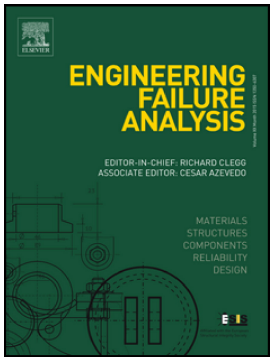

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Sachin Kumar Rathi, Ashok Sharma, Marisa Di Sabatino

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Effect of mould temperature, grain refinement and modification on hot tearing test in Al-7Si-3Cu alloy

Sachin Kumar Rathi*[1], Ashok Sharma[1], Marisa Di Sabatino[2]

[1]Department of Metallurgical and Materials Engineering, Malaviya National Institute of Technology Jaipur, Jaipur-302017, India

[2]Department of Materials Science and Engineering, Norwegian University Science and Technology 7491 Trondheim, Norway.

Email: sachin.baryons@gmail.com (Sachin Rathi), ashok.mnit12@gmail.com (Ashok Sharma), marisa.di.sabatino@material.ntnu.no (Marisa Di Sabatino)

Abstract

In the past decades, a great deal of work had been done on improving the mechanical properties and castability of Al-Si-Cu alloy in foundry industries through grain refinement and modification techniques. Among these alloys, Al-7Si-3Cu alloys are popularly used in automotive applications to produce lighter and more fuel efficient vehicles. In spite of these advantages, when this alloy is cast via permanent mould casting process, it shows a high susceptibility to hot tearing. Inoculation and hot tearing are important factors affecting the quality of the final casting products. Effect of mould temperatures on hot tear formation has been studied at room temperature, 90 ºC, 160 ºC, 230 ºC and 300 ºC. Higher mould temperature helps in reducing hot tear susceptibility of the alloy by refilling the material in later stage of solidification. For hot tear test, a permanent mould having test bar of size 260 mm long and 20 mm in height with constraint at the end has been used. Al-5Ti-1B grain refiner has been added in order to Ti content in order to from 0.040 wt.% Ti to 0.050 wt.% Ti to minimize the hot tear susceptibility of the alloy through alterations in grain size and morphology. The Al-7Si-3Cu alloy has a columnar grain structure with a large grain size, while with the addition of grain refiner it shows a finer equiaxed structure. The effect of processing of Al-5Ti-1B grain refiner and hot rolled or cast in combination with Al-10Sr modifier have also been studied to observe their effect on minimizing hot tear formation. The fracture surfaces of the specimen have been investigated by SEM. The closed packed plans and presence of intermetallic particle on the fracture surface is identified using TEM.

Key words: Al-7Si-3Cu alloy; hot tear; grain refiner; mould temperature; grain size

1. Introduction

Aluminium alloy casting is generally used in the automotive industry for several components such as engine blocks and cylinder heads, due to their favorable combination of low weight, recyclability, easy machinability and low cost. The most common class of aluminum alloys is of aluminum-silicon-copper (Al-Si-Cu) system. These alloys produce lighter and more fuel efficient vehicles aiming to reduce the