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Spinodal decomposition of solutions during crystallization

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Motivation research: The modern theory of phase transitions cannot explain the results of many experiments of interphase mass transfer. One reason for this is the assumption that during crystallization the solution is in the metastable state. The purpose of this study to show that in many cases the solution during crystallization is in an unstable state. The unstable condition leads to decomposition the solution by spinodal scenario. The unstable solution decomposes continuously in the whole volume in this case.

Methodology & Theoretical Orientation: Experimental demonstration of spinodal decomposition of the solution is conducted video shooting process of decomposition of an aqueous solution of bromthymol blue while its crystallization. Locally - configuration thermodynamic model is used to explain the state changes of the solution during the phase transition.

Conclusion & Significance: Spinodal decomposition of the solution explains the process of formation of a periodic distribution of the eutectic composites. The layer of the unstable solution is localized in front of the unstable interface. The unstable solution decomposes into phases, which have a composition close to the eutectic composition of the solid phases. The period of alternation of these phases is set by the period of instability of the interface. Experiments show that the formation of dendrites in the mushy zone and extremum of the component concentration during steady-state regime of crystallization close to interface also occurs in the spinodal decomposition scenario. Spinodal decay during crystallization solutions can be used for their separation into the eutectic phase.

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