

Name: _____ Student ID No: _____

Faculty of Engineering Prince of Songkla University

การสอบกลางภาคการศึกษาที่ 1

ปีการศึกษา 2551

วัน พุธ ที่ 30 ก.ค. 2551

เวลา 13:30 – 16:30 น.

วิชา 237-322 Metallic Materials

ห้อง R200

คำสั่ง

- (1) เขียนคำตอบให้สมบูรณ์ทุกข้อเพื่อให้ได้คะแนนเต็ม
- (2) ให้เอา Note ขนาด A4 ที่เขียนด้วยลายมือเข้าได้ (ห้ามถ่ายเอกสาร)
- (3) ให้เอา Calculator และ Dictionary เข้าห้องสอบได้
- (4) อ่านคำสั่งให้ละเอียด และตอบทุกคำถาม

ทุจริตในการสอบโทษขั้นต่ำคือปรับตกในรายวิชาที่ทุจริตและพักการศึกษา 1 ภาคการศึกษา

Question No.	Point	Result
1	20	
2	20	
3	10	
4	10	
5	10	
6	20	
7	10	
	Total	

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1. Clearly describe the following terms (20 points).

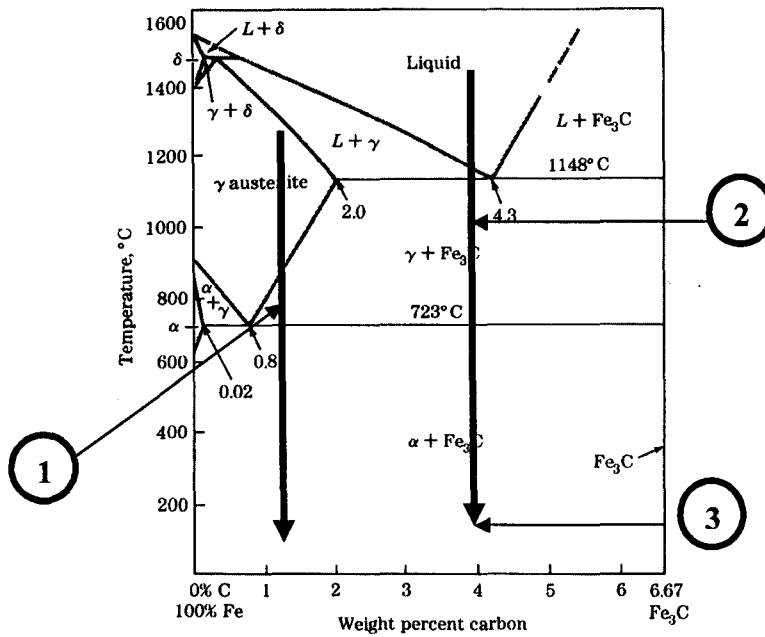
1.1 Blast Furnace

1.2 Basic Oxygen Furnace

1.3 Killed Steel

1.4 Weld Decay

2. Basic Metallurgy (20 points)

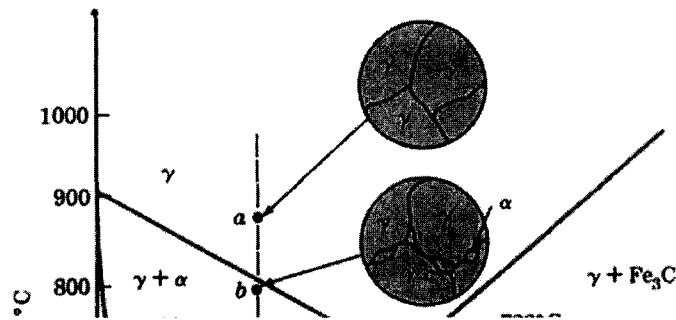


From the phase diagram above, answer the following questions:

a) Draw the microstructure at point **1** at 800°C. Also identify the phases and the amount of each phase. Show your work clearly. (10 points)

b) Draw the microstructure of the metal at points **2** and **3** when the metal is cooled down with moderate cooling rates from the liquid phase to the room temperature. The metal contains some Mg and very low amount of S and P (10 points)

3. Basic Metallurgy (10 points)



From the microstructure evolution above, we can see the grains of α phase nucleating at the grain boundary. Explain clearly why the grains of α phase nucleate on the grain boundary.

4. Roles of Alloying Elements (10 points)

We want to invent a new alloy steel with the following properties. Give one alloying element that will give us the right properties.

- a. We want a very hard surface after we perform nitriding treatment. _____
- b. We want very fine grain structure for room temperature strength. _____
- c. We want very good wear and impact resistance at the surface. _____
- d. We want to easily machine this steel. _____

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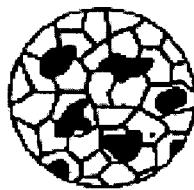
5. High Alloy Steels (10 points)

A ferritic stainless steel containing 16% Cr and 0.05% C will give ferrite phase at room temperature. Assuming that you are an engineer working in a casting company.

- a) **Your manager orders you to make this ferritic stainless steel into a martensitic stainless steel, explain how to do it. (5 points)**
- b) **Your manager also orders you to make this ferritic stainless steel into an austenitic stainless steel, explain how to do it. (5 points)**

6. Cast Irons (20 points)

Assuming that your company wants to produce a cast iron with the following microstructure:



You remember that you have learned this from *237-322 Metallic Materials* that there are two types of cast irons with this microstructure.

- a. **What are the 2 types of cast irons? [Give the full names] (10 points)**

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- b. Your boss asks you to produce these two cast irons. Explain clearly how to produce these two cast irons. (10 points)**

Production Processes of Cast Iron 1:

Production Processes of Cast Iron 2:

7. Strengthening Mechanism (10 points)

Precipitation hardening is the hardening process used in maraging steel.

- a) Explain how precipitation hardening helps increase strength. (5 points)**

- b) Maraging steel is not recommended for use at high temperatures. Explain why maraging will lose strength at high temperatures. (5 points)**