

**PROCEEDINGS**  
**MALAYSIAN SCIENCE AND TECHNOLOGY**  
**CONGRESS '99**

**UPDATE OF R&D FINDINGS**  
**AND COMMERCIALISATION**

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# PROCEEDINGS OF THE MALAYSIAN SCIENCE AND TECHNOLOGY CONGRESS '99

## Symposium A

- Vol. I : Agriculture & Forestry, Biomedical Sciences,  
Health & Nutrition
- Vol. II : Marine Sciences & Fisheries, Social &  
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## Symposium C

- Vol. I : Industrial Technology & Engineering
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*Compiled by* : *Datuk Dr. Mohinder Singh Malhotra &  
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# THE EFFECT OF CREEP AND CREEP-THERMAL CYCLIC LIFE ON LOW ALLOY STEEL

Jamaliah Idris<sup>1</sup> & Agus Suprpto<sup>2</sup>

Faculty of Mechanical Engineering  
Universiti Teknologi Malaysia  
81310, Skudai, Johor.  
e-mail: [jamaliah@fkm.utm.my](mailto:jamaliah@fkm.utm.my)

## ABSTRACT

Most of superheater tubes of power plants using oil as fuel have premature failures usually caused by fluctuating temperature levels at constant stress. This is supported by the evidence to indicate that the thermal cyclic and creep processes interact to produce a synergistic response. In this study creep test was carried out at temperature 550°C with constant stress 33.33 kg/mm<sup>2</sup>, and creep-thermal cyclic was generated by constant stress during hold periods at maximum temperature 550°C and at minimum temperature 420°C. The samples were held at minimum temperature in two different media; in a furnace and in air respectively. Time to rupture in the creep-thermal cyclic tests was longer than that in the static creep tests on low alloy steel superheater tube, which is strongly affected by holding periods, frequency and environment.

**KEYWORD:** superheater tubes, creep-thermal cyclic, creep processes, holding periods, frequency and environment.

## INTRODUCTION

The mechanism of fatigue and creep failure separate into creep and fatigue components under the assumption that the time periods of constant or slowly changing strains (hold periods) are contributing to the creep damage, while the cycles of rapid strain changes cause the fatigue damage. There are two types of fatigue - creep interaction, which have been termed 'sequential' and 'simultaneous'. In the former category, the specimen experiences a complete period of fatigue or creep damage which is then followed by the other mode. In a simultaneous interaction, an element of fatigue (cycle dependent), and an element of creep (time dependent), occurs in each cycle<sup>1,2</sup>.

Early workers have reported that time to rupture in the creep-fatigue tests was longer than that in the static creep tests<sup>3,4</sup>, which is strongly affected by holding periods<sup>5,6,7</sup>, frequency<sup>7</sup> and environment<sup>8</sup>. The purpose of this paper is to describe the influence of holding periods, frequency and environment in creep-thermal cyclic testing.

1. Assoc. Prof., Dr.

2. Ph.D Student, UTM.