Full Paper _____ *Thematic Section:* Physicochemical Research.
Reference Object Identifier – ROI: jbc-02/18-55-8-92 *Subsection:* High Temperature Physical Chemistry.
Publication is available for discussion in the framework of the on-line Internet conference "*Chemical basis for the rational use of renewable natural resources*".
http://butlerov.com/natural_resources/
Submitted on June 22, 2018.

Analytical description of the alkaline metals melts density and calculation of it for francium

© **Ivan K. Garkushin**,*+ **Olga V. Lavrenteva**, and **Yana A. Andreeva**
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: gik49@yandex.ru

*Supervising author; +Corresponding author

Keywords: alkali metals, alkali metals melts, density, reduced density, temperature, melting temperature, s^1-elements order number, calculation, prediction, interrelation, graphic dependencies.

Abstract

At present, the description of properties for elements, simple substances and individual chemical compounds remains relevant for clarification of available in reference literature physicochemical characteristics and prediction of unknown data. In this paper, analytical description of the density are given for alkali metals melts being a constituent in modern thermofors. The isothermic and polythermic methods, the Karapetyans's comparative method, the Mendeleev's method are used for the description and prediction. An analysis of the relationship between absolute and reduced (ρ/Z) density of s^1-elements and temperature are presented. Also an analysis is given for the relationship of density with melting temperature and temperature, above melting temperature on n = 5, 10, 50, 75, 100, 150, 200 K. The dependence $\rho = f(Z)$ (Z – s^1-elements order number) is described analytically and graphically. The dependence $\rho = f(Z)$ (Z – s^1-elements order number) is described analytically and graphically. The dependence of the relationship between density in the liquid and solid state is described in the coordinates "property 1– property 2". On the basis of the analysis the franzium density are predicted. Recommendations are given for using analytical dependencies with the maximum correlation coefficient and the minimum standard deviation for the prediction.

References

[1] G.I. Zamaldinova, S.N. Parfenova, A.I. Garkushin, I.K. Garkushin, V.V. Slepushkin. Properties of s^1-elements, simple substances, halogenides and their mixes: analytical description, calculation and interrelation: monograph. *Samara: SamGTU.* **2010**. 202p. (russian)
[2] M.Kh. Karapet'yants. Methods of comparative calculation of physical and chemical properties. *Moscow: Chemistry.* **1965**. 403p. (russian)
[3] I.K. Garkushin, O.V. Lavrenteva, M.A. Istomova, A.N. Trunova, S.N. Parfenova, A.I. Garkushin, A.V. Kolyado. Methods for calculating the properties of elements, simple substances, compounds and mixes. *Samara: SamGTU.* **2017**. 467p. ISBN 978-5-7964-2060-7 (russian)
[4] I.K. Garkushin, N.A. Nikitina, L.A. Medovshchikova, G.I. Zamaldinova. Calculation, prediction and interrelation of physical properties of simple substances and compounds of elements IA, IIIA, VIIIB-groups of the periodic system. *Samara: SamGTU.* **2003**. 92p. (russian)
[5] S.N. Parfenova, I.K. Garkushin, L.A. Medovshchikova. Graphic-analytical description and prediction of the properties of neutral atoms, simple substances of IIA elements of the periodic system. *Samara: SamGTU.* **1999**. 96p. (russian)
[6] S.N. Parfenova, I.K. Garkushin, L.A. Medovshchikova. Analysis, prediction and interrelation of some physico-chemical properties of IIA-group elements of the periodic system. J. News of high schools. *Chemistry and chemical technology.* **1999**. Vol.42. No.6. P.129-132. (russian)
[7] S.N. Parfenova, I.K. Garkushin, L.A. Medovshchikova. Analysis, prediction of the properties of the IIA-periodic system group chlorides. In Proceedings of *X Intern. Conf. «InCChT - 96». Moscow: Dmitry Mendeleev University of Chemical Technology of Russia.* **1996**. P.129-162. (russian)
[8] S.N. Parfenova, I.K. Garkushin, L.A. Medovshchikova. Graphic-analytical description of thermodynamic properties of chlorides of the IIA elements of group of periodic system. *J. News of high schools. Chemistry and chemical technology.* **1999**. Vol.42. No.6. P.90-94. (russian)

[9] M.V. Runtov, I.K. Garkushin, G.S. Mukovnina. The isothermic method for description and prediction of the electrical conductivity of molten metals of IA- periodic system group. In: Structure and properties of metal and slag melts. In Proceedings of X Russia Conference. *Yekaterinburg-Chelyabinsk: SUSU.* **2001**. Vol.42. P.159-161. (russian)
[10] M.V. Runtov, S.N. Parfenova, G.I. Zamaldinova, A.I. Garkushin, G.S. Mukovnina. Analytical description and prediction of the properties of metals melts and salts by the methods of polythermic and isothermic sections. *Specialist. no. SSC RAS Chemistry and chemical technology.* **2004**. P.21-26. (russian)
[11] A.I. Garkushin, E.G. Danilushkina, S.N. Parfenova, N.M. Barbin. Analytical description of melts density of alkali metal chlorides and prediction for melt of France chloride. *J. Melts.* **2009**. No.4. P.59-63. (russian)
[12] M.V. Runtov, I.K. Garkushin, G.S. Mukovnina. The isothermic method for description and prediction of viscosity of nitrates of IA-group elements of the periodic system. News of high schools. *Chemistry and chemical technology.* **2001**. Vol.44. No.4. P.21-23. (russian)
[13] M.V. Runtov, I.K. Garkushin. Analysis, interrelation and prediction of the alkali metals electrical conductivity. . News of high schools. *Chemistry and chemical technology.* **2001**. Vol.44. No.3. P.145-148. (russian)
[14] M.V. Runtov, I.K. Garkushin, G.S. Mukovnina, E.A. Egorzev. The isothermic method for description and prediction of melts density of IA-group metal of the periodic system. In Proceedings of XI Interuniversity conference «Mathematical modeling and boundary-value problems»**. 2001**. *Samara: SamGTU.* P.197-201. (russian)
[15] M.V. Runtov, I.K. Garkushin. Analysis, interrelation and prediction of alkali metals nitrates density. Bulletin of SamGTU. Ser. Phys.-Chem. Science. *Samara: SamGTU.* **2001**. Vol.12. P.146-149. (russian)
[16] I.K. Garkushin, G.I. Zamaldinova, A.I. Garkushin, I.M. Kondratuk. Analytical description of specific electric conductivity of alkali metal chlorides and its prediction for FrCl melt. *J. Melts.* **2008**. No.5. P.84-88. (russian)
[17] P.I. Bistrov, D.N. Kagan, G.A. Krechetova, E.E. Spielrain. Liquid metal heat carriers of heat pipes and power plants. *Moscow: Science.* **1988**. 263p. (russian)
[18] The chemical encyclopedia in 5 volumes. Under edition N.S. Zefirova. T.5. *Moscow: Scientific publishing house «BRE».* **1998**. P.336. (russian)
[19] Emsli Dzh. Elements: translation from English. *Moscow: MIR.* **1993**. 256p. (russian)
[20] A.I. Efimova, L.V. Belorukova, I.V. Vasilkova, V.P. Chechev. Properties of inorganic compounds. Handbook. *Leningrad: Chemistry.* **1983**. P.82-83. (russian)
[21] V.A. Rabinovich, Z.Ya. Havin. Brief Chemical Handbook. *Leningrad: Chemistry*. **1977**. P.36-38. (russian)
[22] Physico-chemical properties of elements. Handbook ed. G.V. Samsonov. *Kiev: Naukova Dumka.* **1965**. P.236-239.
[23] Kornilov II, Matveeva NM, Pryakhina LI, Polyakova R.Kh. Metallochemical properties of the elements of the periodic system. *Moscow: Science.* **1966**. 352p. (russian)
[24] K. Saito, S. Hayakova, F. Takei, X. Yamadera. Chemistry and the periodic table. Translation from Japanese. *Moscow: World*. **1982**. 320p. (russian)
[25] 10.1520/GTJ11087J.