

The Effect of Metallic Addition on Mechanical Property of Aluminum (LM6) Alloy

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Abstract. This article investigates the effects of addition of alloying element on the impact toughness of as-cast aluminum (LM6) alloy. Presence of 0.1 wt.% Cr increases the toughness up to 38%. In fact the sharp tips Fe intermetallics which have needle shape act as stress raisers with a general reduction of the ductility and ultimate tensile strength. On the other hand by increasing the Cr content in the base alloy the size distribution of the compounds becomes more spread. Therefore addition of Cr improves toughness impact by two mechanisms. First eliminating harmful β -intermetallics and second providing microstructure with more spread particles.

Introduction

Aluminum-silicon based alloys are well-known casting alloys with high wear resistance, low thermal-expansion coefficient, good corrosion resistance, and improved mechanical properties at a wide range of temperatures. These properties lead to the application of Al-Si alloys in the automotive industry, especially for cylinder blocks, cylinder heads, pistons and valve lifters [1-5]. Most of the mechanical properties reported about cast Al-Si alloys are the outcome of tensile testing. Significant scatter is typically observed in the results since this type of testing is extremely sensitive to additions of alloying elements to the sample. Furthermore, the test results are not a strong function of silicon morphology. Charpy impact testing was thus chosen for use in this study while this particular test has always been found to be extremely susceptible to the addition of alloying elements and to silicon morphology [6], despite the fact that data on impact properties is comparatively rare for these alloys. According to prior studies [7], impact strength is the most sensitive of all the mechanical properties to silicon content for alloy compositions containing 3-15% Si [6, 7]. Iron is a frequent impurity element in aluminum alloys. In commercial Al-Si foundry alloys Fe forms brittle intermetallic compounds that have long been identified to be harmful to mechanical properties [8-11]. Even with a very low amount of Fe, the monoclinic particles of β -Al₅FeSi shape up during solidification [9]. The spiky tips of these needles act as stress raisers with