

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

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

Final Examination for Semester: 2

Academic Year: 2008

Date: February 20, 2009

Time: 09.00-12.00

Subject: 237-508 Structures and Mechanical Properties of Materials

Room: A400

Instruction

1. There are 4 problem sets. Please do all of them. Write your answers in the space provided after each problem set. If you need more space, you can write on the back of the paper.
2. Only two pieces of A4-size note are allowed. The note can be written on both sides.
3. Dictionary, calculator and stationery are allowed.
4. Text books, course notes, lecture notes and other studying materials are not allowed.
5. This final exam is counted for 30% of the total grade.

Asst. Prof. Dr. Thawatchai Plookphol

Problem No.	Full Score (points)	Student's Score (points)
1.	20	
2.	20	
3.	30	
4.	20	
Total	90	

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1. Explain the following terms:

1.1 Isotropic (work) hardening (2 points)

1.2 Luders bands (2 points)

1.3 Endurance limit (2 points)

1.4 Creep rupture test (2 points)

1.5 Dislocation creep (2 points)

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1.6 Fracture toughness K_{Ic} (2 points)

1.7 Hall-Petch effect (2 points)

1.8 Low cycle fatigue (2 points)

1.9 Bauschinger effect (2 points)

1.10 Crack resistance, G_C (2 points)

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2. An engineering component made of the heat-resisting Fe-Cr-Ni-Co alloy S-590 is subjected in service to a static stress of 200 MPa at a temperature of 600°C.

2.1 What creep-rupture life in hours is expected? (10 points)

2.2 If the service temperature is raised to 700°C and the component will be used at least for 150,000 hours, what is the allowable stress? (10 points)

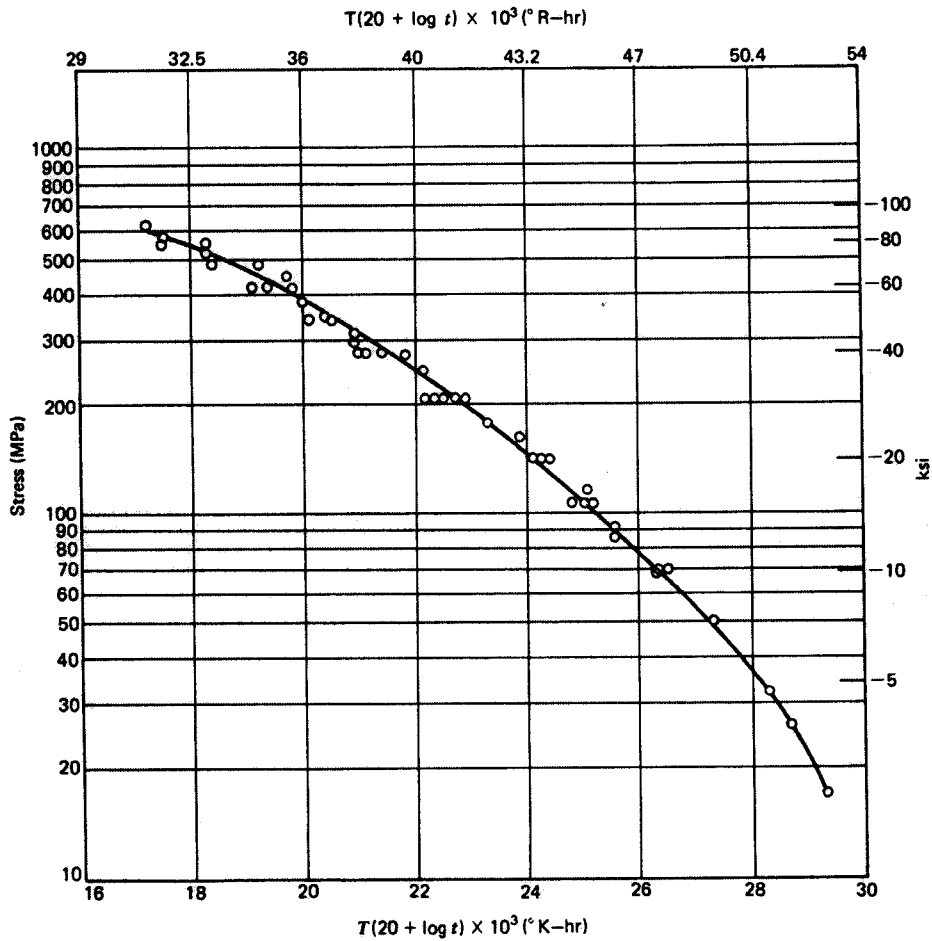


Figure 2. A Larson-Miller Plot of Alloy S-590

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3. Creep test results on 7075-T651 aluminum alloy are shown in Figure 3 below. The melting temperature (T_m) of the alloy is about 635°C. The activation energy for lattice diffusion of pure aluminum, Q_o , is about 143 kJ·mol⁻¹.

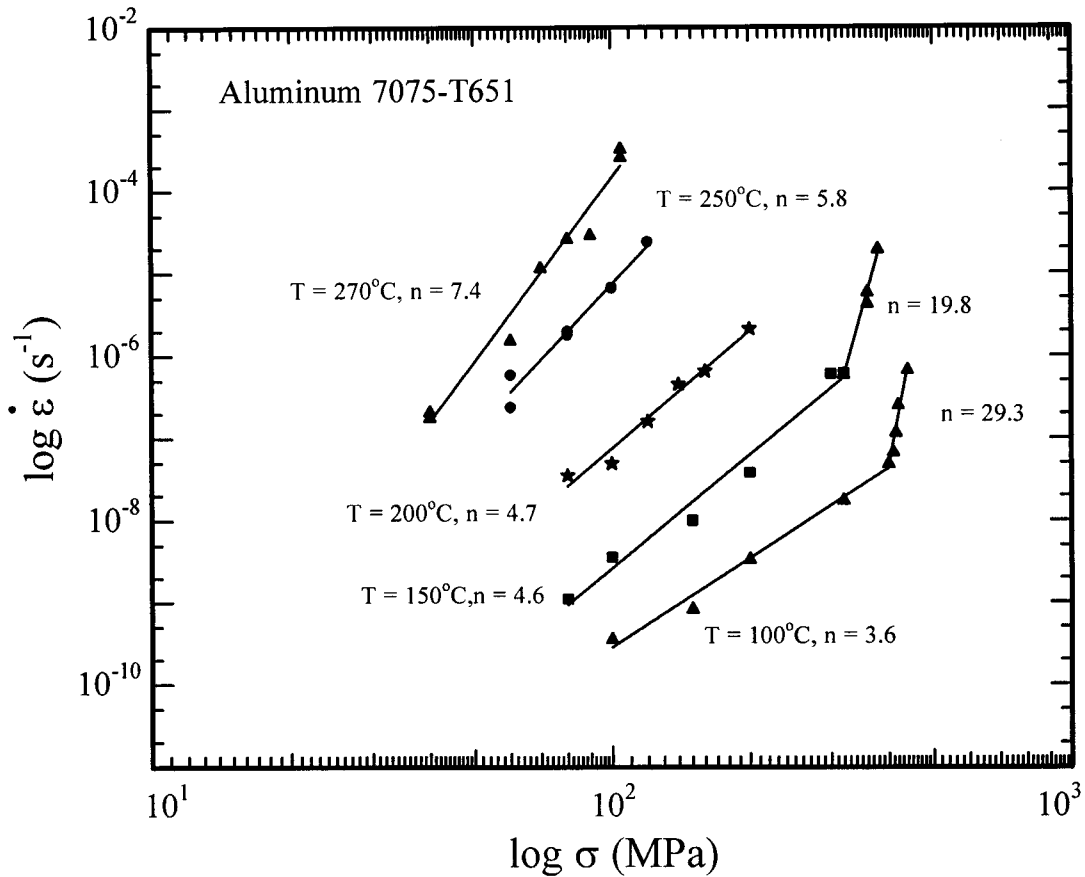


Figure 3 Creep test results of 7075-T651 aluminum alloy

- 3.1 Determine the activation energy for creep, Q_c at the constant stress of 80 MPa. (10 points)
- 3.2 Discuss the creep test results shown in Figure 3 in terms of n and Q_c . (15 points)
- 3.3 What is the creep mechanism from which the experimental data is suggested? Please explain some reasons to support your answer. (5 points)
