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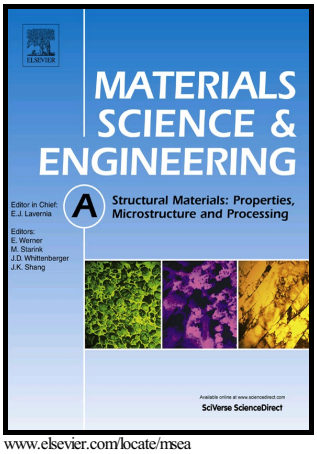

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On the microstructure and mechanical property of as-extruded Mg-Gd-Y-Zn alloy with Sr addition

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Abstract

In this study, microstructure evolutions of Mg-6Gd-3Y-0.1Zn-xSr (x=0, 0.2, 0.6) alloys (named as sample 0Sr, 0.2Sr, 0.6Sr) during heat-treatment and extrusion were investigated. As-cast sample 0Sr contains typical long period stacking ordered (LPSO) phases and Mg_3RE. With Sr addition, amounts of LPSO phases decrease and are gradually replaced by the $Mg_{17}Sr_2$ phases. After homogenization and annealing treatment, profuse strip LPSO phases readily precipitate in grain interiors of sample 0Sr, while only $Mg_{17}Sr_2$ and Mg_3RE phases are detected in samples 0.2Sr and 0.6Sr. It suggests that the Sr addition would inhibit LPSO phases. After extrusion, the bimodal grain structures, the bulk and strip LPSO phases are detected in sample 0Sr, which can contribute to providing strengthening and extra strain hardening. In as-extruded sample 0.2Sr, finer recrystallized grain size, bulk $Mg_{17}Sr_2$ and LPSO phases (micron-scale) and Mg_5RE phase (nano-scale) are found due to the pre-annealing treatment. However, lower amounts of both nano-sized and macro-sized LPSO phases lead to the low ultimate strength (300 MPa). In sample 0.6Sr, the strip LPSO phases are readily formed even though the length and total amounts of LPSO phases decrease. More bulk $Mg_{17}Sr_2$ phases and LPSO phases are also precipitated, which lead to the more superior yield and ultimate strengths of 0.6Sr sample under higher temperature, as compared with the 0Sr sample.