

EXPERIMENTAL AND MHD SIMULATION FOR GRAIN REFINEMENT OF ALLOYS UNDER LOW-VOLTAGE PULSED MAGNETIC FIELD

YANG Y., FENG X., LI Y., LUO T.

Institute of Metal Research, Chinese Academy of Sciences

E-mail: ysyang@imr.ac.cn

A new approach, low-voltage pulsed magnetic field (LVPMF) technique, to refine metal materials has been developed. The effect of the LVPMF on the solidified structure of magnesium alloys under common casting and direct casting conditions was investigated.

The results show that the grain refinement effects on AZ31, AZ91D, AZ80, AM60, AS31 and Mg-Gd-Y-Zr alloys under the LVPMF are obvious. Meanwhile, the morphology of α -Mg is transformed from developed dendrite to fine rosette with the application of LVPMF. The solute segregation in the alloys decreases obviously under the LVPMF.

The magnetic force, flow field and Joule heat with the application of LVPMF were analyzed using the ANSYS element software.

The grain refinement mechanism of magnesium alloys was discussed in terms of nucleation and growth theories.

A model for spheroidization of developed dendrite α -Mg under LVPMF was developed by analyzing the growth behavior of α -Mg dendrite.