Modelling the Crystallization of Metal Alloys

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Technology for improving the quality of cast metal alloys by introducing nano-sized particles or Nano-Modifiers (NM) during the process of crystallization has been recently developed. This technology leads to increase of the centers of crystallization. Experimentally, it has been found that the greater number of centers of crystallization leads to grain refining, and thus to improvement of the mechanical properties of the alloys.

Mathematical model of the crystallization process of small specimens for which the spatial gradients could be ignored and the temperature depends on time only must be developed by using the common theory of crystallization of metal alloys. The model will describe the temperature of the alloy during the whole process – liquid state, crystallization and solid state. The influence of NM on the crystallization process of different kinds of alloys will be investigated. The results will be compared with those of real experiments.

Mathematical background: ODEs, Numerical Methods, Programming (preferably, in MATLAB or Mathematica)

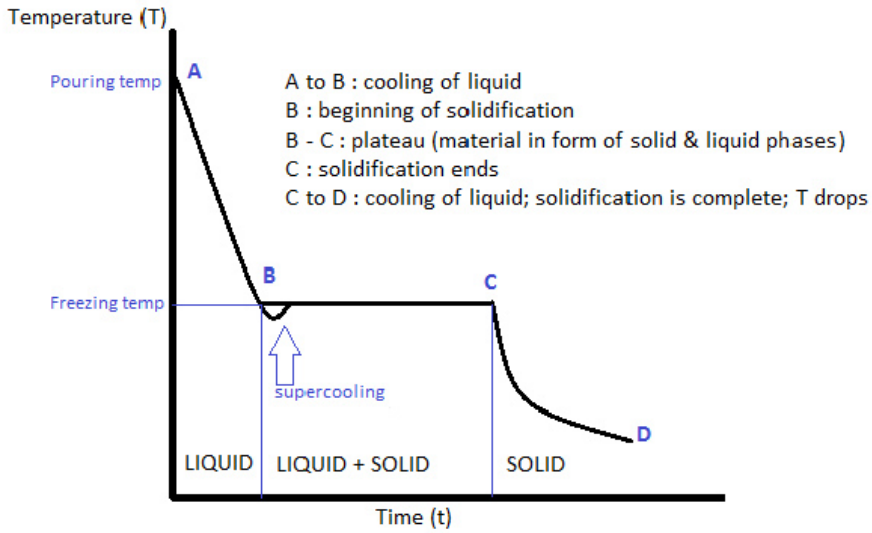

Diagram showing cooling curve of a pure metal