Influence of the electrical field on crystal growth in the system $Li_3PO_4 – Li_4GeO_4 – Li_2MoO_4 – LiF$.

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The simultaneous influence of heat and electrical fields on the crystal growth was studied for the system $Li_3PO_4 – Li_4GeO_4 – Li_2MoO_4 – LiF$. The special set-up was constructed which allowed applying a direct electrical current for the system "growing crystal-melt". The Pt-rod and Pt-crucible served as cathode and anode respectively. Parameters of the crystallization process were as following: temperature of system melting was 970^{o}C, temperature decrease rate in the range 970-950 ^{o}C was 0.1 ^{0}C/h, starting chemical components were 40.11g Li_3PO_4, 56.95g Li_4GeO_4, 73.53g Li_2MoO_4, and 23.53g LiF. Crystallization without electrical field application led to the formation of bulk crystals of superionic compound $Li_{3+x}P_{1-x}Ge_xO_4$ (x=0.31). Growth occurs on the Pt-rod immersed into the flux due to temperature change (low temperature decrease during 3-4 weeks). Application of direct electrical current (voltage V=0.08 and 0.15V) proved to control the growth process. The electrical current was found to control the compositions and growth conditions of crystallizing phases in the system under study. Applying the electrical field led to the change of the composition of the growing crystals. Lithium molybdates Li_2MoO_4 and $Li_{1.3}Mo_3O_8$ were crystallized onto the Pt-rod at V=0.08V while the crystals of lithium germanate Li_2GeO_3 were grown onto the cathode at V=0.15V. Phosphorus remained in the flux forming the vitreous phase. Thus the presence of the electrical field provides the directional ion migration in the melt. The local change of the melt composition and the crystallization of the compounds with various compositions depended on the magnitude of applied voltage. The change of the strength of the current was noticed during the process of crystal growth. At the beginning of the process, when Pt-rod was immersed into the flux, I=10 mA; at the end of the crystallization it was one order higher. The explanation of that phenomenon was suggested based on the electrophysical characteristics of the melt; the composition of the melt and its properties were changing due to the growth of crystals with definite composition. Crystal growth under simultaneous action of heat and electrical fields may be represented as a novel method of crystal growing, which is based on the main principles of the flux growth and electrocrystallization.

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