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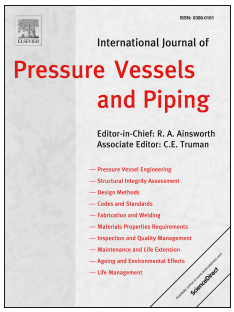

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Ming Song, Tong Xu, Qijiang Wang, Weilian Wang, Yedong Zhou, Min Gong, Chao Sun

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A modified theta projection model for the creep behaviour of creep-resistant steel

Ming Song[1*], Tong Xu[1], Qijiang Wang[2], Weilian Wang[3], Yedong Zhou[2], Min Gong[2], Chao Sun[1]

1 China Special Equipment Inspection and Research Institute

2 Baosteel Co., Ltd.

3 GE-Wuhan Boiler

Abstract

A modified theta projection model is proposed for the description of creep behaviour. The model shows very good flexibility in fitting the entire test data of the creep-resistant steel 12Cr1MoV over the three creep stages. The capability of describing the primary to secondary stage makes it easier to precisely evaluate the steady state or minimum creep rate using the model. The model is derived and modified from the original theta projection method. It also keeps the four indeterminate coefficients and can meet the convergence condition easily during regression by the least squares method. In this paper, the minimum creep rates of 12Cr1MoV are also obtained and discussed.

Keywords

Theta projection model; Creep strain; Minimum creep rate; Creep-resistant steel

Introduction

For decades, the creep behaviour of metal materials for elevated temperature applications has attracted much research interest, as creep may induce a sudden rupture of components during long-term service at high temperature, sometimes without any obvious signs. Therefore, great efforts have been ceaselessly made to find a proper way to characterize creep behaviours and precisely predict the creep life. The most commonly used life prediction models are the Larson-Miller [1, 2], Manson-Haferd [3] and Orr-Sherby-Dorn [4] extrapolations. These methods are all based on the experimental creep rupture time and have been widely adopted by the related industry for allowable stress calculation and remaining life assessment. However, to improve the