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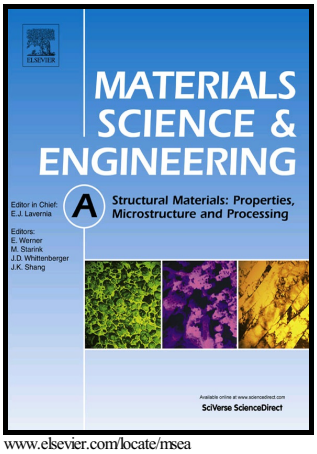

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Deformation Behaviors of Twin Roll Cast Mg-Zn-X-Ca Alloys for Enhanced Room-Temperature Formability

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ABSTRACT
Formability and viscoplastic self-consistent simulations of Mg-4Zn-X-Ca alloys were carried out in an effort to understand the relationship between deformation behaviors and room-temperature formability. The microstructural, textural and mechanical properties of Mg-4Zn-X-Ca alloys were also investigated. All of the alloys showed a sound twin roll cast microstructure without the occurrence of inverse segregation. Annealed Z4 and ZSX400 alloys exhibited strong basal textures; however, the other Mg alloys showed weaker basal textures with splitting in the transverse direction resulting from their different types of static recrystallization. Among the Mg-4Zn-X-Ca alloys, the ZAX400 alloy exhibited a high yield strength value of 189.3MPa and excellent formability of 7.5mm with enhanced yield isotropy, comparable to those of Al alloys. The higher formability values of the Mg-4Zn-X-Ca alloys were closely related to the modified deformation behaviors resulting from the texture evolution. The ZX40, ZAX400, ZWX400 and ZCX400 alloys, which were more formable, had higher relative activity of the basal <a> slip upon compression deformation, thus improving the yield isotropy. However, the Z4 and ZSX400 alloys in this study, had relatively low activity of the basal <a> slip in compression modes, as caused by their different CRSS ratios (tension twin/basal <a> slip).

Keywords: Twin Roll Casting, Mg alloy, Texture, Microstructure, VPSC

1. INTRODUCTION

Twin roll casting (TRC) is a promising process by which to fabricate strip plates, such as stainless steel and Al alloy sheets. Recently, it was reported that commercial Mg alloy sheets can be successfully fabricated through the TRC process at a low cost [1-2]. TRC Mg alloys exhibit good mechanical properties; however, their lower formability at room temperature is a drawback when applied to automobile components due to high cost of sheet forming. Therefore, the development of highly formable, high-strength TRC Mg alloys is necessary in order to widespread the application of