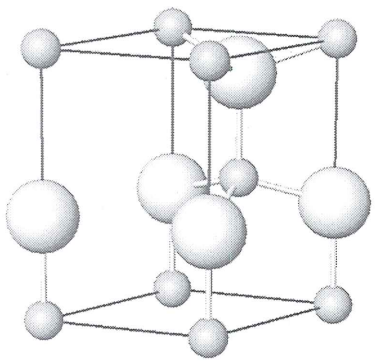
13. A new grade of flexible, impact-resistant polyethylene for use as a thin film requires a density of 0.88 to 0.915 g/cm^3. Which one of the following crystallinities is not the designed polyethylene required to produce these properties: (a) 5 (b) 15 (c) 25 (d) 35, % (Note: the desnsity of amorphous polyethylene is about 0.87 g/cm^3. The % Crystaline= $\frac{\rho_c(\rho-\rho_a)}{\rho(\rho_c-\rho_a)} \times 100$ where the ρ, ρ_a , and ρ_c are the densities of the measured polymer, amorphous polymer, and completely crystalline polymer, respectively.)



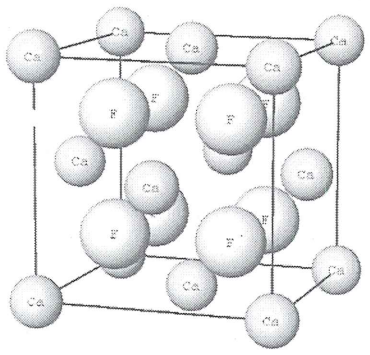
the unit cell of crystalline polyethylene

14. Which one of the following fractgraphs is not the fractured surface of fatigue failure: (a) crack initiated from dislocation slip steps, (b) beachmarks, (c) striations, (d) dimple.

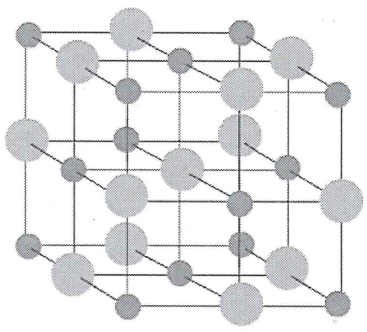
15. Which one of the following ceramic crystal structures is Simple Cubic lattice:



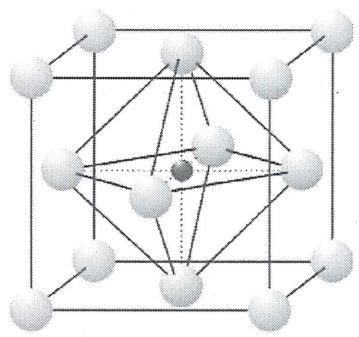
(a) Wurtzite (ZnS)



(b) Fluorite (CaF_2)



(c) Sodium Chloride (NaCl)

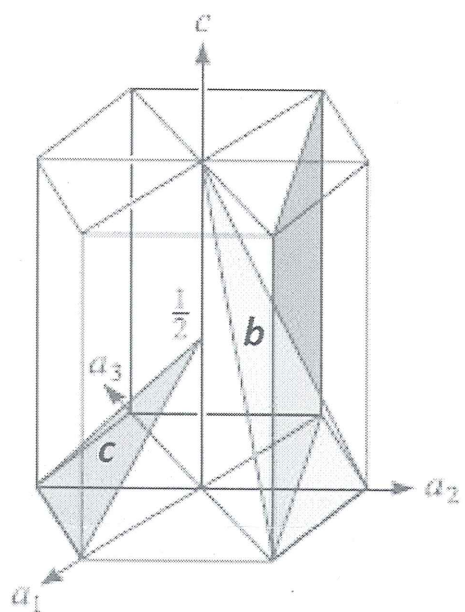


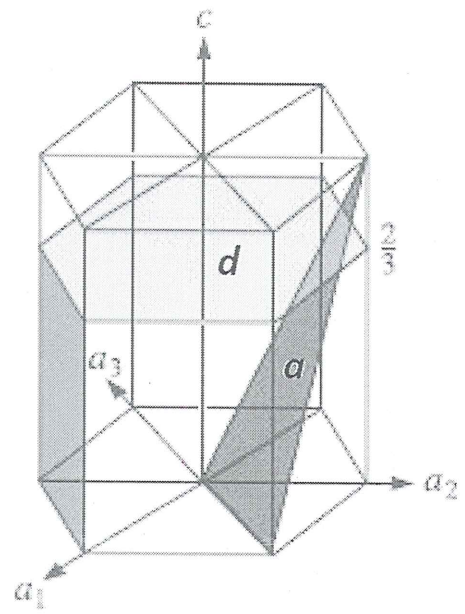
(d) Perovskite ($CaTiO_3$)

16. In steel Martensite phase is produced by heat treamemnt. Which one of the following is not explaintion of Martensite: (a) Body-Centered Tetragonal (b) Body-Centered Cubic, (c) diffusionless solid-state transformation, (d) volume expanded after transformation.
17. In the **C**ontinuous **C**ooling **T**ransformation (C.C.T.) diagram of 0.8wt% plain carbon steel, after various cooling rates of heat treatments which one of the following structures does not exist: (a) Martensite, (b) Bainite, (c)coarse pearlite,(d) fine pearlite.
18. Which is composition in iron-carbon phase diagram for the following optical microstructure: (a) 0.02 wt% C, (b) 0.4 wt% C, (c) 1.5 wt% C, (d) 3.5 wt% C.

black graphite flakes in matrix of pearlite

19. Which flollowing plane is Millers index of $(1\bar{1}01)$:





20. The type of oxide film influences the rate at which oxidation occurs.
For the oxidiation reaction: $n\,M + m\,O_2 \rightarrow M_n\,O_{2m}$

The **Pilling –Bedworth** (P-B) **ratio** is $\frac{(M_{oxide})(\rho_{metal})}{n(M_{metal})(\rho_{oxide})}$ where M is the atomic or molecular mass, ρ is the density, and n is the number of metal atoms in the oxide, which is possible PB ratio of aluminium metal with adherent, non-porous proctective alumimum oxide film on its surface. (Note: the density of aluminium is 2.7 g/cm^3 and that of Al_2O_3 is about 4 g/cm^3. The molecular weight of Al_2O_3 is 101.96 g/mol and that of aluminium is 26.981 g/mol.): (a) 0.3 (b) 1.3 (c) 2.3 (d) 3.3.