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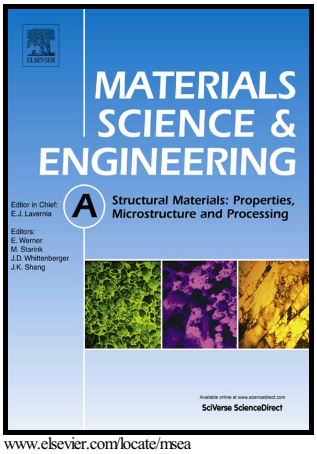

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Naveena, Shin-ichi Komazaki

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Evaluation of Creep Rupture Strength of High Nitrogen Ferritic Heat-Resistant Steels Using Small Punch Creep Testing Technique

Naveena[a*] and Shin-ichi Komazaki[b]

[a]*Division of Mechanical Engineering, Graduate School of Science and Engineering, Kagoshima University, Japan, 890-0065*

[b]*Research Field in Engineering, Science and Engineering Area, Research and Education Assembly, Kagoshima University, Japan, 890-0065*

[*]Corresponding author. Tel.: +81-99-285-8159; fax: +81-99-285-8245. *E-mail address*: naveena@mech.kagoshima-u.ac.jp.

Abstract

The development of next generation ultra-heat-resistant ferritic steels for the future advanced thermal power plants which operate in excess of 700^{o}C are currently in progress in Japan. The small punch (SP) creep testing technique which uses miniature specimens has been applied to evaluate creep rupture strength of newly developed high nitrogen ferritic steels. The SP creep tests have been carried out on different grades of high nitrogen ferritic steels in the temperature range of 600-800 ^{o}C, under different loads in the range of 70-400 N, using specimens of dimension ∅8 mm x 0.5 mm. The SP creep rupture results of high nitrogen ferritic steels have been compared with that of conventional steel (Gr.91). The high nitrogen steels exhibited higher creep rupture strength when compared to the Gr.91. The creep rupture results obtained from SP creep tests were correlated to the uniaxial creep rupture results obtained from conventional creep tests using a stress conversion coefficient of 2.05. The paper investigates the applicability of SP creep testing technique for the evaluation of creep rupture strength of high nitrogen ferritic heat-resistant steels.

Keywords: Small punch creep test, high nitrogen ferritic steels, heat-resistant steels, creep strength

1. Introduction

High chromium ferritic heat-resistant steels have been widely employed as structural materials for high temperature components of fossil-fired power plants because of their superior high temperature strength, high thermal conductivity and low thermal expansion coefficient. The present generation high chromium ferritic heat-resistant steels such as Gr.91, Gr.92 and Gr.122 are employed for components operating in the service temperature range of 550-620 ^{o}C [1, 2]. From the view point of fuel conservation, energy saving and reduction of