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

© **Ivan K. Garkushin**,*[+] **Glafira I. Zamaldinova**, **Alexey I. Garkushin**, **Svetlana N. Parfenova**, **Elena G. Danilushkina**, and **Evgeny I. Frolov**
Department of General and Inorganic Chemistry. Samara State Technical University.
Molodogvardeyskaya St., 244. Samara, 443100. Samara Region, Russia.
Phone: +7 (846) 278-44-77. E-mail: baschem@samgtu.ru

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*Supervising author; [+]Corresponding author

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 s[1] element (M – Na, K, Rb, Cs), the Z_M/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 T_e = f(x) rectilinear dependence is analytically described.

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