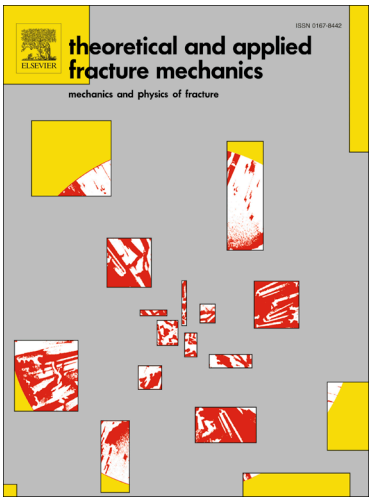

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Effect of low temperature tensile properties on crack driving force for Arctic applications

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Abstract

Many petroleum companies expand their activities further north towards the Arctic region, resulting in design temperatures down to −60 °C, which is much lower than what is usual for most current petroleum installations. As properties of steels are temperature dependent, it is of great interest to evaluate the effects of low temperature on the crack driving force in steels. The present work investigates these effects numerically using a finite element model of a single-edge-notched-tension (SENT) specimen with crack depth $a/W = 0.5$. The effects of Lüders strain and yield strength are studied for gross stress levels $\sigma_G/\sigma_y \leq 0.5$, and it is shown that an increase in yield strength and Lüders strain, as a result of Arctic temperature, intensifies the crack driving force. An approximate model that can be used to estimate the crack driving force based on yield strength, Lüders strain and loading is proposed.

Keywords: Arctic materials, crack driving force, Lüders plateau, low temperature, tensile properties

1. Introduction

The exploitation of hydrocarbons is continuously moving into new areas and harsher environments. Many petroleum companies are expanding their

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