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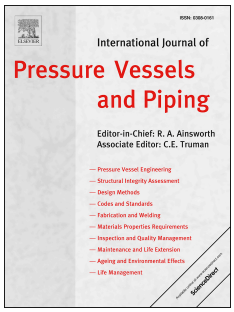

Creep damage and life assessment of thick-walled spherical reactor using Larson–Miller parameter

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Creep damage and life assessment of thick-walled spherical reactor using Larson–Miller parameter

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Abstract

Creep damage and remnant life assessment of a thick-walled spherical reactor made of 316LN austenitic stainless steel (316LN SS) have been investigated. The Robinson's linear damage accumulation rule has been used to obtain damage and remnant life assessment in which time to rupture is determined by Larson-Miller Parameter (LMP). Due to high temperature, creep is the most significant damage mechanism exhausting the lifetime of the reactor. The material properties, except Poisson's ratio, are assumed to depend on the temperature. An analytical solution employed to calculate the stress rates followed by an iterative method using initial thermoelastic stresses at zero time to obtain effective stress histories and then using LMP to calculate the damage and remnant life assessment. It is concluded that the temperature gradient has a significant effect on the effective stress histories so that effective stresses are decreasing with time in a uniform temperature field while they are increasing in the presence of a thermal gradient.

Keywords

Austenitic stainless steel, creep damage mechanics, thick-walled spherical reactor, Larson–Miller Parameter, life assessment

1. Introduction

Creep failure analysis is of serious concern in many industries such as nuclear reactors, petrochemical plants, power generation and aerospace industries [1-4].

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