

Response to Reviewer 2 Comments

We greatly appreciate the time and effort you spent. We are very grateful for the positive evaluation of this reviewer on our manuscript. Our responses are addressed in detail as follows.

Point 1: Keywords to be corrected. Example: Configuration Design, calculation ? The quality of any final metal product is largely dependent on the solidification structure that emerges during the initial casting [1-4]. A refined microstructure with reduced defects in as-cast billets yields improved properties in end products [5-6]. Researchers have used many methods to refine solidified microstructure [7-13]. One of these technologies, Pulsed Magneto-Oscillation (PMO), has been found to significantly refine solidification structure and reduce ingot segregation. The coil in PMO generates a controllable electromagnetic force in the surface region as solidification begins. This electromagnetic force generates forced convection, which in turn promotes the flow within the melt. Because the PMO coil has no direct contact with the melt, this technology avoids both contamination and spattering [14-15] - Yes, the quality of the cast depends on the solidification structure that appears during the first casting, but not only. The structure of the material also depends on the casting method (molding sand or metal moulds - for example, heat accumulation factor b_2). Please, send me full information concerning the dependence of the structure of the finished product material on the factors which depend on obtaining the desired structure.

Response 1: I agree with your opinions completely. There are many factors which would affect the material structure. I have present full information in introduction. “The structure of material is related to material and solidification process controlment. Fine and homogeneous equiaxed grains were expected to get good performance in most castings. Researchers have used many methods to refine solidified microstructure [7-13]. One of these technologies, Pulsed Magneto-Oscillation (PMO), has been found to significantly refine solidification structure and reduce ingot segregation.”

Point 2: This is especially important because some materials crystallize in direction and others in volume. I am asking for a broader discussion of the influence of the Induced magnetic field and electric current on the structure of the material. This is an important issue because in the discussed relationship (1) in determining the total electric field intensity there are variables that affect the distribution of individual structures in the material of the final product, e.g. D electric flux density D , time t .

Response 2: Yes. Some materials crystallize in direction and others in volume. PMO could activate nucleation in the front of solid-liquid interface in either direction or volume crystallizing. The coil in PMO generates a controllable electromagnetic force in the surface region as solidification begins. This electromagnetic force generates forced convection, which in turn promotes the flow within the melt. Temperature gradient became smaller and solute distribution became more even. This will lead to volume crystallizing more easily.

Point 3: I recommend a broader discussion of the results shown in Fig. 2

Response 3: Fig.2 showed FEM models used in the simulation. The grids were divided automatically. Because of different coil configuration, there was little difference among the

grids. This selection of the grid affected the automatically generated nodes in our simulation. We believe this difference has marginal impact on the simulated results. And we add some information in Fig.2.

Point 4: The authors once state that the tests were carried out on pure Al and once on alloy Al - which ??? The more so that in the further part of the work the chemical composition of the alloy (Al: 99.7 wt.%, Fe: 0.2 wt.%, Si: 0.1 wt.%) And casting parameters are given.

Response 4: The material in our tests was pure Al. But the material contains some impurities, which account for about 0.3%.

Point 5: Conclusions very cursory. Please develop the applications.

Response 5: Thanks for your advice. I have corrected as “The distance between the coil and melt has little effect on the grain sizes refined by CPMO-H. Refinement effect would not be reduced with dropping of melt level. CPMO-H could be applied in large scale ingots production.”

Point 6: I suggest rewriting the summary. The summary should be a "report" on the results of the research work results. The summary contains content without reference to the purpose of the research.

Response 6: I have corrected it. “This paper outlines our effort on optimizing Pulsed Magneto-Oscillation (PMO) design in order to improve the efficiency of ingot manufacturing under PMO. SPMO-H and CPMO-H were presented on the basis of SPMO and CPMO. Our numerical and experimental results showed that optimized PMO coil design offered us a device that enabled the operator to examine and operate the melt more convenient without losing the efficiency and decreasing refinement effect. Our work also showed the distance between the coil and the melt surface had little effect on the grain sizes refined. So, in ingot production, the dropping of melt surface is not a problem for PMO application.”

Point 7: The meaning of all symbols, e.g. PMO, SPMO-H, CPMO, CPMO-H etc. - should be explained in the order in which they were placed - in the paper's Introduction

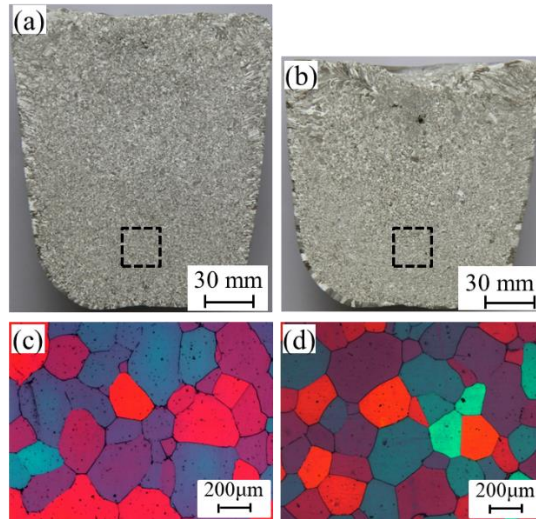
Response 7: I have explained PMO, SPMO-H, CPMO and CPMO-H in introduction. SPMO (plate coil on the top of mold), SPMO-H (ring coil on the top of mold), CPMO (plate coil on and around hot-top) and CPMO-H (ring coil on and around hot-top) were included.

Point 8: Fig. 5. Please correct instead of cm enter [mm]. Fig. 7. It would be good to add a confidence level and in the legend all dimensions should be given in [mm] and not in [cm]

Response 8: I have replaced [cm] by [mm] in Fig. 5, Fig.7 and text.

Point 9: Fig. 8 - d - scale??Figure 8 - the drawing is incorrectly dimensioned. What is the scale ??

Response 9: Thanks for your correction. I am very sorry I have mistaken Figure 8. I corrected it.



Point 10: Fig. 9. A wider comment on the results obtained

Response 10: There is no obvious difference in average grain size within equiaxed zone for three cases (Figure 9). It may be concluded that the magnetic flux intensity was the major factor to solidification refinement. The similar distribution of magnetic intensity would produce similar refinement.