Name.....Student I.D....

Department of Mining and Materials Engineering Faculty of Engineering Prince of Songkla University

Final Examination for Semester: 2 Academic Year: 2004

Date: February 28, 2005 Time: 9.00-12.00

Subject: 237-322 Metallic Materials Room: R300

Instruction

1. There are 2 parts in this exam:

Part A (30%) is given by Dr. Thawatchai Plookphol and

Part B (20%) is given by Dr. Weerawan Sutthisripok.

- 2. Please write your answers on the space provided after each problem set. If you need more space, you may write the answer on the back of the problem set.
- 3. Only two (2) pieces of A4-size note are allowed.
- 4. Dictionary, calculator, and stationery are also allowed.
- 5. Textbooks and other studying materials are not allowed.

Dr. Thawatchai Plookphol

Dr. Weerawan Sutthisripok

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A2. An alloy of Al-4 wt.% Cu was heated to 550°C for few minutes and was then quenched into water. Samples of the quenched alloy were aged at 150°C for various times before being quenched again. Hardness measurements taken from the re-quenched samples gave the following data:

(a) Account briefly for this behavior. (10 points)

Peak hardness is obtained after 100 h at 150°C. Estimate how long it would take to get peak hardness at

(b) 130°C, and (5 points) (c) 170°C. (5 points)

Hint: use Fig. 1

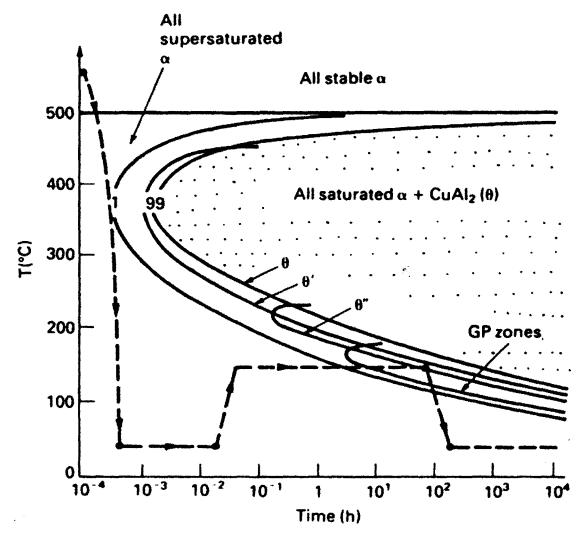


Fig. 1 Detailed TTT diagram for the Al-4 wt.% Cu alloy. We get peak strength to give θ ". The lower aging temperature, the longer the aging time. Note that GP zones do not form above 180°C: if we age above this temperature we will fail to get the peak value of the yield strength. [From Ashby and Jones, 1998]

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A3. On of the major uses of aluminum is for making beverage cans. The body is cold-drawn from a single slug of 3000 series non-heat treatable alloy because this has the large ductility required for the drawing operation. However, the top of the can must have a much lower ductility in order to allow the ring-pull to work (the top must tear easily). Which alloy would you select for the top from Table 10.5? Explain the reasoning behind your choice. Why are non-heat treatable alloys used for can manufacture? (10 points)

TABLE 10.5
YIELD STRENGTHS OF WORK-HARDENED ALUMINIUM ALLOYS

	σ _y (MPa)			
Alloy number	Annealed	"Half hard"	"Hard"	
1100	35	115	145	
3005	65	140	185	
5456	140	300	370	

[From Ashby and Jones, 1998]

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A6 . Briefly give the applications of the	ne following metals:	
(a) Tin and its alloys (5 points	s)	
(b) Lead and its alloys (5 point	nts)	
A7. Describe the zinc die casting prod (10 points)	cess. Why the the easting pi	
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Part B (20%)
B1. What is minimum chromium content in stainless steel and explain how would it improve the corrosion resistance in stainless steel? (3 marks)
B2. Compare and contrast austenitic and martensitic stainless steels including their compositions and common AISI grade, hardenability, corrosion resistance and applications. (4 marks)
B3. Stainless steel that is used in the coastal area or in chloride containing water may suffer from what types of corrosion? Describe these types of corrosion. Is stainless steel grade 304 satisfactory to be used in those applications? If not, suggest the suitable stainless steel grade and give your reason. (10 marks)

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