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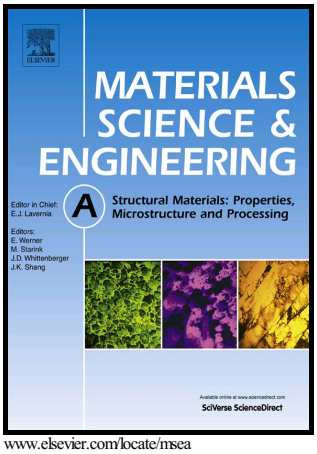

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Impact of Ce-base Mischmetal on the Microstructure and Mechanical Behavior of ZK60 MagnesiumCasting Alloys

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Abstract

Magnesium alloys are important alternatives for structural weight reduction due to their low density and good specific mechanical strength. Among the magnesium alloys, the ZK type exhibits the highest mechanical strength. However, it has limitations on hot working or welding owing to the presence of intermetallics with low melting point and consequently susceptibility to hot crack formation. The addition of rare earths tends to form intermetallics with higher melting points, thus inhibiting the formation of hot cracks, as well as building up thin and dense surface films that improve corrosion resistance. This work studies the addition of 1.5% wt. of mischmetal (Mm) to the ZK60 alloy, and then demonstrates the effects of the casting process with mechanical mixing in the semi-solid state. The alloys produced were: ZK60 and ZK60-1.5wt.%Mm manufactured by conventional casting and rheocast ZK60-1.5wt.%Mm produced with mechanical mixing in the semi-solid state. The casting and cooling methods result in defect-free and chemically homogeneous materials, and the mechanical mixing provides a homogeneous microstructure with globular grains. The mechanical strength was though higher for the ZK60 alloy due to its increased solute content within the Mg-matrix and the smaller quantity of intermetallics that builds up an intermittent network. The Mg_7Zn_3 intermetallic, which is the main precipitate for ZK60 alloy, has hardness 20% higher than the $MgZn_2Ce$ intermetallic that is precipitated with the mischmetal addition and partly removes solute from the Mg-solid solution.

Keywords: ZK60; Mischmetal; Casting; Microstructure; Mechanical properties

1. Introduction