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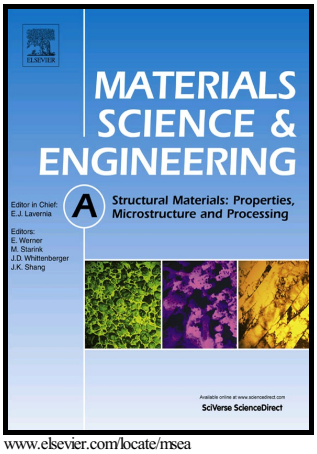

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Refinement of Mg alloys crystal structure via Nb-based heterogeneous substrates for improved performances

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Abstract

Lightness and high specific strength make magnesium alloys ideal materials for the transportation industry, especially the automotive sector that is struggling to cope with the everyday more stringent regulations on emission of carbon dioxide. Wrought magnesium alloys are difficult to deform because of the few active slip systems characteristic of their hexagonal close-packed lattice. Consequently, most of the commercially available magnesium alloys are alloys based on the Mg-Al binary system used in casting processes. The improvement of the mechanical properties of these alloys cannot be achieved by means of grain refinement using Zr due to the formation of Zr aluminides. In this study we propose a novel chemical composition that can refine all types of Mg alloys as proved in the Al-containing AM50 Mg alloy. We demonstrate that Nb-B inoculation of Mg alloys promotes the formation of heterogeneously nucleated primary α-Mg grains leading to the reduction of the grain size and this is obtained over a wide range of cooling rates. We also show that the grain refinement achieved leads to the improvement of the properties of high pressure die cast Mg