Study of Hydrodynamics and Mass Transfer Influence on Crystal Growth from Water-salt Solutions

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The regularities of spatial flows and mass transfer in supersaturated water-salt solutions during a number of crystal growth (potassium dihydrogen phosphate crystal -– KDP [1] and mixed nickel-cobalt crystal -– KCNSH [2]) has been studied. The solution flow occurs in a region of complex shape containing solid crystallizing bodies, the growth of which is determined by the conditions of their flow around (by the velocity and direction of flow around and the salt saturation and temperature of the solution). Two variants of crystallization are considered: in the first, the solution salt saturation is supplied using an external forced flow, and in the second, the solution salt saturation is supported by permanent solution cooling. Both cases are considered in laminar regimes at Reynolds numbers significantly lower than the critical ones. Moreover, the crystallizers sizes were increased and the flow around corresponded to the large Reynolds number and turbulent flow around. In this case, the turbulence models were used for numerical modeling. The crystal growth process is considered in a conjugate formulation as mass transfer in the "solution-crystal" system. It is shown, how local features of hydrodynamics and mass transfer near a growing crystal surface specifically affect on the local crystal growth rate and defect formation.

Acknowledgements. The present work was supported by the Ministry of Science and Higher Education within the framework of the Russian State Assignment under contract No. AAAA-A20-120011690136-2.

References

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