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Cooling curve thermal analysis and microstructure characterization of Mg-5Zn-1Y-xCa (0-1 wt%) alloys

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Highlights

- Mg-5Zn-1Y-xCa (x= 0.0, 0.1, 0.3, 0.5, and 1.0 wt %) alloys were investigated.
- Microstructure and solidification pathway of Mg-5Zn-1Y-xCa alloys were studied.
- Ca refined the grains and developed $Ca_2Mg_6Zn_3$ intermettalic in the microstructure.
- Liquidus and nucleation undercooling temperatures were decreased by Ca addition.
- Ca addition increased solidification range and solidus temperature.

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Abstract

The effect of 0-1wt% Ca addition on solidification pathway of Mg-5Zn-1Y alloy and its solidification characteristics such as nucleation transformation and intermetallics formation temperatures was investigated via plotting cooling and the corresponding first derivative curves. The results revealed the presence of three peaks in the first derivative curve of the ternary Mg-5Zn-1Y alloy, referring to the formation of α-Mg primary phase and intermetallics $Mg_3Zn_3Y_2$ (W-phase) and Mg_3YZn_6 (I-phase). One more peak, corresponding to the formation of intermetallic $Ca_2Mg_6Zn_3$ phase, appeared in that of the quaternary Mg-5Zn-1Y-xCa alloy when Ca content exceeds 0.1 wt%. The cooling curves showed that increasing Ca content from 0 to 1wt% results in reducing the liquidus temperature from 659°C to 636°C and the average