

Semi-empirical Modeling of Columnar and Equiaxed Growth with CET in Zn-Al-Si-Cu Alloys

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It is the purpose of this paper to present an analysis of equiaxed and columnar growth under different sample solidification conditions of Zn-Al-Si-Cu alloys. From temperature measurements a number of important dynamic parameters were derived, such as cooling rates, profiles, gradients and the position and velocity of liquidus and solidus fronts. These parameters were correlated with the structure-like length of columnar grains and size of equiaxed grains. These correlations were used to predict the solidification structure with the aid of a thermal model of solidification. An original feature of the thermal model is the way the latent heat is calculated and released. The nucleation and growth of equiaxed grains is assumed to follow the supercooling from the liquidus temperature. The main observation from the model is the high number of equiaxed grains, which compete with the columnar growth in the transition. Subsequently, we shall define dimensionless parameters, which will enable us to formulate our problem such that the final results are independent of any specific alloy system. Finally, we shall present the important functional relationships of our study, which discusses the physical interpretation of the results obtained in the present work. (This work was partially funded by CONICET)