Improvement of macrosegregation and second phases in Mg Alloys by MC-DC casting

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Magnesium alloys offer the potential for weight and related energy savings in both the automotive and aerospace industries because they have the highest strength-to-weight ratio of all structural metals [1]. For wrought magnesium alloys, formation of macrosegregation and coarse second phase particles not only affects the downstream processing but also results in a high scrap rate of cast billets.

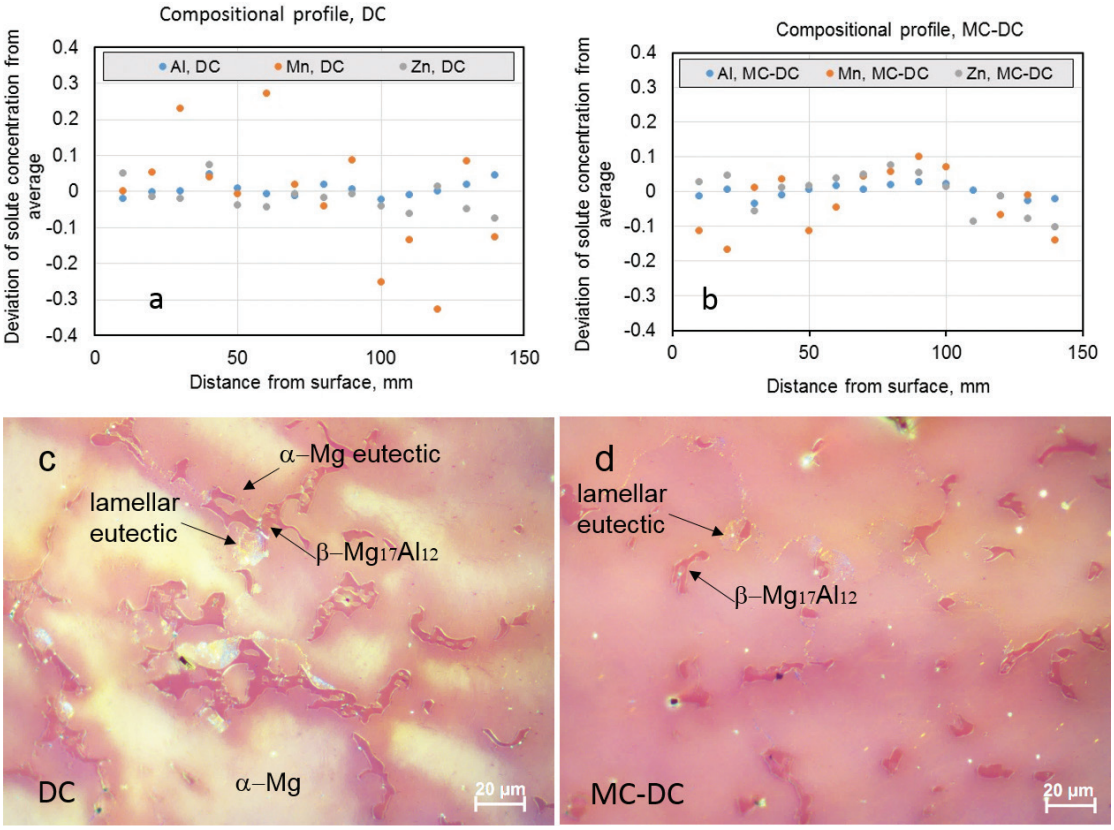

FIGURE 1. Alleviated macrosegregation (a) and (b). Refinement of second phases (c) and (d) in the MC-DC cast billet of a commercial AZ80 alloy with a 300 mm ø.

Melt conditioned direct-chill (MC-DC) casting is an emerging technology to manipulate the solidification process by a rotor-stator high shear mechanism in the sump during the DC casting process [2]. By using MC-DC casting technology, both macrosegregation and second phase particles can be improved in DC cast billets of a commercial Mg alloy. Figure 1 shows the alleviated macrosegregation (Figures 1a and 1b) and refinement of second phase particles (Figures 1c and 1d) in an MC-DC cast AZ80 alloy. These can be ascribed to grain refinement and shallower sump profile achieved by intensive melt shearing.

By manipulating the solidification process in MC-DC casting, the macrosegregation can be alleviated and second phase particles can be refined significantly. Further assessment of the impact on downstream processing is ongoing.

REFERENCES:
[1] P.T. McGlade and P.W. Baker. Magnesium Direct Chill Casting: A Comparison with Aluminium. *Light Metals*, New Orleans, LA, J.L. Anjier, ed., TMS, Warrendale, PA, 2001, 855-862. DOI: 10.1007/978-3-319-48228-6_65.
[2] Z. Fan, et al., Apparatus and method for liquid metals treatment, Pub. No. US 2013/0228045 A1.

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