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84626

Some Problems of the Thermodynamics of Heterogeneous Multicomponent Systems. III. The Relation Between the Changes of the Chemical Potentials of the Components and the Isothermal-isobaric Changes of the Phase Composition

S/076/60/034/010/003/022
B015/B064

that in a change of the composition of ternary two-phase systems along the isothermal-isobaric curve of the phase equilibrium the chemical potential then passes through a maximum when the molar ratio of the two other components in the coexisting phases is equal. A simultaneous application of equations (1) and (3) permits to establish the position and also the kind (maximum or minimum) of the extremum of the chemical potential. The authors emphasize that only a joint analysis of the equilibrium conditions and the stability conditions of heterogeneous systems permits to determine the character of the changes of the chemical potentials along the total length of the isothermal-isobaric curves of composition. If one of the coexisting phases may be regarded as ideal the following holds:

$$\left(\frac{dx_i^{(2)}}{dx_i}\right)_{P,T,x_k/x_l} > 0 \qquad (4)$$

which means that the total molar ratio

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Some Problems of the Thermodynamics of Heterogeneous Multicomponent Systems. III. The Relation Between the Changes of the Chemical Potentials of the Components and the Isothermal-isobaric Changes of the Phase Composition

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B015/B064

of the respective component of the heterogeneous system and its molar ratio in the ideal phase change in the same sense. For a system with an arbitrary number of components the following holds:

$$\left(\frac{d\mu_i^{(k)}}{dx_i^{(k)}}\right)_{P,T} \gtrless 0 \quad \text{if} \quad \left(\frac{dx_i^{(k)}}{dx_i}\right)_{P,T,\frac{x_1}{x_n},\ldots,\frac{x_{i-1}}{x_n},\frac{x_{i+1}}{x_n},\ldots,\frac{x_{n-1}}{x_n}} \gtrless 0 \quad (7),$$

i.e., the chemical potential (the partial pressure of the i-th component of the heterogeneous system) and its molar ratio changes in the studied k-th phase in one and the same (in the opposite) direction if an addition of the corresponding component to the heterogeneous system leads to an increase (decrease) of its molar ratio in this phase. By solving the Gibbs-Duhem equation for each of the coexisting phases

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84626

Some Problems of the Thermodynamics of Heterogeneous Multicomponent Systems. III. The Relation Between the Changes of the Chemical Potentials of the Components and the Isothermal-isobaric Changes of the Phase Composition

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B015/B064

$$d\mu_1 = -\frac{\begin{vmatrix} x_n^{(1)} x_2^{(1)} \dots x_{n-1}^{(1)} \\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot \\ x_n^{(r)} x_2^{(r)} \dots x_{n-1}^{(r)} \end{vmatrix}}{\begin{vmatrix} x_1^{(1)} x_2^{(1)} \dots x_{n-1}^{(1)} \\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot \\ x_1^{(r)} x_2^{(r)} \dots x_{n-1}^{(r)} \end{vmatrix}} d\mu_n, \quad (8)$$

$$d\mu_{n-1} = -\frac{\begin{vmatrix} x_1^{(1)} \dots x_{n-2}^{(1)} x_n^{(1)} \\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot \\ x_1^{(r)} \dots x_{n-2}^{(r)} x_n^{(r)} \end{vmatrix}}{\begin{vmatrix} x_1^{(1)} \dots x_{n-2}^{(1)} x_{n-1}^{(1)} \\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot \\ x_1^{(r)} \dots x_{n-2}^{(r)} x_n^{(r)} \end{vmatrix}} d\mu_n.$$

is obtained, so that from (8) and the stability conditions one obtains equation (9) for the conditions of an extremum of the chemical potential of the i-th component on the isothermal-isobaric curves of heterogeneous systems, consisting of n components and n-1 phases:

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Some Problems of the Thermodynamics of Heterogeneous Multicomponent Systems. III. The Relation Between the Changes of the Chemical Potentials of the Components and the Isothermal-isobaric Changes of the Phase Composition

S/076/60/034/010/003/022
B015/B064

$$[d\mu_i]_{P,T} = 0, \quad \text{если} \quad \begin{vmatrix} x_1^{(1)} \dots x_{i-1}^{(1)} x_n^{(1)} x_{i+1}^{(1)} \dots x_{n-1}^{(1)} \\ \dots\dots\dots\dots\dots \\ x_1^{(r)} \dots x_{i-1}^{(r)} x_n^{(r)} x_{i+1}^{(r)} \dots x_{n-1}^{(r)} \end{vmatrix} = 0. \qquad (9)$$

The practical importance of equation (8) consists in the fact that from the data on the composition of the coexisting phases and on the changes of the chemical potential of one component only, it is possible to determine the changes of the chemical potentials partial pressures and activities of all other components of a system that is monovariant and heterogeneous under isothermal-isobaric conditions. There are 3 figures and 15 references: 14 Soviet and 1 US.

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84626

Some Problems of the Thermodynamics of Heterogeneous Multicomponent Systems. III. The Relation Between the Changes of the Chemical Potentials of the Components and the Isothermal-isobaric Changes of the Phase Composition

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B015/B064

ASSOCIATION: Leningradskiy gosudarstvennyy universitet im. A. A. Zhdanova (Leningrad State University imeni A. A. Zhdanov)

SUBMITTED: November 15, 1958

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

54700

28736 S/020/61/140/003/018/020
B110/B101

AUTHORS: Nikol'skiy, B. P., Corresponding Member AS USSR, Shul'ts, M.M., Peshekhonova, N. V., and Belyustin, A. A.

TITLE: Particular electrode behavior of glasses containing two acid (glass-forming) oxides

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 140, no. 3, 1961, 641 - 643

TEXT: Electrodes of alkali glasses with basic oxides (modifiers): Cs_2O CaO, BaO, La_2O_3, etc. have hydrogen function in a large pH interval: $\varphi = \varphi^o + \vartheta \log_{H^+}$ (1); ($\vartheta = (RT/F) \cdot 2.303$). By ion exchange: H^+(glass) + M^+(solution) $\rightleftharpoons$ H^+(solution) + M^+(glass) (2), the hydrogen function changes to the metal function at certain pH's (section a"'б' of the curve 1, Fig. 1). According to the ion exchange theory, curve 1 is described by $\varphi = \varphi^o + \vartheta \log(a_{H^+} + Ka_{M^+})$ (3), where K is the equilibrium constant of Eq. (2). The divergence from Eq. (3) observed in the a"'б' section, specifically when B_2O_3 is introduced (curve 2), is explained by the

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presence of hydrogen ions bound differently strong to the glass. When adding B_2O_3 or Al_2O_3, one obtains a glass electrode with metal function (curve 4). B and Al free glasses correspond to weak acids ($K \sim 10^{-12}$, curve 1). Curves 2 and 4 correspond to Na_2O-CaO-SiO_2 systems with additions of Al_2O_3, B_2O_3, and ZrO_2. In the section aa' (curve 3), the hydrogen ions are bound to the anions of strong and weak acids in glass phase. In the section a'β'''β", the hydrogen ions are replaced by weakly bound alkali-metal ions. These are bound stronger in section β"∂. The metal function is complete in ∂'β'''. This has been established experimentally in the ternary system Li_2O-Al_2O_3-SiO_2 with 0 - 3 mole% of Al_2O_3. Similar to Al_2O_3, B_2O_3 effects a differentiation in the system Na_2O-B_2O_3-SiO_2 at 0.1 N and 3 N Na-ion concentrations of the solution. With the curves representing the pH dependence of the potential, the vertical distance between the sections of the Na functions for glasses containing 6.6 and 9.4 mole% of B_2O_3 is: $\Delta E = \vartheta \log (a''_{NaCl}/a'_{NaCl}) = 83$ mv. Similar conditions were found for the following systems: Li_2O - R_nO_m - SiO_2 (R_nO_m

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B110/B101

Particular electrode...

= B_2O_3, Ga_2O_3, ZnO_2); Na_2O - R_nO_m - SiO_2 (R_nO_m = Al_2O_3, Ga_2O_3, Fe_2O_3, GeO_2, SnO_2, TiO_2, ZrO_2, P_2O_5, Sb_2O_3, Bi_2O_3). The second hydrogen range due to the weaker acid disappears with a pH of 0 - 14, when relatively large amounts (3 - 9%) of Al_2O_3, Fe_2O_3, B_2O_3, and ZrO_2 are added (curve 4, Fig. 1). Thus, alkali-metals are bound in complex silicate systems by Al_2O_3, B_2O_3, and similar oxides. The established "differentiating effect" of a small quantity of acid oxide in glasses of simple composition is common to all glass-forming oxides and confirms the assumed binding and coordination of atoms of glass-forming elements according to M. M. Shul'ts (Ref. 18: Vestn. LGU, No. 22, 40 (1960)) and (Ref. 19: Stekloobraznoye sostoyaniye (the vitreous state), Izd. AN SSSR, 1960). There are 3 figures and 19 references: 15 Soviet-bloc and 4 non-Soviet-bloc. The most recent reference to the English-language publication reads as follows: Ref. 11: G. Eisenmann, D. O. Rudin, J. U. Casby, Sci., 126, 831 (1957).

ASSOCIATION: Leningradskiy gosudarstvennyy universitet im. A. A. Zhdanova (Leningrad State University imeni A. A. Zhdanov)

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5351

S/054/62/000/001/009/011
B121/B138

15.4170

AUTHORS: Shul'ts, E. M., Belyustin, A. A.

TITLE: Effect of boric oxide on the electrode properties of plain sodium silicate glasses

PERIODICAL: Leningrad. Universitet. Vestnik. Seriya fiziki i khimii, no. 1, 1962, 135-142

TEXT: Classes free from calcium oxide and aluminum oxide were studied. Electrode glasses were produced from chemically pure boric acid, sodium carbonate, and quartz in a silite furnace in platinum crucibles at 1200-1450°C. The electrode properties of the glasses were studied in buffer mixture solutions of 0.1-3.0 N sodium chloride. Hydrogen and calomel electrodes were used for pH measurements. The EMF was measured with a ППТВ-1 (PPTV-1) potentiometer by the compensation method. Each experiment lasted 10-14 hrs. The EMF values measured with the glass - calomel electrode were represented by the curve E versus pH. B_2O_3 additions to sodium silicate glasses were found to affect their hydrogen function in the low pH region. Glasses with higher B_2O_3 content behave like plain

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sodium silicate glasses and are suited for wider pH determinations. The dependence of EMF, measured with a hydrogen - calomel electrode, on the pH of the solution, gives a stepped curve for boron silicate glasses with a B_2O_3 content of up to 7%. The effect of boric oxide on the electrode properties of the glasses is characteristic of vitrifying oxides. Stepped curves of the EMF - pH dependence of boron silicate glasses have been predicted in theoretical studies by B. P. Nikolskiy in 1953 (Ref. 15: B. P. Nikol'skiy ZhFKh, 27, 724, 1953). B. P. Nikolskiy and M. M. Shul'ts recently suggested the formula for the potential of glass electrodes with two groups of anions:

$$\varphi = \varphi^{o} + (1/2)\vartheta \log (a_{H^+} + Ka_{Na^+}) - (1/2)\vartheta \log \left(\frac{1}{a_{H^+}\alpha_1 Ka_{Na^+}} + \frac{\beta}{a_{H^+}+\alpha_2 Ka_{Na^+}} \right), \quad (1)$$

where φ is the glass electrode potential; φ^{o} is the standard potential, a_{H^+} and a_{Na^+} are the ion activities in the solution, N_{H^+} and N_{Na^+} are their concentrations in the glasses,

$K = \frac{a_{H^+} N_{Na^+}}{a_{Na^+} N_{H^+}}$, β is a constant dependent on the number of anion groups in

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Effect of boric oxide on the ...

the glasses, α_1 and α_2 are constants which correspond to the ratio of dissociation constants of "acid" and "salt" anion groups in the glass. The electrode properties of a glass consisting of two vitrifiers in a certain composition range, depend on the distribution of basic oxide (Na_2O) among the acid oxides (B_2O_3 and SiO_2). There are 3 figures, 1 table, and 17 references: 14 Soviet-bloc and 3 non-Soviet-bloc. The two references to English-language publications read as follows: D. A. Mac Innes, M. Dole, J. Amer. Chem. Soc., 52, 29, 1930. G. Rynders, O. Graner, D. Hubbard. J. Amer. ceram. soc., 31, 269, 1948.

SUBMITTED: July 7, 1961

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

S/054/62/000/003/007/010
B101/B186

5,4700

AUTHORS: Shul'ts, M. M., Peshekhonova, N. V., Romanova, L. M., Andrianov, A. A.

TITLE: Study of the electrode properties of lithium alumino silicate glasses

PERIODICAL: Leningrad. Universitet. Vestnik. Seriya fiziki i khimii, no. 3, 1962, 108 - 115

TEXT: According to the generalized ion exchange theory of the glass electrode developed by B. P. Nikol'skiy (ZhFKh, 27, 5, 1955; DAN SSSR, 140, 641, 1961), the curve E = f(pH) may have steps if the glass contains hydrogen ions with bonds of different strength. This was checked on lithium alumino silicate glasses containing 24, 27, 30, or 33 mole% Li_2O and 0 - 6 mole% Al_2O_3. The curve E versus pH was plotted by measuring the emf of the following elements:
(Pt)H_2|3 M LiOH,LiCl||saturated KCl solution, Hg_2Cl_2|Hg;
Ag|AgCl,0.1 N HCl|glass membrane|3 M LiOH,LiCl||saturated KCl solution,

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S/054/62/000/003/007/010
B101/B186

Study of the electrode...

Hg_2Cl_2 Hg.

Results: (1) Lithium silicates without admixture of Al_2O_3 have an H^+ function from pH<1 to pH ≈10-11; at higher pH, transition to a Li^+ function occurs. (2) Even an admixture of 0.5 mole% Al_2O_3 inflects the E-versus-pH curve in the acid range; and at a higher Al_2O_3 content this inflexion extends to a horizontal section with a Li^+ function. (3) Glass electrodes with ≥3 mole% Al_2O_3 behave like Li^+ electrodes at pH 3 - 12. (4) This effect of Al_2O_3 decreases with increasing content of Li_2O in the glass; therefore, higher Al_2O_3 admixtures are necessary to obtain a Li^+ function. The measured values were well reproducible both with rising and falling pH. The behavior of lithium alumino silicate electrodes is explained by the formation of lattice points with excessive negative charges during the introduction of trivalent aluminum in the silicate lattice with the coordination number 4; in these lattice points, the hydrogen ions have no longer a covalent but a weaker bond. The following holds: $\varphi = \varphi^0 + 0.5\vartheta\log(a_{H^+} + Ka_{M^+}) - 0.5\vartheta\log[1/(a_{H^+} + \alpha Ka_{M^+}) + \beta_2/a_{H^+} + \alpha_2 Ka_{M^+})]$.

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B101/B186

Study of the electrode...

There are 7 figures and 1 table. The most important English-language reference is: G. E. Eisenman, D. O. Rudin, J. M. Casby, Science, 126, 331, 1957.

SUBMITTED: July 7, 1961

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

L1111
S/054/62/000/003/008/010
B101/B186

5.4700

AUTHORS: Shul'ts, M. M., Belyustin, A. A.

TITLE: Electrode properties of sodium silicate glasses containing aluminum, gallium, or indium oxides

PERIODICAL: Leningrad. Universitet. Vestnik. Seriya fiziki i khimii, no. 3, 1962, 116 - 124

TEXT: Different effects of "glass-forming" and "modifying" oxides on the function E = f(pH) have been studied for sodium silicate glasses with 22 mole% Na_2O and with different concentrations of Al_2O_3, Ga_2O_3, In_2O_3, or BaO, by measuring the emf of the element Ag|AgCl, 0.1 HCl|glass| buffer solution NaCl||KCl solution, saturated, Hg_2Cl_2|Hg. The constant K of the equation $\varphi = \varphi^0 + \log(a_H + Ka_{Na})$ and the value $\chi = K^{NaAl}/K^{Na}$ were determined, where K^{NaAl} is the constant for sodium alumino silicate glass, and K^{Na} the constant for sodium silicate glass. Admixing small amounts of Al_2O_3 gave the curve E = f(pH) a stepwise course due to different

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B101/B186

bindings of the hydrogen ions to the SiO_4 and AlO_4^- tetrahedrons of the glass structure. Al_2O_3 acts as a typical glass former. The range of the Na^+ function in the E-versus-pH curve extends with rising Al_2O_3 content. Ga_2O_3 also acts as glass former, but its modifying capacity becomes evident in shifting the transition from the H^+ function to the Na^+ function towards higher pH. It is concluded that gallium enters the glass both as Ga^{IV} (glass former) and as Ga^{VI} (modifier). In_2O_3 acts still less as glass former and shows even more intensive modifier action by a wide range of the H^+ function. Admixture of BaO (modifier) to Na-Al glasses reduces the effect of the second glass former (Al_2O_3), making the E-versus-pH curves similar to those for Na-In glasses. The difference between glass former and modifier can be seen from $\log \chi = f([M_2O_3]/[Na_2O])$, M = B, Al, Ga, In (Fig. 3). A small χ is characteristic of modifiers. There are 4 figures and 2 tables. The most-important English-language reference is: G. E. Eisenman, D. O. Rudin, J. M. Casby, Science, 126, 831, 1957.

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B101/B186

Electrode properties of...

SUBMITTED: November 27, 1961

Fig. 3. Logχ versus $[M_2O_3]/[Na_2O]$. (1) $Na_2O - Al_2O_3 - SiO_2$, $[Na_2O]<25$ mole%; (2) $Na_2O - Al_2O_3 - SiO_2$, $[Na_2O]>25$ mole%; (3) $Na_2O - B_2O_3 - SiO_2$; (4) $Na_2O - Ga_2O_3 - SiO_2$; (5) $Na_2O - In_2O_3 - SiO_2$.

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

35544

S/020/62/142/006/017/019
B101/B144

AUTHORS: Nikol'skiy, B. P., Corresponding Member AS USSR, Isakova, N. P., and Shul'ts, M. M.

TITLE: Composition of boron alumosilicate glasses and its effect upon their electrodic and acid properties

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 142, no. 6, 1962, 1331-1334

TEXT: The present paper was read at the session of the OS Otdeleniya khimicheskikh nauk AN SSSR (OS of the Department of Chemical Sciences of the AS USSR) on May 30, 1957. It concerns a new method of solving glass electrode problems and such related to hyalurgy in general. The electrode potential as a function of the pH of the electrolytic solution was measured on silicate glasses with a content (mole%) of 0-16.3 of B_2O_3, 0-2 of Al_2O_3, 10-22.7 of Na_2O, and 0-6.4 of CaO: $\varphi = \varphi^o + \vartheta \log(a_{H^\cdot} + Ka_{Na^\cdot})$, where $\vartheta = 2.3RT/F$; $K = a_{H^\cdot} \cdot N_{Na^\cdot} / a_{Na^\cdot} \cdot N_{H^\cdot}$ is the exchange coefficient between Na^+ and H^+. With increasing pH, each glass passed from the hydrogen function

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($\varphi_{H^\cdot} = \varphi^o + \vartheta \log a_{H^\cdot}$) to the sodium function: $\varphi_{Na^\cdot} = \varphi^o + \vartheta \log K a_{Na^\cdot}$. This results in the relation: $-\log K = (\varphi_{H^\cdot} - \varphi_{Na^\cdot})/\vartheta - \log(a_{H^\cdot}/a_{Na^\cdot})$. A dependence of K on the ratio between the strong acids and the sum of strong and weak acids in the glass was found. $-\log K$ is a unique function of the molar part, a, of the strong acids in the glass: $a = [B_2O_3(\%) + Al_2O_3(\%)]/[Na_2O(\%) + CaO(\%)]$. The transition from the hydrogen to the sodium function occupies a wide zone of the diagram in glasses with a comparable content of strong and weak acids, and a narrow one in glasses with a prevailing content of either strong or weak acids (Fig. 3). There are 3 figures, 1 table, and 8 references: 7 Soviet and 1 non-Soviet. The reference to the English-language publication reads as follows: B. Lengyel, E. Blum, Trans. Farad. Soc., 30, 461 (1934).

ASSOCIATION: Nauchno-issledovatel'skiy khimicheskiy institut Leningradskogo gosudarstvennogo universiteta im. A. A. Zhdanova (Scientific Research Chemical Institute of the Leningrad State University imeni A. A. Zhdanov)

SUBMITTED: March 11, 1961

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

NIKOL'SKIY, B.P.; SHUL'TS, M.M.; BELYUSTIN, A.A.

Influence of the nature of the second glass-forming oxide on the sodium and potassium electrode functions of silicate glasses. Dokl.AN SSSR 144 no.4:844-848 Je '62. (MIRA 15:5)

1. Leningradskiy gosudarstvennyy universitet im. A.A.Zhdanova.
2. Chlen-korrespondent AN SSSR (for Nikol'skiy).
(Electrodes, Glass) (Oxides)

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

SHUL'TS, M.M.; PESHEKHONOVA, N.V.; ROMANOVA, L.M.; ANDRIANOV, A.A.

Study of the electrode properties of lithium aluminosilicate glasses. Vest. LGU 17 no.16:108-115 '62. (MIRA 15:9)
(Electrodes, Glass)

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

NIKOL'SKIY, B.P.; SHUL'TS, M.M.

Some aspects of glass electrode theory. Zhur. fiz. khim. 36 no.6:1327-1330 Je'62 (MIRA 17:7)

1. Leningradskiy gosudarstvennyy universitet.

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

S/054/63/004/001/010/022
B101/B215

AUTHORS: Stefanova, O. K., Shul'ts, M. M., Materova, Ye. A., Nikol'skiy, B. P.

TITLE: The e. m. f. of galvanic cells containing ion exchange diaphragms

PERIODICAL: Leningrad. Universitet. Vestnik. Seriya fiziki i khimii, no. 1, 1963, 93-98

TEXT: The galvanic cell

$$Ag \,|\, \underset{\text{solution 1}}{AgCl}, ACl, BCl \,\underset{I}{|}\, \text{diaphragm} \,\underset{II}{|}\, ACl, BCl, \underset{\text{solution 2}}{AGCl} \,|\, Ag \quad (1)$$

where A and B are univalent metals or hydrogen, is studied. The diaphragm is taken as being permeable only to cations. The change in free energy caused by the transport of solvent is not taken into consideration. Based on a paper by G. Scatchard (J. Amer. Chem. Soc., 75, 2883, 1953),

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The e. m. f. of galvanic cells ...

$$E = \frac{RT}{F} \ln \frac{a^2_{\pm\,(BCl)_1} + \frac{\bar{u}_A}{\bar{u}_B} K a^2_{\pm(ACl)_1}}{a^2_{\pm\,(BCl)_1} + \frac{\bar{u}_A}{\bar{u}_B} K a^2_{\pm(ACl)_1}} \qquad (6)$$

is obtained for the e. m. f.; a being the activity coefficients of the ions and $\bar{u}$ being their mobility in the diaphragm. The effect of incomplete dissociation on the validity of Eq. 6 is discussed, and the equation whose validity can be determined qualitatively by plotting the curve e. m. f. versus composition of solution is checked experimentally. Substitution of the transport numbers t'_i and t''_i of ions in the surface layer of the diaphragm in Eq. 6 yields

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S/054/63/004/001/011/022
B101/B215

AUTHORS: ~~Shul'ts, M. M.,~~ Parfenov, A. I., Peshekhonova, N. V., Belyustin, A. A.

TITLE: Method for studying the electrode properties and chemical stability of glasses

PERIODICAL: Leningrad. Universitet. Vestnik. Seriya fiziki i khimii, no. 1, 1963, 98-104

TEXT: The regularities governing the relation between the electrode properties of glasses and their chemical composition were studied in binary alkali silicate glasses such as Li_2O - SiO_2 and Na_2O - SiO_2, as well as in three-component glasses which, besides alkali oxide and SiO_2, contained also an element belonging to the groups II, III, IV, or V of the periodic system, as well as in multicomponent glasses such as Li_2O - Cs_2O - La_2O_3 - SiO_2; Li_2O - BaO - La_2O_3 - SiO_2; Na_2O - BaO - Al_2O_3 - SiO_2 and others. The production of electrodes in the form of blown-up glass balls of 8-10mm diameter, wall thickness 0.2-0.3mm is described.

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The curves E versus pH were plotted and the point b of the beginning H^+ function, point c of the end of the H^+ function, and point d of the beginning metal function were determined in order to characterize the electrode properties. The equation $E = E^o + \vartheta \log (a_{H^+} + Ka_{M^+})$, where $\vartheta = 2.3RT/F$, K = equilibrium constant of the ion exchange between glass and solution is of satisfactory validity for a sharp transition from the H^+ function to the metal function. For three-component glasses, $\lambda = K^x/K'$ was obtained where K^x is the exchange constant of the glass containing a second oxide and K' is the exchange constant of the binary glass. The chemical stability was determined by treating the powdered glass (particle size = 80 - 100μ) for 1 hr with water or 0.1 N HCl at 100°C and by determining colorimetrically the components in solution. The chemical stability was characterized by the ratios $[R_2O]_{sol}/[R_2O]_{glass}$ and $[SiO_2]_{sol}/[SiO_2]_{glass}$. In some cases the stability of the ground glass faces was tested by measuring the loss of weight in $g/cm^2 \cdot hr$. These methods have been applied in the papers on

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Method for studying the electrode ...

glass electrodes appearing in the same number of this periodical.

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S/054/63/004/001/012/022
B101/B215

AUTHORS: ~~Shul'ts, M. M.,~~ Peshekhonova, N. V., Parfenov, A. I., Ivanova, Ye. A., Petrova, V. N.

TITLE: Study of how alkaline earth oxides affect the electrode properties and chemical stability of lithium silicate glasses

PERIODICAL: Leningrad. Universitet. Vestnik, Seriya fiziki i khimii, no. 1, 1963, 104-114

TEXT: Glasses containing 24, 27, or 30 mole% Li_2O and an addition of 0.20 mole% of BaO, CaO, MgO, or BeO were studied by plotting the curves E versus pH. Results: BaO shifts the upper limit of the H^+ function range by 0.1 - 0.3 pH units into the alkaline region. In some cases, also the lower limit of the H^+ function is shifted in positive direction. The exchange constant of Li - Ba glasses is somewhat lower than that of binary glass. CaO addition narrows the H^+ function range in the alkaline region, extends the transition range by ~1 pH unit, and increases

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the exchange constant. MgO has the same effect but much more intensively. The shift in the upper limit of the H^+ function caused by 15 mole% MgO at 27 mole% Li_2O is 3.3 pH units, but that due to 15 mole% CaO is only 1 pH unit. The shift caused by BeO is 2 - 3 pH units at no more than 2.5 mole%; at 15 - 20 mole% BeO, this shift in acid direction is 3-4 pH units. The effect on the exchange constants increases as follows: BaO $\langle$ CaO $\langle$ MgO $\langle$ BeO. This is probably due to weaker H-bonds owing to the formation of strongly acid ionogenic groups. An addition of small amounts of BaO changes the stability of glass to H_2O but slightly, whereas 20 mole% BaO reduces its chemical stability. The stability is increased by up to 10 mole% CaO, and decreased by higher CaO concentrations; but it remains higher than that of binary glass. In an acid solution, 5 mole% CaO increasesthe stability, but at 10-20 mole% CaO the Li_2O leaches out intensively. MgO has a similar effect on the chemical stability. BeO increases the stability in H_2O and in acids.

Conclusion: The stability of the glass is increased by elements that form ionogenic groups in lithium silicate glasses such as MgO and

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Study of how alkaline earth oxides ... S/054/63/004/001/012/022
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especially BeO, and reduced by oxides which form modifying ions (BaO). There are 3 figures and 5 tables.

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

S/054/63/004/001/013/022
B101/B215

AUTHORS: Shul'ts, M. M., Peshekhonova, N. V., Kopuntsova, T. A., Shandalova, L. P.

TITLE: Effect of alkaline earth oxides on the electrode properties and chemical stability of sodium silicate glasses

PERIODICAL: Leningrad. Universitet. Vestnik. Seriya fiziki i khimii, no. 1, 1963, 114-120

TEXT: Sodium silicate glasses containing 15, 20, or 25 mole% of Na_2O and additions of 0 - 20 mole% BaO, CaO, MgO, or BeO were studied by plotting the curves E versus pH. Results: (1) The upper limit of the H^+ function is shifted into the alkaline region by BaO, hence, the total region of the H^+ function is extended. The exchange constant beomces 1-2 orders of magnitude smaller than that of the binary glass. (2) CaO increases the H^+ function range. In the acid region this increase is 1.5 - 2.0 pH units. The exchange constant becomes 1-2 orders of magnitude smaller. (3) MgO narrows the range of the H^+ function. At

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pH = 10 - 11, the Na^+ function is complete. The exchange constant becomes 1-2 orders of mangitude larger. (4) BeO has the same effect as MgO, but acts more intensively. Already 5 mole% BeO causes the formation of the Na^+ function. The exchange constant increases by 4 - 6 orders of magnitude. (5) Glasses containing BaO as their third component have the widest H^+ function range, whereas glasses containing BeO have the narrowest. (6) All alkaline earth oxides increase the stability of the glass to H_2O and 0.1 N HCl. The effect of alkaline earth oxides on the electrode properties of the glasses is explained by the mainly modifying effect of BaO. MgO and BeO, however, form strongly acid ionogenic $\left[RO_{4/2}\right]^{2-}$ groups, thus facilitating the substitution of alkali cation for proton. There are 2 figures and 5 tables.

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

S/054/63/004/001/014/022
B101/B215

AUTHORS: Parfenov, A. I., Shul'ts, M. M., Nekrasova, T. N., Polozova, I. P.

TITLE: Electrode properties and chemical stability of lithium silicate glasses containing rare earth oxides of yttrium oxide

PERIODICAL: Leningrad. Universitet. Vestnik. Seriya fiziki i khimii, no. 1, 1963, 126-134

TEXT: This is a report on the study of glasses belonging to the systems $Li_2O - Nd_2O_3 - SiO_2$, $Li_2O - CeO_2 - SiO_2$, and $Li_2O - Y_2O_3 - SiO_2$. The curves E versus pH were plotted at room temperature in the pH interval -0.5 - 14 and at 95°C in the pH interval -0.5 - 12 in solutions with a constant 3 N concentration of Li^+ or Na^+ ions. In addition, the stability of the glass to H_2O or 0.1 N HCl was determined at 100°C. Results: (1) Addition of rare earth oxides or Y_2O_3 shifts the total H^+ function

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range toward more acid values. (2) A small content of rare earth oxides or Y_2O_3 (up to 5 mole%) causes an intensive shift which becomes comparatively small as the content of rare earth oxides or Y_2O_3 is increased. (3) The shift increases the higher the number of the rare earth element in the periodic system i. e. the smaller its ion radius. The exchange constants K_{HLi} increase. (4) The effect of Y_2O_3 is more intensive than that of rare earth oxides. (5) The stability of glass to H_2O and 0.1 N HCl is increased by rare earth oxides and Y_2O_3. There are 4 figures and 7 tables.

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

S/054/63/004/001/015/022
B101/B215

AUTHORS: Shul'ts, M. M., Bobrov, V. S., Bukhareva, I. S.

TITLE: Electrode properties of glasses containing titanium oxide

PERIODICAL: Leningrad. Universitet. Vestnik, Seriya fiziki i khimii, no. 1, 1963, 134-142

TEXT: Glasses of the composition M_2O - TiO_2 - SiO_2, where M = Na or Li, were studied. The curve E versus pH was plotted at 18°C or 95°C in a buffer solution containing 3 N $[Li^+]$ or $[Na^+]$. The system Li_2O - TiO_2 - SiO_2 yielded glasses with a maximum content of TiO_2 not exceeding 6 mole%. A higher TiO_2 content caused devitrification. TiO_2 reduced the upper limit of the H^+ function, yielding a second linear section on the curve E versus pH which is not as steep as that of the H^+ function. The system Na_2O - TiO_2 - SiO_2 yielded glasses containing up to 30 mole% TiO_2, which had a differentiating effect. At 1.5 or 3 mole% TiO_2 the curve of E

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versus pH includes a second linear section (58 mv/pH). Glasses containing 6, 10, or 14% TiO_2 show three linear sections, one with 58 mv/pH, one with 25 - 15 mv/pH, and a horizontal one which corresponds to the Na^+ function. A further increase in TiO_2 content widens the range of the metal function continuously. At 26 mole% TiO_2, the metal function occurrs already at pH $\geqslant$6. At smaller additions, TiO_2 acts like a glass forming oxide and increases the acidity of the glass by forming ionogenic $[TiO_{6/2}]^{2-}2M^+$ groups. More than 10% TiO_2 yields an increasing number of $[TiO_{4/2}]$ tetrahedrons which bind the H^+ more firmly and reduce the acidity of the glass. There are 5 figures.

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S/054/63/004/001/016/022
B101/B215

AUTHORS: Shul'ts, M. M., Parfenov, A. I., Panfilova, N. P.

TITLE: Effect of zirconium dioxide on the electrode properties and the chemical stability of alkali silicate glasses

PERIODICAL: Leningrad. Universitet. Vestnik. Seriya fiziki i khimii, no. 1, 1963, 143-148

TEXT: Silicate glasses containing 27 mole% Li_2O and 0 - 9 mole% ZrO_2 were studied by plotting the curves E versus pH at room temperature and at 95°C in a 3 N alkaline solution or 3 - 20 N H_2SO_4. Furthermore the chemical stability to H_2O or 0.1 N HCl at 100° was tested. Results: Even 3 mole% ZrO_2 shifts the upper limit of the H^+ function considerably towards more acidic pH values. At the same time the region of transition from H^+ to the metal function is extended. The exchange constants increase by 2 orders of magnitude at room temperature and by 4 orders

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of magnitude at 95°C. In sulfuric acid, even 0.5 mole% ZrO_2 shifts the H^+ function towards acid pH values; at 9% ZrO_2 the lower limit of the H^+ function in 20% H_2SO_4 is pH = -2. ZrO_2 increases the stability of glass to alkali and acid. The glass - acid interaction is attended by leaching out, but in alkaline solutions the glass components are dissolved at the same ratio as when contained in the glass. Conclusion: A ZrO_2 addition leads to the formation of groups having H^+ bonds of different strengths. Besides the weakly acid $[SiO_{4/2}]$ H groups, also strongly acid ionogenic $[RO_{6/2}]^{2-}$ $2H^+$ groups are formed. There are 4 figures and 4 tables.

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S/054/63/004/001/017/022
B101/B215

AUTHORS: Belyustin, A. A., Shul'ts, M. M.

TITLE: Electrode behavior of sodium silicate glasses containing oxides of elements of the IV and V main groups of the periodic system

PERIODICAL: Leningrad. Universitet. Vestnik. Seriya fiziki i khimii, no. 1, 1963, 149-155

TEXT: The effect of Fe_2O_3, GeO_2, SnO_2, P_2O_5, Sb_2O_3, and Bi_2O_3 on sodium silicate glasses was studied by plotting the curves E versus pH. Results: (1) Fe_2O_3 acts similarly to Al_2O_3. As little as 0.5 mole% Fe_2O_3 disturbs the H^+ function in the region pH = 1 - 4 and shifts the section of the Na^+ function towards more positive values. (2) Up to a content of 7 mole%, GeO_2 affects the curve E versus pH only slightly. Stages characteristic of glass forming oxides are formed in the region pH = 2-4, whereas at a content of more than 7 mole% GeO_2, the region of the H^+ function becomes

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narrower owing to the formation of strongly ionogenic $[GeO_{6/2}]^{2-}$ groups whose content is lower than that of GeO_4 groups. (3) SnO_2 addition causes intensive formation of $[SnO_{6/2}]^{2-}$ groups; the effect of the glass forming oxide is very distinct and is comparable to that of Al_2O_3. (4) Glasses containing more than 4 mole% P_2O_5 were unstable, they dissolved rapidly in 0.1 N HCl. The curve E versus pH consists of two intersecting lines, the inclination of the second section being 24 - 33 mv/pH, i. e. close to v/2. The microinhomogeneity of the glass is assumed to be responsible for the above phenomenon. Addition of BaO neutralizes the effect of P_2O_5. (5) Sb_2O_3 and Bi_2O_3 yielded only very unstable glasses, but various series of tests gave orientation data. In Sb_2O_3, the effect of the glass-forming oxide Sb_2O_3 which yields $[SbO_{4/2}]^-$ groups becomes superposed on the effect of the modifying ions Sb^{III} (probably SbO^+ ion). The formation of ionogenic $[SbO_{6/2}]^{2-}$ groups is possible. In Bi_2O_3, the effect of the strongly acid groups decreases as the Bi_2O_3 content increases.

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Electrode behavior of sodium silicate ...

Conclusion: In sodium silicate glass the oxides of the elements in groups IV and V of the periodic system form element-oxygen structural units which can be proved by examining the glass electrode. There are 5 figures.

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

NIKOL'SKIY, B.P.; SHUL'TS, M.M.

New concepts of the ion exchange theory of glass electrodes. Part 1. Vest. LGU 18 no.4:73-86 '63. (MIRA 16:3)
(Electrodes, Glass) (Ion exchange)

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

NIKOL'SKIY, B.P.; SHUL'TS, M.M.; BELYUSTIN, A.A.

New concepts of the ion exchange theory of glass electrodes. Vest. LGU 18 no.4:86-93 '63. (MIRA 16:3)
(Electrodes, Glass) (Ion exchange)

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

SHUL'TS, M.M.; PESHEKHONOVA, N.V.; SHEVNINA, G.P.

Electrode properties of lithium borosilicate and gallosilicate glasses. Vest. LGU 18 no.4:120-126 '63. (MIRA 16:3)
(Electrodes, Glass) (Lithium borosilicate) (Lithium gallosilicate)

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

SHUL'TS, M.M.; PARFENOV, A.I.; CHEN DE-YUY [Ch'ên Tieh-yü]

Electrode properties of glasses of the system of oxides Li_2O - Cs_2O - La_2O_3 - SiO_2. Vest. LGU 18 no.4:155-160 '63. (MIRA 16:3)
(Electrodes, Glass) (Oxides)

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SHUL'TS, M.M.; PESHEKHONOVA, N.V.; LIPETS, T.V.

Electrode properties and chemical stability of lithium silicate glasses containing barium and lanthanum oxides. Vest. LGU 18 no.4:160-162 '63. (MIRA 16:3)
(Electrodes, Glass) (Lithium silicates) (Barium oxide) (Lanthanum oxide)

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

BOBROV, V.S.; SHUL'TS, M.M.

Electrode properties of nonsilicate glasses. Vest. LGU 18 no.4: 166-171 '63. (MIRA 16:3)

(Electrodes, Glass)

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

SHUL'TS, M.M.

Dependence of the electrode properties of glasses on their structure. Vest. LGU 18 no.4:174-186 '63. (MIRA 16:3)
(Electrodes, Glass) (Systems (Chemistry))

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

NAZAROV, A.A.; SHUL'TS, M.M.; STORONKIN, A.V.

Thermodynamic properties of the system AgCl - NaCl - $PbCl_2$. Part 2: Activities and activity coefficients of components of a system for the solid phase of variable composition. Vest. LGU. 18 no.16:94-102 '63. (MIRA 16:11)

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

SHUL'TS, M.M.; BUSHUYEVA, I. M.

Thermodynamic investigation of solid solutions in the system NaCl-KCl-CdCl. Part 1. Vest. LGU 18 no. 22:120-130 '63. (MIRA 17:1)

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

BUSHUYEVA, I.M.; SHUL'TS, M.M.

Thermodynamic study of solid solutions in the system Na NaCl - KCl - $CdCl_2$. Part 2. Vest. LGU 18 no.22:160-163 '63. (MIRA 17:1)

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

SHULTS, M. M.

"Structural ionogenic groups of glass and its electrode properties."

report submitted for 4th All-Union Conf on Structure of Glass, Leningrad, 16-21 Mar 64.

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

ACCESSION NR: AT4040547 S/0000/64/000/000/0096/0105

AUTHOR: Shul'ts, M.M., Peshekhonova, N.V., Belyustin, A.A., Parfenov, A.I., Bobrov, V.S.

TITLE: Electrode properties of alkali silicate glasses containing the oxides of gallium, indium, titanium and zirconium

SOURCE: Soveshchaniye po khimii redkikh elementov. Leningrad, 1961. Khimiya redkikh elementov (Chemistry of rare elements); doklady* soveshchaniya. Leningrad, Izd-vo Leningr. univ., 1964, 96-105

TOPIC TAGS: glass, silicate glass, electrode behavior, silicate glass electrical property, rare earth oxide, alkali silicate glass, gallium oxide, indium oxide, titanium oxide, zirconium oxide

ABSTRACT: After a theoretical review of the electrode properties of various glasses and the relationship between the EMF of an Ag AgCl, HCl glass buffer KCl, Hg_2Cl_2 Hg cell and pH, the authors describe the effect of the addition of various amounts of rare oxides to lithium-silicate, lithium-aluminium-silicate, sodium-aluminium-silicate, and sodium-barium-aluminium-silicate glasses. In glasses of

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the series of 24% Li_2O-X% R_2O_3 - (76-X)% SiO_2, when R=B, Al, Ga, in order to obtain the same effect it is necessary to incorporate more Ga_2O_3 than Al_2O_3 and more B_2O_3 than Ga_2O_3, which means that the effect of Ga_2O_3 on the electrode properties is between the effects of B_2O_3 and Al_2O_3. Analogous results were obtained with glasses containing 27 and 30% LiO_2. In glass of the system 22% Na_2O-X% Ga_2O_3-(78-X)% SiO_2, added gallium acts as a glass former and to some extent as a modifier. In a system containing 22% Na_2O-X% In_2O_3 - (78-X)% SiO_2, it was observed that the deviation from the hydrogen function increased with an increase in In_2O_3, but was less than with Ga_2O_3. In glass of the system 22% Na_2O - 4% R_2O_3 - 74% SiO_2 (R=B, Al, Ga and In), the effect of the R_2O_3 oxides on the electrode behavior of sodium silicate glasses decreased in the order Al > Ga>B>In, as in the lithium silicate glasses. This order is characteristic for glasses when $[R_2O_3]/[Na_2O] < 0.3$. If $0.3 < [R_2O_3]/[Na_2O] < 1$, the order is different: A > B > Ga > In; while if $[R_2O_3]/[Na_2O] > 1$, the order is Ba > Al > Ga > In. In the system Na_2O-TiO_2-SiO_2 where Na_2O = 16-22 mol.%, the effects were characteristic for the oxides of glass formers, and analogous data were obtained with some LiO_2-TiO_2-SiO_2 systems. Relatively small amounts of TiO_2

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produced differentiation with respect to the stability of the bonds to H^+ions similar to that obtained for the R_2O_3 oxides. In sodium and lithium silicate glasses, ZrO_2 showed similar results. The electrode behavior of alkali silicate glasses into which oxides of Ti and Zr are incorporated can be explained by the formation of bonds in which the atoms of these elements are surrounded by oxygen in such a way that a complex is formed which carries a negative charge and which determines the predominantly ionic bond of hydrogen in the glass. Addition of barium oxide to lithium silicate glasses containing ZrO_2 seems to abolish the glass forming properties of ZrO_2. Orig. art. has: 7 figures.

ASSOCIATION: none

SUBMITTED: 21Jan64 ENCL: 00 SUB CODE: MT, IC

NO REF SOV: 011 OTHER: 001

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

ACCESSION NR: AT4040548 S/0000/64/000/000/0106/0115

AUTHOR: Nikol'skiy, B. P.; Shul'ts, M. M.; Peshekhonova, N. V.; Parfenov, A.I.; Mazurin, O. V.

TITLE: Lithium-cesium-lanthanum silicate electrode glass for pH determinations

SOURCE: Soyeshchaniye po khimii redkikh elementov. Leningrad, 1961. Khimiya redkikh elementov (Chemistry of rare elements); doklady* soveshchaniya. Leningrad, Izd-vo Leningr. univ., 1964, 106-115

TOPIC TAGS: glass, electrode glass, pH measurement, hydrogen electrode, silicate glass, rare earth oxide, glass electrical conductivity, lithium oxide, cesium oxide, lanthanum oxide

ABSTRACT: The authors investigated the effect of the oxides of Li, Cs and La on the limits of linearity of the relationship between pH and electrode potential, as well as the specific electrical conductivity and chemical stability, of electrodes made from glass formed by oxide systems of progressing complexity: Li_2O - SiO_2,

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SHUL'TS, M.M.; BUSHUYEVA, I.M.

Thermodynamic study of solid solutions in the system NaCl - KCl - CdCl at 540, 580, 623°C. Part 3: Thermodynamic properties of solid solutions. Vest. LGU 19 no.4:111-121 '64. (MIRA 17:3)

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

BELYUSTIN, A.A.; PISAREVSKIY, A.M.; SHUL'TS, M.M.; NIKOL'SKIY, B.P.

Glass electrode sensitive to the change in oxidation potential of solution. Dokl. AN SSSR 154 no.2:404-406 Ja'64. (MIRA 17:2)

1. Leningradskiy gosudarstvennyy universitet im. A.A. Zhdanova. 2. Chlen-korrespondent AN SSSR (for Nikol'skiy).

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

L 51845-65 EWP(e)/EWT(m)/EWP(i)/EWG(m)/EWP(j)/T/EWP(b) Pc-4/Pq-4 RWH/RM/WH

ACCESSION NR: AP5011812 UR/0080/65/038/004/0766/0771
541.134+666.1/.2

AUTHOR: Bobrov, V. S.; Kalmykova, L. P.; Shul'ts, M. M.

TITLE: Manifestation of the coordination state of boron in the electrode behavior of lithium borosilicat glasses

SOURCE: Zhurnal prikladnoy khimii, v. 38, no. 4, 1965, 766-771

TOPIC TAGS: borate glass, silicate glass, lithium compound

ABSTRACT: The electrode behavior of the Li_2O-B_2O_3-SiO_2 system was studied over a wide range of compositions, and a relationship was established between the electrode properties and structural transformations in glass caused by the change in the coordination number of boron. The electrode behavior was followed by studying the emf of electrodes made of the glasses under consideration as a function of the pH. The electrodes were prepared immediately before the experiment; their Li_2O content was 27 mol % (see fig. 1 of the Enclosure). The B_2O_3 content is designated by numbers on each curve. In the presence of small amounts of B_2O_3 (3%), a "differentiating" effect ("step" on the E-pH curve) appears; it indicates the presence of

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L 51845-65

ACCESSION NR: AP5011812

two types of ionogenic groups in the glass which differ considerably in the strength of their bond with hydrogen. The first linear segment of the E-pH curve in the acid region where a hydrogen function is observed is due to the presence of borate structural units $[BO_{4/2}]$ which are weakly bonded to hydrogen ion and produce strongly acidic ionogenic groups $[BO_{4/2}]^-H^+$. The second linear segment is due to the presence of weakly acidic ionogenic silicate groups of the type $|SiO_{4/2}|OH$. On further addition of B_2O_3 (14%), the "step" disappears, and a very smooth transition from a hydrogen function (in the acidic pH range) to a metallic function is observed. As the B_2O_3 content rises from 23 to 50 mol %, the length of the linear segment shows that the proportion of the weakly acidic groups increases. The symbatic relationship observed indicates that the nature of the new weakly acidic ionogenic groups is determined by the borate component of the glass structure. These groups are due to the presence of triangles $[BO_{3/2}]$, in which boron has the coordination number 3. Orig. art. has: 4 figures.

ASSOCIATION: none

SUBMITTED: 10Jul64 ENCL: 01 SUB CODE: MT

NO REF SOV: 009 OTHER: 000

Card 2/3

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

L 51845-65

ENCLOSURE: 01

ACCESSION NR: AP5011812

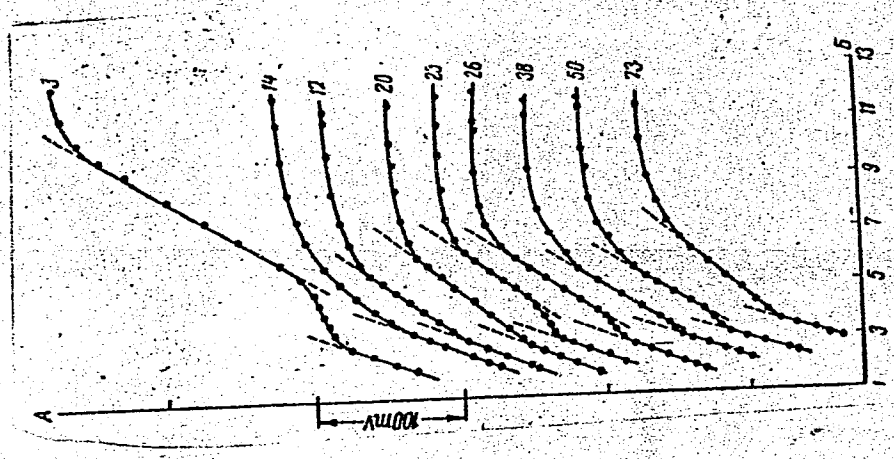

Fig. 1. E versus pH for a series of glasses containing 27% Li_2O.

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

KORCHAGIN, V.V.; STORONKIN, A.V.; SHUL'TS, M.M.

Thermodynamic properties of the binary solid solution $C_3Cl-C_3B_2$. Zhur. fiz. khim. 39 no. 1:227-230 Ja '65 (MIRA 19:1)

1. Leningradskiy gosudarstvennyy universitet imeni A.A. Zhdanova. Submitted May 8, 1964.

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

MALYSHEV, V.N.; SHUL'TS, M.M.; MAKAROV, L.I.

Equilibrium of anomalous mixed crystals. Zhur. fiz. khim. 39 no.6:1504-1507 Je '65. (MIRA 18:11)

1. Leningradskiy gosudarstvennyy universitet imeni Zhdanova. Submitted March 25, 1964.

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

L 43645-66 EWT(d) IJP(c)

ACC NR: AP6011285 SOURCE CODE: UR/0378/66/000/001/0030/0033

43
41
B

AUTHOR: Shul'ts, M. M.

ORG: none

TITLE: Sampling problem

SOURCE: Kibernetika, no. 1, 1966, 30-33

TOPIC TAGS: combinatorial analysis, set theory, data sampling

ABSTRACT: The problem of representatives of subsets is a sampling problem: given a set of objects, it is required to select a subset having certain defined properties. One solution for a closely related problem is given. This is the problem on non-adjacent representatives. Given a set $P = \{p_i | i=1,2,\ldots,n\}$ and a family of subsets $B = \{b_\alpha | \alpha=1,2,\ldots,m\}$, then the "points" p_i and p_j are *adjacent* if there is a subset (block) b_α such that $p_i \in b_\alpha$ and $p_j \in b_\alpha$. The subset $S \subseteq P$ is a system of nonadjacent representatives if for every block the inequality $|b_\alpha \cap S| \leq 1$ is satisfied. When the equality holds, the blocks are said to be represented. If all blocks are represented blocks, we have a complete system of nonadjacent representatives (CSNAR). Two problems are considered: first, to establish necessary and sufficient conditions for

UDC: 519.8

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

L 43645-66

ACC NR: AP6011285

2

the existence of a CSNAR; second, to find the maximal system of nonadjacent representatives. The author thanks Yu. V. Glebskiy and A. A. Markov for their help. Orig. art. has: 3 formulas.

SUB CODE: 12/ SUBM DATE: 10May65/ ORIG REF: 001/ OTH REF: 004

Card 2/2

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

L 38163-66 EWT(m)/EWP(e) WW

ACC NR: AP6019236 (A) SOURCE CODE: UR/0364/66/002/003/0288/0294

AUTHOR: Bobrov, V. S.; Shul'ts, M. M.; Kalmykova, L. P.

ORG: Leningrad State University im. A. A. Zhdanov (Leningradskiy gosudarstvennyy universitet)

TITLE: Differentiation of the bond stability of a hydrogen ion in lithium borosilicate glass

SOURCE: Elektrokhimiya, v. 2, no. 3, 1966, 288-294

TOPIC TAGS: borate glass, lithium, ~~hydrogen bond~~, molecular structure, electrode, electric potential, acid solution, ion, electrochemistry, HYDROGEN BONDING, SILICATE GLASS, BONDING PROPERTY

ABSTRACT: A new type of experimental curve (potential - pH) composed of 3 steps and linear portions is developed for the study of hydrogen bond stability and boron atom coordination in the Li_2O-B_2O_3-SiO_2 system. The displacement of the curves obtained in buffer solutions as a function of B_2O_3 content (in the glass electrode) was related to the grouping of bond stabilities of hydrogen ions "differentiation effect". Four different types of curves having as many as 3 steps and linear portions of varying slope and/or levels were obtained. Curves are given for glass with a Li_2O content of 33 mol% and boron anhydride contents ranging from 0 to 20%. The addition of as little as 5% B_2O_3 shifted the E - pH curve downwards and changed the linear 0% line into one

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L 38163-65

ACC NR: AP6019236

having 3 slopes. The initial slopes were related to the ionic group $[BO\ 4/2^{-}H^{+}$, where boron had a coordination of four. At higher pH levels the appearance of the ionic groups [SiO 3/2]OH caused the slope changes. These two regions were separated by a linear slope of 18 mv/pH as a result of the intermediate mixing of the two ionic groups. The three-stepped character of the curves was maintained under a variety of experimental conditions. A section of the Na_2O-B_2O_3-SiO_2 ternary, in which boron has a coordination of four, was shown with points indicating the range of compositions used experimentally. About half the points fell within that region. Data are presented for the 11 mol% B_2O_3 triangular section for Li_2O contents ranging from 24 to 39%. Again, the differentiation effect occurred and the slope changes were interpreted as before; $[BO\ 4/2]^{-}H^{+}$, [BO 2/2]OH and [SiO 3/2]OH are related to slope changes a, b and c respectively. Orig. art. has: 4 figures.

SUB CODE: 07,11/ SUBM DATE: 31Mar65/ ORIG REF: 011/ OTH REF: 000

Card 2/2

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

42142-66 EWP(e)/EWT(m)/EWP(j)/T DS/RM/WH

ACC NR: AP6022424 SOURCE CODE: UR/0364/66/002/004/0420/0425

59
57
B

AUTHOR: Bobrov, V. S.; Shul'ts, M. M.; Kalmykova, L. P.

ORG: Leningrad State University imeni A. A. Zhdanov (Leningradskiy gosudarstvennyy universitet)

TITLE: Coordination state of boron in lithium borate glasses, based on a study of their electrode properties.

SOURCE: Elektrokhimiya, v. 2, no. 4, 1966, 420-425

TOPIC TAGS: borate glass, lithium glass, electrode potential, ACID BASE EQUILIBRIUM, BORON, CHEMICAL BONDING, COORDINATION CHEMISTRY

ABSTRACT: The electrode behavior of glasses of the $Li_2O-B_2O_3$ system was studied by recording the potential of the glass electrode versus the pH (i. e., plotting E-pH curves) in a universal water-alcohol buffer solution containing 0.1 mole of Li ions per liter, 85% ethyl alcohol, and also hydrobromic, salicylic, monochloroacetic, and benzoic acids (0.05 M each). It was found that the coordination state of boron manifests itself in the electrode behavior of the glasses. An increase in the content of Li_2O to 42 mole % causes an increase in the relative content of strongly acidic ionogenic groups $[BO_{4/2}]^-H^+$ of tetracoordinated boron. The electrode behavior of the glasses was shown to reflect the influence of various ionogenic groups of tetracoordinated boron, which are characterized by a marked stability of their bond with hydrogen ions. The observed correlation between the electrode behavior of glasses and the coor-

Card 1/2 UDC: 541.135.53

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42142-66

ACC NR: AP6022424

dination state of boron indicates that the "electrode" method is sufficiently sensitive for studies of structural transformations in lithium borate glasses. Authors are deeply grateful to M. D. Anikiyeva for assistance in the analysis of the glasses. Orig. art. has: 3 figures and 1 table.

SUB CODE: 07/ SUBM DATE: 01Jul65/ ORIG REF: 017/ OTH REF: 001

Card 2/2 MCP

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

MAKHNEVA, Valentina Alekseyevna, referent; SHUL'TS, N., red.

[From the window of a trolleybus; guide to the trolleybus route through the mountains from Simferopol' to Yalta] Iz okna trolleibusa; putevoditel' po gornoi trolleibusnoi trasse Simferopol' - IAlta. Simferopol, Krym, 1965. 60 p. (MIRA 18:7)

1. Simferopol'skaya gorodskaya ekskursionnaya organizatsiya obshchestva "Znaniye" (for Makhneva).

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

SHUL'TS, N.; DMITRIYEV, V.

People's universities. Avt. transp. 43 no.9:6-7 S '65. (MIRA 18:9)

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

GUBANOV, Ivan Grigor'yevich, st. prepodavatel'; PODGORODETSKIY, Petr Dmitrivevich, kand. geogr. nauk; SHUL'TS, N., red.;

[Treasures of the earth; geolcgical review and minerals of the Crimea] Bogatstva nedr; geologicheskii ocherk i poleznye iskopaemye Kryma. Simferopol', Izd-vo "Krym," 1965. 84 p. (MIRA 19:1)

1. Krymskiy gosudarstvennyy pedagogicheskiy institut im. M.V.Frunze (for Podgorodetskiy,Gubanov).

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

SHUL'TS, N.A.

Synphasic frequency of changes in the functional leukocyte count and solar activity. Probl.gemat. i perel.krovi 4 no.7:41-42 Jl '59. (MIRA 12:10)

1. Iz Sochinskogo territorial'nogo upravleniya kurortov, sanatoriyev i domov otdykha (glavnyy vrach D.I.Zhirnov).
(LEUKOCYTE COUNT
eff. of sunlight (Rus))
(SUNLIGHT, eff.
on leukocyte count (Rus))

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

SHUL'TS, N.A.

Laboratory network of the All-Union Sanatroium. Lab.delo. 5 no.5:59 S-O '59. (MIRA 12:12)

(SOCHI--MEDICAL LABORATORIS)

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

SHUL'TS, N.A.

Effect of fluctuations in solar activity on hemopoiesis. Priroda 48 no.6:92-94 Je '59. (MIRA 12:5)

1.Sochinskoye kurortnoye upravleniye.
(BLOOD CELLS) (SOLAR RADIATION)

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

SHUL'TS, N.A.

Dynamics of the changes in the quantity of leucocytes in connection with solar radiation. Lab.delo 6 no.2:36-38 Mr-Ap '60. (MIRA 13:6)

1. Sochinskoye territorial'noye upravleniye kurortov, sanatoriyev i domov otdykha (glavnyy vrach D.I. Zhirnov).
(LEUCOCYTES) (SLOAR RADIATION--PHYSIOLOGICAL EFFECT)

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

SHUL'TS, M.A.

Influence of cosmic factors on the results of precipitation reactions. Lab. delo 7 no.6:3-5 Je '61. (MIRA 14:7)

1. Sochinskiy filial Vsesoyuznogo nauchnogo obshchestva vrachey - laborantov.

(PHYSIOLOGICAL CHEMISTRY)

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

SHUL'TS, N. A.

Relative lymphocytosis and solar activity. Terap. arkh. no.7:97-99 '61. (MIRA 15:2)

1. Iz Sochinskogo territorial'nogo kurortnogo upravleniya.

(LYMPHOCYTES) (SOLAR RADIATION—PHYSIOLOGICAL EFFECT)

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

L 44444-66 EWT(1) GW

ACC NR: AR6015219 SOURCE CODE: UR/0269/65/000/012/0055/0055

29
B

AUTHOR: Shul'ts, N. A.

ORG: none

TITLE: Nonsuitability of Wolf numbers in the study of sun-earth relation in the biosphere

SOURCE: Ref. zh. Astronomiya, Abs. 12.51.421

REF SOURCE: Solnechnyye dannyye, No. 1, 1965, 73-78

TOPIC TAGS: sun, sunspot, Wolf number, solar activity, biosphere

ABSTRACT: When comparing the biological processes with the rate of W Wolf numbers, the parallelism of indices compared is frequently broken because the sunspot-forming activity of the sun does not reflect all manifestations of solar activity. Interruption of the correlation is particularly noticeable when diurnal Wolf numbers are used. Other indices of solar activity are therefore necessary. The solar activity for 1960-1961 is analyzed. It is shown that in a series of cases,

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

SHUL'TS, N.G.

[illegible]

[illegible] "[illegible]" [illegible]

[illegible] str. [illegible]-111.

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

Shul'ts, N. Ye.

2

Chem

The carbonate equilibrium in soil solutions. P. A. Kryukov and N. E. Shul'ts (Hydrochem. Inst., Novocherkassk). *Gidrokhim. Materialy* 23, 110-37(1955).—Several methods of detg. the carbonate equil. (HCO_3^-, CO_3^{--}, and free CO_2) are discussed. When alky. is due to HCO_3^- alone, titration is satisfactory provided Groag's mixed indicator (100 cc. of satd. alc. soln. of methyl red and 4 cc. of 4% aq. sol. of methylene blue) is used. The results are identical with those obtained potentiometrically. When salts besides bicarbonates are present their alky. is deducted from total alky. The method of Goetikov and Forsch is suitable in this case. When the soln. is colored, potentiometric titration tends to overcome this difficulty. Other advantages of potentiometry are the possibility of using small amounts (1-2 cc.) and obtaining an idea of the nature of the nonvolatile acids when present in the soil soln. When carbonates and free carbonic acid are present together with bicarbonates reliable results are obtained by liberating the total CO_2, and detg. it in the absorbing soln. either titriometrically or potentiometrically. The bicarbonates can be detd. in the same soln. by treating with Ba^{++} in which case the sol. carbonates are converted into $BaCO_3$ and the bicarbonates into $BaCO_3$ plus CO_2, which is removed and detd. The equiv. amt. of bicarbonates is calcd. and deducted from total alky. representing the sum of carbonates and bicarbonates. This does not take into account free CO_2 and can be used when the amount of the latter is negligible. When the amount of free CO_2 cannot be overlooked and that of the carbonates is negligible $BaCl_2$ will expel free CO_2 and half of the CO_2 of the bicarbonates. Acid added to another sample will expel all the free and

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Kryukov, P.A. and Shults, N.E.

bound CO_2 and titration or potentiometry of both solns. will furnish the amounts of bicarbonates and free CO_2. Since carbonates and free CO_2 are very rarely present together a quick and reliable method is given for detg. the carbonate equil. The app. used in the procedure is described in detail.

A. S. Mirkin

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

BORUCHINKINA, A.A.; DRENOV, N.V.; MENNER, V.V.; SHUL'TS, N.E.

Devonian stratigraphy of the interfluve of the Stony and Lower Tunguska Rivers. Trudy VAGT no.7:133-139 '61. (MIRA 14:7)
(Podkamennaya Tunguska Valley--Geology, Stratigraphic)
(Lower Tunguska Valley--Geology, Stratigraphic)

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

SHALYT, Semen Lyudvigovich, prof., doktor biol. nauk; SHALYT, A.S., isp. obyazan. prof., kand. biol. nauk, red.; KOZIN, Ya.L., prof., doktor geol.-miner. nauk, red.; SHUL'TS, N.P., red.

[Fishes in freshwater bodies of water] Ryby presnykh vodoyemov. Simferopol', Izd-vo "Krym," 1964. 69 p. (MIRA 17:7)

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

DOBROHRAVIN, Petr Pavlovich, kand. fiz.-matem. nauk; STESHENKO, Nikolay Vladimirovich, kand. fiz.-matem. nauk; SHUL'TS, N.P., red.

[Crimean Astrophysical Observatory of the Academy of Sciences of the U.S.S.R.] Krymskaia astrofizicheskaia observatoriia Akademii nauk SSSR. Simferopol', Krym 1965. 78 p. (MIRA 18:12)

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"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

1. SHUL'TS, O.A.

2. USSR (600)

4. Fur Farming

7. Work practice of a leading fur section on the "Vpered" Collective Farm, Kar. i zver. 6 no. 2, 1953.

9. Monthly List of Russian Accessions, Library of Congress, APRIL 1953, Uncl.

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2"

"APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550210005-2

1ST AND 2ND ORDERS

3RD AND 4TH ORDERS

PROCESSES AND PROPERTIES INDEX

SHVI-TS, O.R.

16

CA

Preparation of naturally fortified Soviet wine. O. R. Shul'ts. *Vinodelie i Vinogradarstvo S.S.S.R.* 9, No. 4, 40-3(1949).--Expts. showed the highest alc. content results from fermentation of sweetened musts at 14°-18°; aeration was an insignificant factor unless fermentation was terminated within 5 days; the usual period was 50 days.
H. Oatfield

COMMON ELEMENTS

OPEN

MATERIALS INDEX

COMMON VARIABLES INDEX

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

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SHUL'TS, O.R.

Wine production in the Southern Ukraine. O. R. Shul'ts (Agr. Inst., Kherson). *Vinodelie i Vinogradarstvo S.S.S.R.* 10, No. 8, 30-4(1950).—A discussion: the native white wines in the Southern Ukraine are characterized by their relatively low total acidity (approx. 5 g./l.). Addn. of 150-200 mg. SO_2/l. must before the alc. fermentation prevents the decrease of the acidity. By keeping the high SO_2 concn. during the entire post-fermentative treatment of wine the quality of the product increases. During the first year of aging 100-125 mg. SO_2/l. is required. Wines contg. higher amts. of extractive materials preserve their acidities more easily. The SO_2 treatment of wines is described. B. Wierbicki

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SOV/123-59-16-63582

Translation from: Referativnyy zhurnal. Mashinostroyeniye, 1959, Nr 16, p 3 (USSR)

AUTHOR: [redacted]

TITLE: Specializing the Manufacture of Dies and Appliances

PERIODICAL: Narodnoye khozyaystvo Sov. Latvii, 1957, Nr 2-3, pp 58-60 (Russian)

ABSTRACT: The question is considered to organize in Latvia a special factory for the manufacture of dies, press molds and appliances, in which 75% of all necessary heavy tools are to be produced in a centralized manner. Labor efficiency increases approximately by 1.8 times, if individual orders are executed in a centralized manufacture, and if uniform and standardized tools are produced, by 4 times. The establishment of such a factory would save in 1960 about 1.5 million manhours, would set free 900 units of manufacturing equipment and 10,000 sq m of manufacturing space. It is recommended to incorporate in the factory a big designing and standardizing office, as well as necessary laboratories. The proposed measure would relieve to a great extent the tool shops of the machine building plants.

B.L.D.

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SHUL'TS, PAVEL INDRIKOVICH

Spetsializatsiya I Kontsentratsiya Proizvodstva Instrumentov V Mashinostroyenii Latviyskoy SSR. Riga, Izd-vo Akademii Nauk Latviyskoy SSR, 1958.
148 (1) P. Graphs, Maps, Tables.
At head of Title: Akademiya Nauk Latviyskoy SSR. Institut Ekonomii.
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[Specialization and concentration of the manufacture of metal cuttin tools in the machinery industry of the Latvian S.S.R.]Spetsializatsiia i kontsentratsiia proizvodstva instrumentov v mashinostroenii Latviiskoi SSR. Riga, Izd-vo Akad. nauk Latviiskoi SSR, 19581 148 p. (MIRA 15:12)

(Latvia--Metal-cutting tools)

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TKACHUK, V.G., doktor geol.-miner. nauk, otv. red.; YURK, Yu.Yu., doktor geol.-min. nauk, red.; IVANOV, B.N., kand. geogr. nauk, red.; GOLOVTSYN, V.N., doktor geol.-min. nauk, red.; VOINSTVENSKIY, M.A., doktor bio.. nauk, red.; SHUL'TS, P.N., kand. ist. nauk, red.; DUBLYANSKIY, V.N., kand.geol.min. nauk, red.; SERDYUK, O.P., red.izd-va; TURBANOVA, N.A., tekhn. red.

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VANECHEK, V., kand. tekhn. nauk; SHUL'TS, R., inzh.

Hydraulic resistance of the lower layers of granular materials fluidized by gases. Khim. i neft. mashinostr. no.5:22-23 N '64 (MIRA 18:2)

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[illegible]. [illegible] [illegible]. Tr. Tropich, in-ta [illegible], t. [illegible].

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1931. [illegible] N. gen. n. sp. ([illegible]: [illegible])
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