編號： 75

國立成功大學 109 學年度碩士班招生考試試題

系　　所：機械工程學系

考試科目：機械製造及材料

考試日期：0210，節次：2

※ 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) Toughness vs Resilience　　(b) Coarse pearlite vs fine pearlite

   (c) Isotropic vs anisotropic

2. (a) Compare interstitial and vacancy atomic mechanisms for diffusion (6%)

   (b) Cite two reasons why interstitial diffusion is normally more rapid than vacancy diffusion. (6%)

   (c) What is Fick's first law for diffusion? (4%)

3. (a) Considering the Cu-Ni phase diagram (Fig. 1), derive the lever rule (represented by W_α, and W_L, C_L, C_0, C_α)? (10%)

   (b) See Fig. 2, for a 99.6 wt% Fe-0.40 wt% C steel at a temperature just below the eutectoid, determine the amount of cementite, pearlite and proeutectoid ferrite (α) (in grams) that forms in 100 g of steel. (12%)

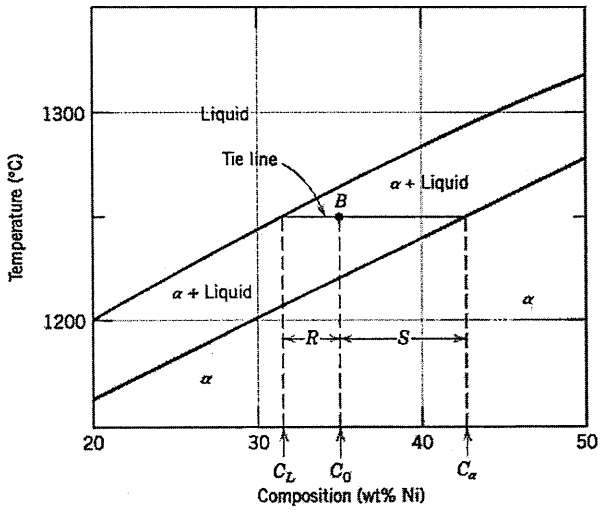

Fig. 1

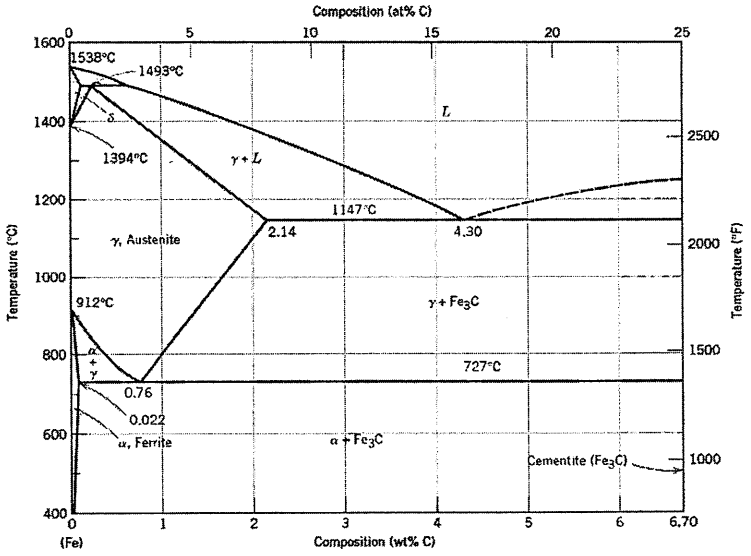

Fig. 2

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4. Explain the following manufacturing processes.
   (a) Powder Metallurgy Process (3%)
   (b) Selective Laser Sintering (3%)
   (c) Metal Extrusion (3%)
   (d) Injection Molding (3%)
   (e) Photolithography (3%)

5. Answer the following questions regarding to stress and strain.
   (a) What is the difference between true strain and engineering strain? (4%)
   (b) The relationship between true stress and true strain is $\sigma = K\epsilon^n$, where σ is true stress, ϵ is true strain, K and n are constants. For low carbon steel, K is 530 MPa and n is 0.26. What is the engineering ultimate tensile stress? (4%)
   (c) Please derive that $n = \epsilon$ in the condition of necking. (7%)

6. Answer the following questions.
   (a) What is the specific energy in machining? (5%)
   (b) For steels, the specific energy is about 2-9 W·s/mm^3 in cutting, and it is 14-68 W·s/mm^3 in grinding. Why the specific energy in grinding is much higher than that in cutting? (5%)

7. Explain and compare Laser Machining and Electricial-discharged Machining. Which one would cause thermal damage on the workpiece? (10%)