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Quasi-static Compressive Behavior of the Ex-situ Aluminum-alloy Foam-filled Tubes under Elevated
Temperature Conditions

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Abstract

This manuscript focuses on the uniaxial compressive performance of thin walled steel tubes filled with closed-cell aluminum-alloy foam (ex-situ FFTs) at high temperature. For this purpose, the axial compressive behavior of empty tubes, closed-cell aluminum foam, and ex-situ FFTs was evaluated under quasi-static loading conditions at 300°C. The FFTs were compressed according to the concertina mode with the formation of two folds at the tested temperature. Also it was concluded that inserting closed-cell aluminum foam as a filler material inside the empty steel tube improved its energy absorption by 23% at 300°C, as well as reducing crack initiation and propagation in the steel tube.

Keywords: Porous Materials; Aluminum foam filled tube; compression test; elevated temperature; cast

1. Introduction

Multi material structures have become promising candidates for use in the automotive industry in recent years [1]. Aluminum foam (AFs) containing composites have gained a lot of attention in recent years. Bakir et al produced a three layer sandwich composite with Aluminum foam sheets for energy absorption applications [2]. Duarte et al [3] manufactured thin walled aluminum tubes filled with Aluminum foam, and observed that the presence of foam as filler in empty tubes resulted in better mechanical properties and energy absorption capability. Taherishargh et al [4] studied the bending behavior of in situ perlite syntactic Aluminum foam inside aluminum tubes, and concluded that the foam filler improved the energy absorption of the tubes by about 40%

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