

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:

Aging time (h)	0	10	100	200	1000
Hardness (MPa)	650	950	1200	1150	1000

(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

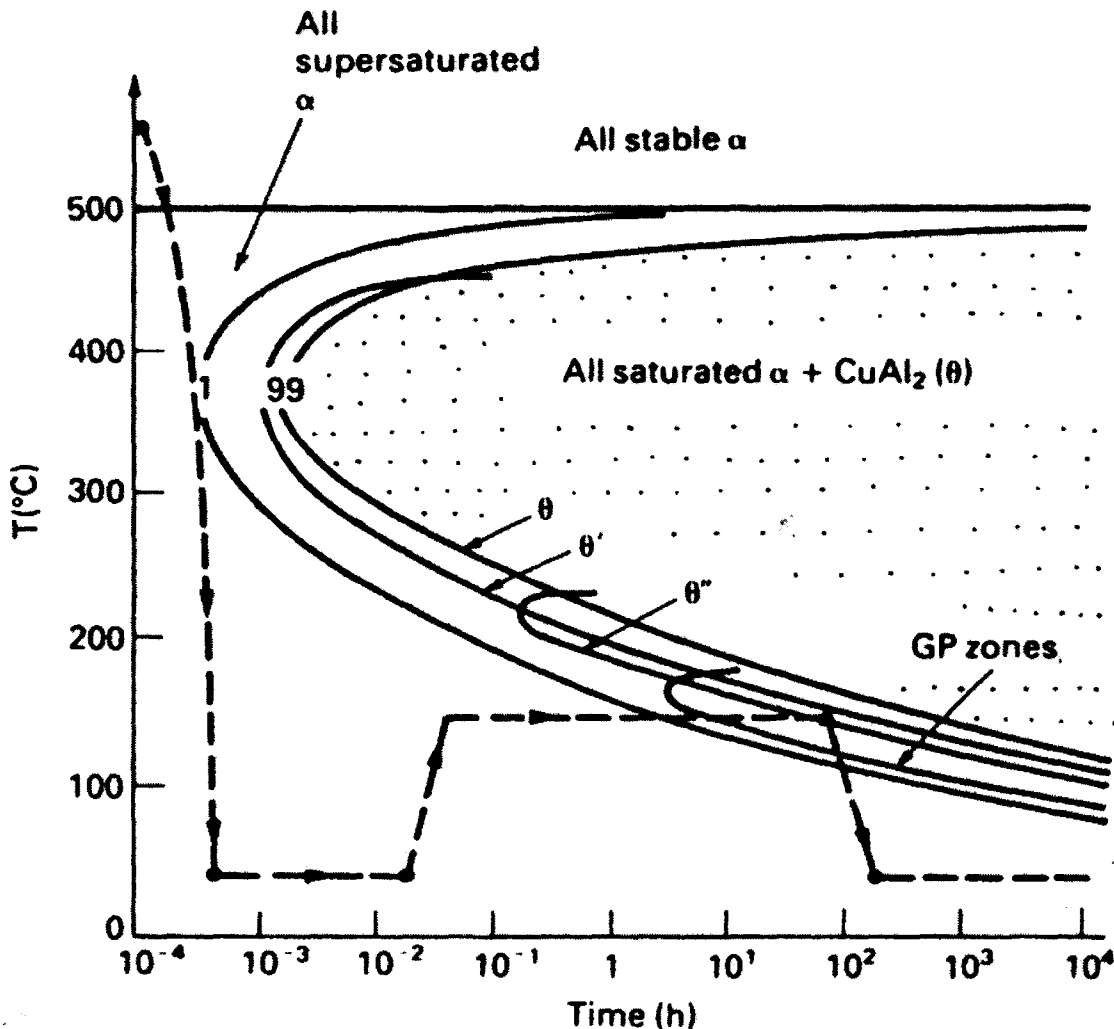


Fig. 1 Detailed TTT diagram for the Al-4 wt.% Cu alloy. We get peak strength to give θ'' . The lower aging temperature, the longer the aging time. Note that GP zones do not form above 180°C: if we age above this temperature we will fail to get the peak value of the yield strength. [From Ashby and Jones,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

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B6. Describe the following terms: (you may give any examples or their advantages)
(12 marks)

- Ordered intermetallics

- Shape memory alloys

- SHS (Self-propagating High-temperature Synthesis)

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B7. Discuss the advantages of titanium aluminides over nickel-base superalloys and suggest their potential applications. (5 marks)

B8. Briefly discuss three applications of shape memory alloys and give your reason why they are suitable. (6 marks)

B9. What are advantages of single-crystal over polycrystalline Ni-base superalloys? (BONUS for 2 marks)
