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Abstract

Numerical and Analytical Analysis of the Low Cycle Fatigue Behavior of Notched and Un-Notched 316 L (N) Austenitic Stainless-Steel Samples at Ambient and Elevated Temperatures †

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Abstract: Smooth and notched mechanical components made of metals frequently experience repeated cyclic loads at different temperatures. Thus, low cycle fatigue (LCF) is considered the dominant failure mode for these components. Stainless steel (SS) is the most widely selected material by engineers owing to its outstanding mechanical and LCF and anti-corrosion properties. Moreover, a reliable estimation of the fatigue life is essential in order to preserve people's safety in industries. In the present study, an evaluation of some of the commonly known low cycle fatigue life methodologies are performed for notched and un-notched samples made of 316L (N) SS at ambient and higher temperatures. For the notched samples, the elastic–plastic strains were firstly determined and then the fatigue lives were estimated for constant nominal strain amplitudes, varying from ±0.4% to ±0.8%. A comparison between the calculated fatigue lives and those obtained experimentally from the literature was made. Overall, some of the widely used fatigue life prediction methods for smooth specimens have resulted in unsafe estimations for applied strain amplitudes ranging from ±0.3% to ±1.0%, and those of the notched specimens were generally found to give strongly conservative predictions. To overcome this problem, attempts were made to suggest new parameters that can precisely assess the lifetimes of smooth samples, and a new equation was suggested for notched samples under both room and high temperatures.

Keywords: notched samples; smooth samples; low cycle fatigue; 316 L (N) austenitic stainless steel

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