國立成功大學

112學年度碩士班招生考試試題

編　號：70

系　所：機械工程學系

科　目：機械製造及材料

日　期：0206

節　次：第 1 節

備　註：可使用計算機

※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Explain or distinguish the following terms: (12%)

   (a) TTT vs CCT diagrams　　　　　　　(b) Fatigue life vs fatigue limit

   (c) Gibbs phase rule

2. (a) Cite the primary differences between elastic, anelastic, viscoelastic and plastic deformation behaviors? (4%)

   (b) A single crystal of a metal that has the BCC crystal structure is oriented such that a tensile stress is applied in the [100] direction. If the magnitude of this stress is 4.0 MPa, compute the resolved shear stress in the [1 $\bar{1}$ 1] direction on the (110) plane. (8%)

   (c)　List four methods for strengthening metals and alloys and explain the mechanisms briefly. (8%)

3. (a) Using the Figure 1 below, for an alloy of composition 25 wt% Sn-75 wt% Pb, determine the phase(s) present and their composition(s) at 200°C? (6%)

   (b) For alloys of two hypothetical metals A and B, there exist an α, A-rich phase and a β, B-rich phase. From the mass fractions of both phases for two different alloys provided in the Table 1, determine the composition of the phase boundary for both α and β phases at this temperature. (8%)

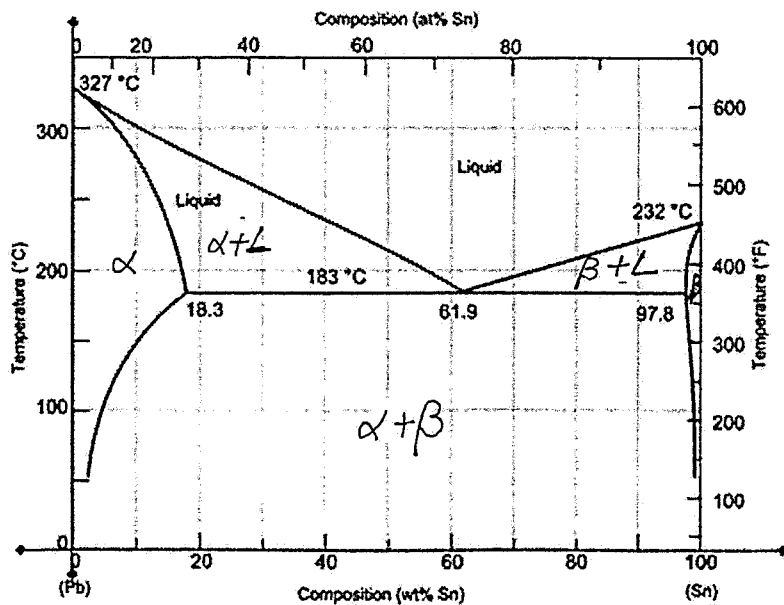   (c) Explain the reason causing the specific structure in Figure 2, and what is this structure called? (4%)

Figure 1

Alloy Composition	Fraction α Phase	Fraction β Phase
60 wt% A - 40 wt% B	0.57	0.43
30 wt% A - 70 wt% B	0.14	0.86

Table 1

Figure 2

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4. Please explain machinability and what it means in engineering. (10%)

5. Please explain the lost-wax and lost-foam processes and the similarities and differences between these two processes. (10%)

6. A solid cylindrical slug made of 6061 is 120 mm in diameter and 80 mm high. It is reduced in height by 50% at room temperature by open-die forging with flat dies. Assuming that the coefficient of friction is 0.3, calculate the forging force at the end of the stroke. (15%)

7. An orthogonal cutting operation is being carried out under the following conditions: t_0 = 0.1 mm, t_c = 0.2 mm, the width of cut = 5 mm, V = 2 m/s, rake angle = 10°, F_c = 500 N, and F, = 200 N. Calculate the percentage of the total energy that is dissipated in the shear plane. (15%)