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## Grain refinement of Al–Si alloys by Nb–B inoculation. Part II: Application to commercial alloys



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### ABSTRACT

The potency of Nb–B inoculation for the refinement of Al–Si cast alloy has been demonstrated in Part I of this work by the systematic analysis of binary Al–xSi alloys (where  $x = 1–10$  wt.%). In Part II of this work the effect of Nb–B inoculation on commercial Al–Si alloys is assessed. Specifically, hypo-eutectic alloys such as LM24 (A380) and LM25 (A356) as well as near-eutectic LM6 (A413) Al–Si alloys are considered. The aim is to quantify the grain refinement and detect possible interaction with alloying elements commonly present in Al cast alloys, such as Mg, Fe, Cu, Mn and Zn. The in-depth analysis of the alloys solidified under wide range of cooling rates indicates that Nb–B inoculation does not only lead to a much finer microstructural features but also makes the final grain size far less sensitive to the cooling rate employed to solidify the material. Finally, the mechanism essential for the grain refinement of commercial Al cast alloys by Nb–B inoculation is determined on the base of SEM and thermal analysis results. It is found that in-situ formed  $Al_3Nb$  and  $NbB_2$  intermetallic particles (forming from the interaction of Al alloy/Nb powder/ $KBF_4$  flux) are the heterogeneous nuclei responsible for the grain refining of Al cast alloys.

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