Analytical description of the LiCl-MCl (M-Na, K, Rb, Cs) low melting compositions and prediction of the LiCl-FrCl eutectic characteristics

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Abstract

Qualitative analysis of a number of the LiCl-MCl systems (M – Na, K, Rb, Cs) has shown that the liquidus curve of the unstudied LiCl-FrCl system bears a eutectic and a peritectic. In addition to qualitative analysis, analytic correlations between melting temperatures of low melting compounds of the LiCl-MCl systems were described in dependence to the atomic number of the s¹ element (M – Na, K, Rb, Cs), the Z⁺/Z Li⁺ atomic numbers ratio, melting points of the MCl, the T(MCl)–T(LiCl) melting points ratio, ionic radius of the M⁺ (Na⁺, K⁺, Rb⁺, Cs⁺), and the Γ M⁺/Γ Li⁺ ionic radii ratio. The optimal equations were chosen from the analytic correlations obtained, using the least-squares method whereby the root-mean-square deviation is minimal, and the correlation coefficient is maximum.

The optimal equations were graphed for the eutectic temperatures of the LiCl–MCl systems and the eutectic characteristics of the LiCl-FrCl system were determined: 42.5 mole % FrCl, 595 °C. In order to confirm the adequacy of the equations obtained, the Tₑ = f(x) rectilinear dependence is analytically described.

References