# Vibration influence on microstructure formation during directional solidification

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During different kinds of solidification process, the solute distribution depends strongly on the type of transport in the liquid phase. In ground-based experiments, even when solidification is performed in a both thermal and solutal stabilizing configuration, strong convective flows could remain present, when the solidification velocity is slow enough, due to residual radial thermal gradients. Nevertheless, for the considered convection, namely upward solidification with a solutal stabilizing effect, a weak longitudinal macrosegregation is expected with a large radial macrosegregation. Applying vibrations to the sample enables to control the convection in the liquid phase. It has been shown that a more planar solid-liquid interface and a much more uniform microstructure are obtained when applying vibrations.

In this report, we present experimental results on the influence of this type of convection upon the cellular and dendritic growth during directional solidification of Al - 3.5 wt% Ni, in a both thermal and solutal stabilizing configuration. We show that the coupling between the natural convection and the morphological microstructures can be strong, even when solidification is performed in a both thermal and solutal stabilizing configuration. In this situation, the convection throughout the melt is absent, but the convection near the interface can also distort the front and than steepling and cluster phenomenen occur. The characterize scale of the convection is the radius of the sample.

The above ground experiments with natural convection are our premier steps for realizing the experimental investigation of the influence of vibration on microstructure formation during directional solidification. The following well-defined experiments on Al-based alloys and transparent systems will be performed in our group for other two different situations: 1) ground experiments with imposed fluid motion by vibration or rotational movements on the sample, and 2) benchmark experiments under diffusive condition in microgravity environment.

[1] R.N. Grugel, X.F. Shen, A.V. Anilkumar and T.G. Wang, The influence of vibration on microstructural uniformity during floating-zone crystal growth, J.Cryst. Growth, 142 (1994) 209

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