

SI/019/60/000/010/007/057  
A151/A029



AUTHORS: Vulikh, A.I., Senyavin, M.M., Karoli, Yu.B., Korotkevich, B.I.,  
Sidorova, L.G., and Galkina, N.K.

TITLE: A Method for Obtaining Rubidium<sup>1</sup> or Cesium<sup>1</sup> Carbonates

PERIODICAL: Byulleten' izobreteniy, 1960, Nr 10, p 19  
Class 12 1, 16. Nr 128454 (622176/23 of Apr 21, 59).

TEXT: A method for obtaining rubidium or cesium carbonates from their dissolved salts, by a process of double ion-exchange. It has the following special features: to increase the degree of metal extraction, ammonium carbonate is used as the second reagent, whereupon the solution of rubidium (or cesium) carbonate and of ammonium carbonate is separated by distillation, while the solution or a salt separated therefrom is being heated.

Card 1/1

VULIKH, A.I.; KAZ'MINSKAYA, V.A.; ZHERDIYENKO, L.P.

Ion exchange method for obtaining acids from poorly soluble salts.  
Prom.khim.reak. i osobo chist.veshch. no.2:7-13 '63. (MIRA 17:2)

VULIKH, A.I.; BOGATYREV, V.L.

Static and dynamic ion exchange methods for the preparation of electrolytes. Prom.khim. reak. i osobo chist.vushch. no.2:14-17 '63.  
(MIRA 17:2)

VULIKH, A.I.; STATSENKO, A.A.; MAKOVETSKIY, M.I.; MIL'SKIY, S.A.

Chemical method for the preparation of welding fluxes. Prom.khim. reak.  
1 osobo chist.veshch. no.2:18-22 '63. (MIRA 17:2)

L 12660-55 EWG(j)/EAT(m)/ESP(c)/EPF(n)-2/EPR/EPF(b) Pr-4/Ps-4/Pa-4  
 ASD(d)/AS(mp)-2/AND(m)-3/AEDG(b) JD/JG/MLK

ACCESSION NR: AT446116

8/0000/63/000/002/0023/0026

AUTHOR: Vulikh, A. I.; L.D. Prikhod'ko; M. I. Makovetskiy B

TITLE: Preparation of anhydrous lithium hydroxide and oxide from lithium hydroxide monohydrate 21

SOURCE: USSR. Gosudarstvennyy komitet khimicheskoy i neftyanoy promyshlennosti. Promyshlennost' khimicheskikh reaktivov i osobo chistykh veshchestv (Industry of chemical reagents and extra pure substances); informatsionnyy byulleten', no. 2. Moscow, IREA, 1963, 23-26

TOPIC TAGS: lithium hydroxide, lithium oxide, anhydrous lithium hydroxide, anhydrous lithium oxide, thermal decomposition, vacuum melting, vacuum dehydration, corundum crucible

ABSTRACT: The thermal decomposition of lithium carbonate and lithium hydroxide monohydrate in a vacuum was investigated on a large scale, and the conditions for obtaining anhydrous lithium hydroxide and lithium oxide from the monohydrate were established. Among all the crucible materials tested, corundum was found to be the best for this purpose. A horizontal vacuum electric furnace with a steel retort and Silite heaters was used, with a VN-2 oil vacuum pump. The process was

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L 12660-65  
ACCESSION NR: AT406116

carried out in two stages: first, the water of hydration was removed by heating at 300-350C in vacuo (600-650 mm Hg) and the anhydrous hydroxide was obtained, which is a porous product with a structure similar to that of the initial monohydrate. In the second stage, the complete dissociation of lithium hydroxide is obtained at a gradually increasing temperature (up to 900-1000C) and a gradually decreasing pressure (down to 1 mm Hg). The resulting lithium oxide is a solid cake, which separates readily from the corundum crucible. The weight is only 1-2% lower than the theoretical yield. No traces of the product could be detected outside the crucible. Thus, by removing most of the water from LiOH at a temperature lower than 900C, when the vapor pressure of LiOH is still low, loss of lithium oxide can be avoided. Chemical analysis showed that the reaction product contained 98-99% Li<sub>2</sub>O, less than 0.1% Al, and less than 1% Li<sub>2</sub>CO<sub>3</sub> (the initial lithium hydroxide contained 0.5% CO<sub>2</sub>).

ASSOCIATION: None

SUBMITTED: 27Nov63

ENCL: 00

SUB CODE: IC, CC

NO REF SOF: 003

OTHER: 012

Card 2/2

VULIKH, A.I.; KOROTKEVICH, B.I.

Preparation of pure fluorides with the use of sodium fluosilicate as  
a source of fluorine. Prom.khim. reak. l osobo chist.veshch. no.2:38-  
45 '63. (MIRA 17:2)

VULIKH, A.I. DOGATYREV, V.L.

Ion-exchange preparation of acids under static-dynamic conditions.  
Izv. SO AN SSSR no.7 Ser.khim.nauk no.2:40-47 '63. (MIRA 16:10)



MIKULINSKIY, A.S.; KOZHEVNIKOV, G.N.; BAKHIREVA, L.D.; VULIKH, A.I.

Vacuum-thermal separation of cesium and potassium fluorides. Izv.  
SO AN SSSR no.7 Ser.khim.nauk no.2:105-107 '63. (MIRA 16:10)

1. Ural'skiy filial AN SSSR, Sverdlovsk.

BOGATYREV, V.L.; VULIKH, A.I.

Ion exchange preparation of acids. Izv. SO AN SSSR no.11 Ser.khim.  
nauk no.3:70-72 '63. (MIRA 17:3)

VULIKH, A.I., kand.tekhn.nauk; STATSENKO, A.A., inzh.; MAKOVETSKIY, M.I.,  
Inzh.; MIL'SKIY, S.A., inzh.

New technology for the production of fluxes for soldering and  
welding. Svar. proizvod. no.9:24-26 S '63. (MIRA 16:10)

1. Novosibirskiy zavod khimicheskikh reaktivov.

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USSR

ACCESSION NR: AP4004065 S/0286/63/000/020/0012/0012  
AUTHOR: Kutolin, S. A.; Vulikh, A. I.  
TITLE: Preparative method for alkali metal titanates. Class 12, No. 157967  
SOURCE: Byul. izobret. i tovarn. znakov, no. 20, 1963, 12  
TOPIC TAGS: titanates, titanate synthesis, alkali metal titanates, titanium oxides, titanium dioxide, alkali metal hydroxide  
ABSTRACT: An Author Certificate has been issued for a method of preparing alkali metal titanates by fusing alkali metal hydroxides with titanium dioxide at 1 mm Hg.  
ASSOCIATION: None  
SUBMITTED: 21Nov62 DATE ACQ: 13Dec63 ENCL: 00  
SUB CODE: CH NO REF SOV: 000 OTHER: 000  
Card: 1/1

VULIKH, A.I. (Novosibirsk); KAZ'MINSKAYA, V.A. (Novosibirsk); ZHERDIYENKO, L.P.  
(Novosibirsk)

Chemical experiments with the use of ion exchangers. Khim. v shkole  
18 no.5:57-65 3-0 '63. (MIRA 17:1)

BOGATYREV, V.L.; VULIKH, A.I.

Ion exchange preparation of bromic and iodic acids. *Zhur.prikl.khis.*  
36 no.1:220-222 Ja '63 (MIRA 16:5)  
.. (Bromic acid) (Iodic acid) (Ion exchange)

VULIKH, A.I.

Method of calculating equilibrium in the system ion exchanger - sparingly soluble electrolyte - water. Zhur. prikl. khim. 36 no.10:2321-2323 0 '63. (MIRA 17:1)

NIKOLAYEV, A.V.; BOGATYREV, V.L.; VULIKH, A.I.

Study of ion exchange processes by means of physicochemical analysis.  
Dokl. AN SSSR 153 no.2:360-362 N '63. (MIRA 16:12)

1. Institut neorganicheskoy khimii Sibirskogo otdeleniya AN SSSR.
2. Chlen-korrespondent AN SSSR (for Nikolayev).



ACCESSION NR: AP4046449

//0076/64/009/010/2359/2361

AUTHOR: Kutolin, S. A.; Druz', N. A.; Vulikh, A. I.

B

TITLE: Second stable modification of lithium metazirconate

SOURCE: Zhurnal neorganicheskoy khimii, v. 9, no. 10, 1984, 2359-2361

TOPIC TAGS: lithium metazirconate, stable modification, x ray analysis

ABSTRACT: The existence of a second stable modification of lithium metazirconate in the  $\text{Li}_2\text{O} \cdot \text{ZrO}_2$  system was established. Heating of  $2\text{LiOH} \cdot \text{ZrO}_2$  in a muffle furnace for 4 hours at 950C gave a product  $\text{Li}_2\text{ZrO}_3$  (II) which differed from that  $\text{Li}_2\text{ZrO}_3$  (I) synthesized by A. A. Grizik and V. Ye. Plyushchev (Zh. neorg. khimii, 6, 2249 (1961)) from  $\text{Li}_2\text{CO}_3 + \text{ZrO}_2$  by heating at 1100C for 1-2 hours. Differences in the two modifications were established from x-ray data. No mutual transitions of the two modifications were noted. Differences in their physical properties were established; fusion temperatures-- $\text{Li}_2\text{ZrO}_3$  I,  $1300 \pm 50\text{C}$  and  $\text{Li}_2\text{ZrO}_3$  II,  $1530 \pm 50\text{C}$ ; densities--4.125 and 3.508, respectively. The

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ACCESSION NR: AP4046449

refractive index of both materials was above 1.7. An examination of the hydrolysis kinetics showed  $\text{Li}_2\text{ZrO}_3\text{II}$  hydrolyzed much more readily than  $\text{Li}_2\text{ZrO}_3\text{I}$ . Orig. art. has: 2 figures and 1 table.

ASSOCIATION: None

SUBMITTED: 02Jul63

ENCL: 00

SUB CODE: GC

NO REF SOV: 003

OTHER: 006

Card 2/2

NIKOLAYEV, A.V.; BOGATYREV, V.L.; VULIKH, A.I.

Ion-exchange system  $R^+$ ,  $NH_4^+$  ||  $R^-$ ,  $Cl^- - H_2O$ . Zhur. neorg. khim.  
9 no.10:2469-2474, 0 '64.

(MIRA 17:12)

1. Institut neorganicheskoy khimii Sibirskogo otdeleniya AN SSSR.

L 23185-65 EWP(m)/EWP(t)/EWP(b) LJP(c) JD/JG  
ACCESSION NR: A125002192

S/0080/84/037/012/2748/2748

AUTHOR: Kutolin, S. A.; Vulikh, A. I.

11.  
B

TITLE: Synthesis of alkali metal metatitanates under vacuum

SOURCE: Zhurnal prikladnoy khimii, v. 37, no. 11, 1964, 2748

TOPIC TAGS: alkali metal metatitanate, synthesis, lithium metatitanate, potassium metatitanate

ABSTRACT: A method was worked out for the synthesis of alkali metal titanates by sintering their hydroxides with  $TiO_2$  under vacuum.  $TiO_2$ , "special grade", was well mixed with a stoichiometric amount ( $Me_2O$ ): $TiO_2 = 1$ ) of LiOH or KOH and placed in a vacuum furnace with a horizontal retort. The temperature was brought to 650 or 800C for the Li or K, respectively, and held for 1 hour at atmospheric pressure. The pressure was then reduced to 0.5-1 mm Hg and the temperatures were maintained for 2 more hours. The fusion temperature of the product  $Li_2TiO_3$  was  $1325 \pm 50C$  and of  $K_2TiO_3$ ,  $820 \pm 10C$ . Orig. art. has: no

Card 1/2

L 2345-65

ACCESSION NR: AP5002192

graphics

ASSOCIATION: None

SUBMITTED: 26Apr63

NR REF SOV: 0/3

ENCL: 00

OTHER: 006

SUB CODE: GC

Card 2/2

NIKOLAYEV, A.V.; BOGATYREV, V.L.: VULIKH, A.I.

Ion exchange system  $H^+$ ,  $Ca^{2+}$ ,  $Mg^{2+}$ ,  $R^+$ ,  $Cl^-$   $H_2O$  investigated by the  
ray method. Dokl. AN SSSR 155 no. 3:607-610 Mr '64.  
(MIRA 17:5)

1. Institut neorganicheskoy khimii Sibirskogo otdeleniya AN  
SSSR. 2. Chlen-korrespondent AN SSSR (for Nikolayev).

L 35064-65 ENT(m)/ENP(t)/ENP(E) IJP(c) JD/JG  
ACCESSION NR: AP5008518

S/0286/65/000/006/0019/0019

15  
B

AUTHOR: Vulikh, A. I.; Arkhipov, S. M.; Sidorova, G.

TITLE: A method for producing bromides and iodides of rubidium and cesium, Class 12, No. 169081

SOURCE: Byulleten' izobreteniy i tovarnykh znakov, no. 6, 1965, 19

TOPIC TAGS: reducing agent, cesium inorganic compound, rubidium compound, bromide, iodide

ABSTRACT: This Author's Certificate introduces a method for producing bromides and iodides of rubidium and cesium by interaction of the higher hydroxides of the bi-carbonates or carbonates of these metals with bromine or iodine in the presence of reducing agents which produce only gaseous products during oxidation. The use of hydrazine hydrate as the reducing agent improves the purity of the product.

ASSOCIATION: none

SUBMITTED: 11May64  
NO REF SOV: 000  
Card 1/1

ENCL: 00  
OTHER: 000

SUB CODE: GC, IC

KUTOLIN, S.A.; WOLIKH, A.I.

Synthesis of alkali metal manganites by vacuum sintering.  
Izv. AN SSSR. Khim. mat. I no.2:236-239 P 165. (MIRA 18.7)



L 53696-05 EWP(n)/EPF(n) 2/1/23P(e)/EAP(b)/E A(e) Pu-4 IJP(e) JD/RW/JG  
 UR/0363/65/001/003/0382/0391  
 666.3:542.9

ACCESSION NR: AP5011936

AUTHOR: Kutolin, S. A.; Vulikh, S. I.; Sergeyeva, A. Ye.

TITLE: Effect of atmospheres of various gases on the thermal synthesis and the properties of  $Me_2 Me^{IV} O_3$  and  $Me Me^V O_3$  type compounds

SOURCE: AN SSSR. Izvestiya. Neorganicheskiye materialy, v. 1, no. 3, 1965, 360-391

TOPIC TAGS: thermal synthesis, mixed oxide, alkali metal, titanium, zirconium, hafnium, niobium, tantalum

ABSTRACT: Thermal synthesis of anhydrous compounds  $Me Me^{IV} O_3$  and  $Me Me^V O_3$  (where  $Me^I$  is an alkali metal,  $Me^{IV}$  is  $Ti^{4+}$ ,  $Zr^{4+}$ ,  $Hf^{4+}$  in air and nitrogen atmospheres and in a vacuum. Preparation of these types of electrical ceramic industries. The title compounds were prepared by fusing mixtures of alkali metal carbonates with oxides of the transition elements in the temperature range from 500°C to 900°C. Quantitative formations of  $Me Me^{IV} O_3$  and

the thermal synthesis and the properties of  $Me_2 Me^{IV} O_3$  and  $Me Me^V O_3$  type compounds

materialy, v. 1, no. 3, 1965, 360-391

alkali metal, titanium, zirconium, niobium, tantalum

is  $Me_2 Me^{IV} O_3$  and  $Me Me^V O_3$  (where

and  $Me^V$  is  $Nb^{5+}$ ,  $Ta^{5+}$ ) was studied

Preparation of these types of electrical ceramic industries.

of alkali metal carbonates with oxides of the transition elements in the temperature range from 500°C to 900°C. Quantitative formations of  $Me Me^{IV} O_3$  and

10  
59

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L 53696-65

ACCESSION NR: IP5011935

Me<sup>I, V</sup> O<sub>3</sub> were achieved by fusing carbonates of Li, Nb<sub>2</sub>O<sub>5</sub>, and Ta<sub>2</sub>O<sub>5</sub> in the stream of nitrogen and in the absence of mineralizers. Presence of air atmosphere has a deleterious effect on rate of formation of Me<sup>I, IV</sup> O<sub>3</sub> and Me<sup>I, V</sup> O<sub>3</sub> due to chemisorption of O<sub>2</sub>, H<sub>2</sub>O, and CO<sub>2</sub> by the solid reaction products. The optimum hours and the optimum reaction temperature is from 700° to 800°C in both nitrogen atmosphere and in a vacuum (1 mm Hg). Densities, graphic structures, of several Me<sup>I, IV, V</sup> compounds were determined. Orig. art. has: 4 tables and 1 figure.

K, and Cs with TiO<sub>2</sub>, ZrO<sub>2</sub>, HfO<sub>2</sub>, a vacuum at 700° to 800°C and in atmosphere has a deleterious effect to chemisorption of O<sub>2</sub>, H<sub>2</sub>O, and CO<sub>2</sub> by the solid reaction products. The optimum hours and the optimum reaction temperature is from 700° to 800°C in both nitrogen atmosphere and in a vacuum (1 mm Hg). Densities, graphic structures, of several Me<sup>I, IV, V</sup> compounds were determined. Orig. art. has: 4 tables and 1 figure.

ASSOCIATION: none

SUBMITTED: 04Jan55

NO REF SOV: 009

ENCL: 00

OTHER: 004

SUB CODE: 33, GC

*SR*  
Card 2/2

L 34503-65 EWP(m)/EWP(t)/EWP(b) IJP(c) JD/JG  
ACCESSION NR: AP5002802 S/0078/65/010/001/0140/0144

AUTHOR: Kutol'n, S. A.; Vulikh, A. I.

14  
B

TITLE: Synthesis of alkali metal metatitanates in vacuum

SOURCE: Zhurnal neorganicheskoy khimii, v. 10, no. 1, 1965, 140-144

TOPIC TAGS: alkali metal metatitanate, synthesis, structure, density, fusion temperature, hydrolysis

ABSTRACT: The reaction of LiOH, KOH and  $\text{Li}_2\text{CO}_3$  with  $\text{TiO}_2$  at atmospheric pressure and under 1 mm Hg vacuum at 650-950 C for 2-4 hours to synthesize the alkali metal metatitanates was investigated.  $\text{Li}_2\text{TiO}_3$  and  $\text{K}_2\text{TiO}_3$  were produced quantitatively by low temperature (650 and 800 C, respectively) reaction under vacuum. Higher temperatures resulted in colored products and corrosion of the corundum and porcelain crucibles. There was no reaction between the carbonate and  $\text{TiO}_2$  in air: under vacuum the reaction was essentially the same as with the hydroxide. X-rays showed the structure of the  $\text{Li}_2\text{TiO}_3$  was ordered. The densi-

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L 34503-65

ACCESSION NR: AP5002802

ty and the fusion temperatures of  $\text{Li}_2\text{TiO}_3$  and  $\text{K}_2\text{TiO}_3$  were determined. Both compounds were stable to 800C. Both hydrolyzed in water, the  $\text{K}_2\text{TiO}_3$  decomposing somewhat more readily than  $\text{Li}_2\text{TiO}_3$ . Orig. art. has: 2 tables and 1 figure.

ASSOCIATION: None

SUBMITTED: 24Jul63

ENCL: 00

SUB CODE: GC, IC

NR REF SOV: 005

OTHER: 016

Card 2/2

L 63568-65 EPA(s)-P/ENT(m)/EPF(c)/EPF(n)-2/T/EWP(t)/ENP(b)/ENA(s) Pr-L/ PT-7/Pu-l IJP(c) JD/JG	
ACCESSION NR: AP5012973	CR/0078/65/G10/005/1225/1228 41.123.62:546.135
AUTHOR: Kirgintsev, A. N.; Kashina, N. I.; Vulikh, A. I.; Korotkevich, B. I.	41 40 B
TITLE: Ternary aqueous systems consisting of potassium, rubidium and cesium chlorates at 25°C	27 27 27
SOURCE: Zhurnal neorganicheskoy khimii, v. 10, no. 5	1965, 1225-1228
TOPIC TAGS: potassium chlorate, rubidium chlorate, cesium chlorate	
<p>ABSTRACT: The solubility of <math>KClO_3-CaClO_3-H_2O</math>, <math>KClO_3-RbClO_3-H_2O</math>, and <math>RbClO_3-CaClO_3-H_2O</math> ternary systems at 25°C is studied (see fig. 1 of the Enclosure). The selection of a feasible method for analyzing potassium, cesium and rubidium systems is discussed. The method of isothermal desupersaturation was used to study the solubility. In the first system, no solid solutions were formed between potassium chlorate and cesium chlorate, and only the liquid phase was analyzed. In the second system, both the solid and liquid phases were analyzed; no solid solutions were formed between potassium chlorate and rubidium chlorate. In the third system, the solid and liquid phases were also analyzed; rubidium chlorate and cesium chlorate</p>	
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L 63568-65

ACCESSION NR: AP5012973

form a continuous series of solid solutions. The authors calculated the activity coefficients for  $\text{RbClO}_3\text{-CaClO}_3$  solid solutions, using F. Schaefer's formula

$$\lg \gamma_1 = - \int_0^{x_1} x_2 \lg D_{11} dx_2 \quad \lg \gamma_2 = - \int_0^{x_2} x_1 \lg D_{22} dx_1$$

where

$$D_{11} = \frac{x_2 v_1}{v_2 x_1}; \quad D_{22} = \frac{x_1 v_2}{v_1 x_2}$$

The effect of composition on the logarithm of the activity coefficient is adequately described by equations from the theory of regular solutions

$$\ln \gamma_1 = 1.79 x_2^2; \quad \ln \gamma_2 = 1.79 x_1^2$$

The constant coefficient in these equations (1.79) is close to 2. In accordance with theory, this means that  $\text{RbClO}_3\text{-CaClO}_3$  solid solutions are close to phase separation. Orig. art. has: 2 figures, 7 tables, and 7 formulas.

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L 63568-65

ACCESSION NR: AP3012973

ASSOCIATION: Institut neorganicheskoj khimii Sibirskogo otdeleniya Akademii nauk SSSR (Institute of Inorganic Chemistry, Siberian Department, Academy of Sciences, SSSR)

SUBMITTED: 04Dec63

ENCL: 01

SUB CODE: IC

NO REF SOV: 001

OTHER: 001

Card 3/4



L 63568-65

ACCESSION NR: A75012973

ENCLOSURE: 01

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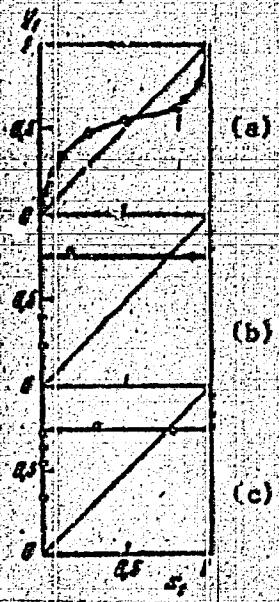


Fig. 1. Solubility diagram in the system  $\text{RbClO}_4\text{-CaClO}_3\text{-H}_2\text{O}$  (a);  $\text{KClO}_4\text{-RbClO}_3\text{-H}_2\text{O}$  (b);  $\text{KClO}_4\text{-CaClO}_3\text{-H}_2\text{O}$  (c).

Card 4/4 *dim*



VULSKH, A.T.; BOGATYREV, V.I.

Specific gravity of ion exchangers as dependent on their ionic composition. Zhur. prikl. khim. 38 no.1:99-102 Ja 1965.

(MIRA 18:3)

VULIKH, A.I.; NIKOLAYEV, A.V.; ZAGOPSKAYA, M.K.; BOGATYREV, V.L.

Absorption of ammonia and chlorine by ion-exchange resins under dynamic conditions. Dokl. AN SSSR 160 no. 5:1072-1074, P '65.  
(MIRA 18:2)

1. Institut neorganicheskoy khimii Sibirakogo otdeleniya AN SSSR.
2. Chlen-korrespondent AN SSSR (for Nikolayev).

KIRGINTSEV, A.N.; AVVAKUMOV, Ye.C.; VULIKH, A.I.

Behavior of alkali metal impurities in the crystallization of cesium salts from a melt. Dokl. AN SSSR 162 no.6:1315-1318  
0 165. (MIRA 18:10)

1. Institut neorganicheskoy khimii Sibirskogo otdeleniya AN SSSR.  
Submitted March 29, 1965.

L 27359-66 ENI(m)/EIC(f)/EMG(m) RM/DS/JD

ACC NR: AP6008806

SOURCE CODE: UR/0136/65/000/011/0096/0099

AUTHORS: Bogatyrev, V. L.; Vulikh, A. I.; Sokolova, S. I.

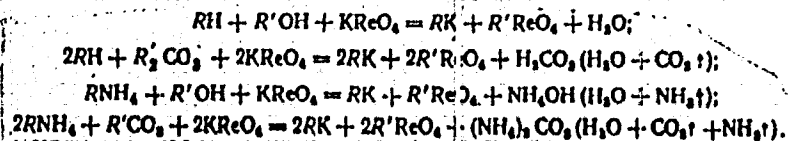
ORG: none

TITLE: Derivation of ammonium perrhenate from potassium perrhenate with the aid of mixed bed ion exchangers

SOURCE: Tsvetnyye metally, no. 11, 1965, 96-99

TOPIC TAGS: ammonium salt, rhenium compound, ion exchange : esin, cation exchanger, anion exchanger, ion exchange/ KU-2 cation exchanger, AV-17 anion exchanger

ABSTRACT: This investigation was conducted to extend the work of N. M. Rubinshteyn (Avt. svid. No. 148390 (Byull. izobret., No. 13, 1962)). Ammonium perrhenate was synthesized from potassium perrhenate and ammonium carbonate with the aid of a mixed bed KU-2 cation exchanger and AV-17 anion exchanger. The reaction was carried out according to the scheme



The optimum conditions for maximum yield of ammonium perrhenate were established. The

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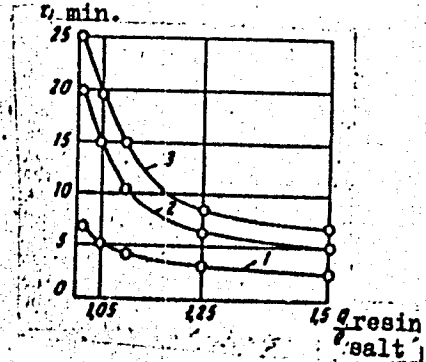
UDC: 669.849:66.074.7

L 27359-66

ACC NR: AP6008806

experimental results are presented in graphs and tables (see Fig. 1),

Fig. 1. Dependence of the duration of the process on the nature of the compounds formed and the ratio of resin to salt (in mg--eq.); t = 20C, potassium perrhenate charge = 3 g, volume of solution v = 50 ml; 1 - H<sub>2</sub>O; 2 - H<sub>2</sub>CO<sub>3</sub>; 3 - NH<sub>4</sub>OH.



and a flow diagram for the reaction is also presented. It was found that 250 g of ammonium carbonate were required per 1000 g yield of ammonium perrhenate. For a mixture of 0.4 kg EU-2 and 0.6 kg AV-17 ion exchangers and at a cycling time of 1.5--2 hours, the yield of ammonium perrhenate was 0.5 kg. The potassium ion content in the product was less than 0.001%. Orig. art. has: 2 tables, 3 graphs, and 1 equation.

SUB CODE: 07/ SUM DATE: none/ ORIG REF: 004/ OTH REF: 002

Card 2/2

L 34610-66 EWT(1) RO

ACC NR: AP6026571

SOURCE CODE: UR/0240/66/000/003/0100/0102

AUTHOR: Vulikh, A. I. (Candidate of technical sciences); Shivandronov, Yu. A. <sup>11/3</sup>  
(Candidate of technical sciences); Zagorskaya, M. K. (Candidate of technical sciences);  
Bogatyrev, V. L. (Candidate of chemical sciences)

ORG: Novosibirskiy Factory of Chemical Agents (Novosibirskiy zavod khimicheskikh reaktivov); Institute of Inorganic Chemistry, Siberian Branch, AN SSSR (Institut neorganicheskoy khimii Sibirskogo otdeleniya AN SSSR)

TITLE: Filtering ionite gas mask<sup>10</sup>

SOURCE: Gigiyena i sanitariya, no. 3, 1966, 100-102

TOPIC TAGS: gas mask, gas absorption, ion exchange resin, gas mask component, gas filter, industrial hygiene

ABSTRACT: The authors tested in a wide range of concentrations and gas velocities the absorption from gau-air mixtures of ammonia, amines (by KU-2 cationite in hydrogen form), sulfur dioxide, chlorine, and hydrogen chloride (by AV-17 and EDZ-10P anionites in the hydroxyl and carbonate forms). The basic and acidic gases were invariably completely absorbed. The capacity of the ionites was 80-90% of the total exchange capacity, i.e., 4 meq/g for KU-2 and about 3 meq/g for AV-17. The most universal absorbents are the highly ionized single-function resins (KU-2, OBS-3, SEV, and AV. The carboxyl cationites (e.g., KB-4) and anionites with secondary and tertiary

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L 34610-66

ACC NR: AP6026571

amino groups (e.g., EDE-10P), whose capacity is 8-9 g/g, seem to be more effective in absorbing strongly acidic and strongly basic gases. Ionites with large pores (KU-2P for amines, etc.) are best for absorbing gases or fumes of organic substances with large molecules.

The article concludes with a brief description of an ionite gas mask successfully used for several months under industrial conditions to provide protection against ammonia. An antidust filter from a RP-5 respirator is mounted on the lower part of the tank. KU-2 in the II form was the absorbent used. The total weight of the tank with the antidust filter was 200-250 g. Loaded with 50 g of KU-2, it absorbed 3.5 g of ammonia and worked continuously for 30 hours. Orig. art. has: 1 figure and 1 table. [JPRS: 36,455]

SUB CODE: 06, 15, 07 / SUBM DATE: 24Nov64 / ORIG REF: 003 / OTH REF: 001

Card 2/2 90

L 05025-67 EWT(m)/EWP(t)/ETI IJP(c) JD/JG/WR

ACC NR: AP6032980

SOURCE CODE: UR/0078/66/011/010/2328/2330

AUTHOR: Kirgintsev, A. N.; Avvakumov, Ye. G.; Vulikh, A. I.

ORG: Institute of Inorganic Chemistry, Siberian Branch, AN SSSR (Institut neorganicheskoy khimii, Sibirskoye otdeleniye, AN SSSR)

TITLE: Cesium nitrate purification by zonal recrystallization

SOURCE: Zhurnal neorganicheskoy khimii, v. 11, no. 10, 1966, 2328-2330

TOPIC TAGS: metal crystallization, recrystallization, oriented crystallization, alkali metal, cesium nitrate, zonal recrystallization

ABSTRACT: The method of oriented crystallization is used to determine the distribution of alkali metals in cesium nitrate at different crystallization rates (under constant mixing). The data obtained show that the method of zonal recrystallization may be recommended to free cesium nitrate of alkali metals. Orig. art. has: 1 table and 3 figures. [Authors' abstract]

SUB CODE: 07/

SUBM DATE: 08Jan65/ ORIG REF: 005/

Card 1/1 *XC*

UDC: 546.36'175:548.53

23  
B



L 10392-67 BWT(m) DS/RM  
ACC NR: AP7003122

SOURCE CODE: UR/0080/65; 039/008/1760/1765

16

AUTHOR: Bogatyrev, V. L.; Vulikh, A. I.; Sokolova, S. I.

ORG: Institute of Inorganic Chemistry, SO, AN SSSR (Institut neorganicheskoy khimii SO AN SSSR)

TITLE: Density of ion-exchange resins

SOURCE: Zhurnal prikladnoy khimii, v. 39, no. 8, 1966, 1760-1765

TOPIC TAGS: ion exchange resin, polymer cross linking

ABSTRACT: A systematic determination was made of the densities of the most widespread industrial cation- and anion-exchange resins in various salt forms (in the dry and swollen states), for use in the development of technological and analytical methods based on the use of ion-exchange resins. The dependence of the density of the investigated ion-exchange resins upon the nature of the sorbed ion, grain size, and degree of cross linking was demonstrated. Fluctuation of the temperature within the range 10-30° was found to have no significant effect upon the results of the determinations. General patterns of variation were observed: 1) the density of the swollen ion-exchange resin was always less than the density of the dry resin, since the density of the latter was greater than one in all cases; 2) the density of the cation-exchange resins was generally greater in absolute magnitude than the density of the anion-exchange resins, which corresponds to the ratio of the densities of their matrices; 3) the density of the same ion-exchange resin increased with increasing equivalent weight of the sorbed ion; 4) the density of various ion-exchange resins containing the same

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ACC NR: AP7003122

ion was generally greater the capacity of the ion-exchange resin. The dependence of the density of the cationite KU-2 upon the atomic weight in the series of alkali metals was linear, with the density increasing from lithium to cesium. The influence of degree of cross-linking was investigated on the cation-exchange resin KU-2, containing 4, 12, and 24% divinylbenzene. No dependence of the density on the cross-linking was found for the dry cation-exchange resin, but a pronounced increase with increasing divinylbenzene content was observed on the swollen ion-exchange resin. Formulas are cited for the calculation of the optimum density of the partitioning liquid and time of separation of ions according to the known densities of the ion-exchange resins. Orig. art. has: 2 figures and 4 tables. [JPRS: 38,970]

SUB CODE: 37 / SUBM DATE: 14Jul64 / ORIG REF: 005 / OTH REF: 002

Card 2/2 <sup>6p</sup>

ACC NR: AP6032947

SOURCE CODE: UR/0363/66/002/010/1803/1810

AUTHOR: Kutolin, S. A.; Vulikh, A. I.; Druz', N. A.; Shammsova, A. Ye.

ORG: none

TITLE: Dependence of the structure and properties of the  $A_2BO_3$  and  $ABO_3$  compounds on the composition of the gaseous atmosphere in thermal synthesis

SOURCE: AN SSSR. Izvestiya. Neorganicheskiye materialy, v. 2, no. 10, 1966, 1803-1810

TOPIC TAGS: ferroelectric material, antiferroelectric material, dielectric constant, physical chemistry property, refractive index

## ABSTRACT:

In a recently published article, the authors [association unknown] analyzed the data from Western and Soviet literature, including their own experimental data which were published in 1964-66, on the thermal synthesis, structure, and properties of  $A_2BO_3$  and  $ABO_3$  compounds, where A is an alkali metal and B is Ti, Zr, Mn, Nb, or Ta.

In previous publications, the authors established the effect of the gaseous medium in which the compounds were synthesized on their structure and particle size. Now, they have made a detailed analysis of the earlier data to correlate the conditions of synthesis,

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ACC NR: AP6032947

primarily the gaseous medium, with the physicochemical properties of the compounds. In the authors' opinion, this analysis is of practical importance for the synthesis and application of these compounds. The properties studied were: density, index of refraction, dielectric constant, intensity of IR absorption bands, and catalytic activity. The experimental data were obtained with samples sintered at a relatively low temperature from a solid mixture of an alkali carbonate and an acidic oxide, in vacuum or in a nitrogen stream.

The nature of the gaseous medium was shown to affect only the structure of alkali metatitanates and manganites ( $A_2BO_3$ ), and not their physicochemical properties, such as density, index of refraction, or dielectric constant. Density was the only property of the manganites which was actually measured; the index of refraction and dielectric constant of the manganites exceeded the measurable values. An exception was the crystal symmetry of  $K_2TiO_3$  and  $RbTiO_3$  which apparently remained unaffected by the gaseous medium in which their synthesis was accomplished. However, the existence in these two compounds of second order phase transitions, undetected by x-rays, may not be excluded. In all alkali metatitanates the intensity of the IR absorption bands due to deformation vibrations of

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ACC NR: AP6032947

the  $[\text{TiO}_6]$  octahedra was found to be independent of the method of synthesis. Their catalytic activity was affected by the gaseous medium, as shown, for example, by the comparative data on specific surface, preexponential factor, and activation energy for a maximum decomposition of hydrogen peroxide on a  $\text{Li}_2\text{TiO}_3$  catalyst prepared in the air or in vacuum.

In the group of  $\text{A}_2\text{BO}_3$  and  $\text{ABO}_3$  compounds, where B is Zr, Nb, or Ta, i. e., alkali metazirconates, metaniobates, and metatantalates, only  $\text{NaTaO}_3$  behaved like the alkali metatitanates and manganites versus the gaseous atmosphere in the synthesis. The gaseous atmosphere changes the crystal structure, i. e., symmetry type and lattice constants of  $\text{NaTaO}_3$ , but does not affect its picnometric density or intensity of deformation vibrational bands in their IR transmission spectra. Other compounds of this group --  $\text{Li}_2\text{ZrO}_3$ ,  $\text{NaNbO}_3$ ,  $\text{KNbO}_3$ ,  $\text{CsNbO}_3$ , and  $\text{CsTaO}_3$  -- change their crystal structure, i. e., symmetry type and/or lattice constant, in different gaseous media simultaneously with certain physicochemical properties, e. g., picnometric density, dielectric constant, intensity of deformation vibrational bands in the IR absorption spectra, and catalytic activity versus  $\text{H}_2\text{O}_2$  decomposition.

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The crystal structure of  $\text{LiNbO}_3$ ,  $\text{LiTaO}_3$ , and  $\text{KTaO}_3$ , was not affected by the difference in gaseous atmosphere in the synthesis, but picnometric density, index of refraction, and intensity of deformation vibrational bands of the IR spectra were substantially changed.

These diverse and strong effects of the gaseous medium on the structure and properties of  $\text{A}_2\text{BO}_3$  and  $\text{ABO}_3$  compounds were explained as the result of deformability of their structure, specifically of the tendency toward distortion of the  $[\text{TiO}_6]$ ,  $[\text{NbO}_6]$ , and  $[\text{TaO}_6]$  octahedra. This deformability was correlated with a significant ionic polarizability of the alkali metatitanates, metaniobates, and metatantalates. This correlation which was experimentally established for the above-indicated compounds (presumably) may be extended to other compounds with significant ionic polarizability and may form the base for predicting the possibility of a beneficial effect of a given gaseous medium on the completeness of synthesis of a given compound. In addition, a significant ionic polarizability of a given compound may be an indication of a potential ferroelectric or antiferroelectric property.

An additional indication of the possible ferroelectric or antiferroelectric property of alkali metatitanates was seen in the ob-

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ACC NR: A16032947

served analogy in the structure of their IR absorption bands which are linked to the stretching vibrations of the  $[TiO_6]$  octahedra and in the structure of the corresponding bands of the  $[NbO_6]$  and  $[TaO_6]$  octahedra in the IR absorption spectra of the alkali metaniobates and metatantalates. The observed spectral structure is characteristic of ferroelectric materials. The authors concluded that confirmation of the effect of a gaseous medium on solid-phase synthesis of a given compound is a prerequisite for studying the ferroelectric property in this compound. Orig. art. has: 1 figure and 8 tables.  
[FSB: v. 3, no. 2]

SUB CODE: 11,07,20 / SUBM DATE: 14Jul65 / ORIG REF: 022 / OTH REF: 016

Card 5/5

BOGATYREV, V.L.; VULIKH, A.I.; SOKOLOVA, S.I.

Obtaining ammonium perrhenate from potassium perrhenate with  
the help of a mixed layer of ionites. TSvet. met. 38 no.11:  
96-99 N '65. (MIRA 18:11)



L 10046-66 EWT(m)/ETC/EWS(m) RM/DS

ACC NR: AP6000233 SOURCE CODE: UR/0289/65/000/002/0023/0027

AUTHOR: Nikolayev, A. V.; Bogatyrev, V. L.; Vulikh, A. I.

ORG: Institute of Inorganic Chemistry, Siberian Section, AN SSSR, Novosibirsk  
(Institut neorganicheskoy khimii Sibirskogo otdeleniya AN SSSR)

TITLE: Separation of cation and anion exchangers in organic liquids

SOURCE: AN SSSR. Sibirskoye otdeleniye. Izvestiya. Seriya khimicheskikh nauk, no. 2, 1965, 23-27

TOPIC TAGS: anionite, ion exchange resin

ABSTRACT: The cation exchanger KU-2 was separated from the anion exchanger AV-17 in mixtures of benzene, dichloroethane, and carbon tetrachloride. Values of the density and viscosity at 20C in these systems were determined. The dependence of the time of separation was studied as a function of the density of the separating liquid and grain size of the exchangers, and the effect of the difference in the density of the cation and anion exchanger during their separation was demonstrated. Formulas derived earlier for the calculation of the optimum density of the separating liquid and duration of separation of cation and anion exchangers were confirmed experimentally. Orig. art. has: 3 figures and 5 tables.

SUB CODE: 07, 11 / SUBM DATE: 15Jun64

HW  
Card 1/1

UDC: 541.13

KUTOLIN, S.A.; VULIKH, A.I.

Synthesis of metatitanates of alkaline metals in a vacuum.  
Zhur. neorg. khim. 10 no.1:140-144 Ja '65. (MIRA 18:11)

1. Submitted July 24, 1963.

VULIKH, B.L.

Nekotoryye teoremy o posledovatel'nostyakh razryvnykh funktsiy. DAN, 1 (1935), 357-362.  
Ob odnom tipe metricheskikh prostranstv. DAN, 4 (1935), 295-296. Sur les formes ge'ne'-  
rals de certaines ope'rations line'aires. Matem. sb., 2 (44). (1937) 275-306. K  
hopmirovannyye prostranstva. L., Uche'n. zap. ped. in-ta, 28 (1939), 179-224.

So: Mathematics in the USSR, 1917-1947  
edited by Kurosh, A.G.,  
Markushevich, A.I.,  
Nashevshiy, P.K.  
Moscow-Leningrad, 1948

Vukob, B. Z.

Vukob, B. Sur les fonctionnelles linéaires dans les espaces  
 ordonnés linéaires. C. R. (Doklady) Acad. Sci.  
 URSS (N.S.) 52, 95-98 (1946).  
 Let  $X$  be a semi-ordered linear space satisfying the axioms  
 (1)-(7) of Kantorovitch [Rec. Math. [Mat. Sbornik] N.S.  
 2(49), 121-165 (1937)]. Let  $X$  contain a unit 1, i.e.,  
 an element  $e > 0$  for all  $x > 0$ . An element  $x$  is called a quasi-  
 unit if  $\inf(e, x) > 0$ . For every positive continuous  
 linear functional  $f$  define  $e_f$  as the supremum of all quasi-units  
 on which  $f$  vanishes. Define  $e(f) = 1 - e_f$  and  $e^* = \sup e(f)$   
 as  $f$  varies over all positive continuous linear functionals.  
 Let  $X^*$  consist of all elements  $x$  whose characteristic element  
 $e_x = e^*$ . It is shown that the conjugate space  $X$  contains a  
 unit if and only if there exists a linear functional on  $X$   
 essentially positive on all of  $X^*$ . A representation theorem  
 for bounded linear functionals on  $X$  is also given for the  
 case where  $X$  has a unit.  
 N. Dunford.

Source: Mathematical Reviews, Vol. 8, p. 8

Vulich, B.

Vulich, B. Sur les opérations linéaires multiplicatives.

*Vestn. R. (Doklady) Acad. Sci. USSR (N.S.)* 52, 383-386 (1946).

An earlier result [same *C. R. (N.S.)* 41, 142-144 (1943); *ibid.* Rev. 6, 130] is improved by proving that a continuous linear operation  $u$  between two partially ordered spaces  $X$  and  $Y$ , each with a unit, is multiplicative if and only if, for each quasi-unit  $e$  in  $X$ ,  $u(e)$  is a quasi-unit in  $Y$ . As a corollary it follows that (with a suitable choice of the unit in  $Y$ ) a linear continuous operation  $u$  is multiplicative providing  $u(x_1)$  and  $u(x_2)$  are disjoint whenever  $x_1$  and  $x_2$  are disjoint. In the note mentioned above the author represented linear multiplicative operations by means of an abstract integral. In the present note he correlates the continuity properties of the operator with those of the measure function.

*V. Duford (New Haven, Conn.).*

Source: *Mathematical Reviews*,

Vol.

No.

VULICH, B.

Vulich, B. Sur quelques opérations non-linéaires dans les espaces semi-ordonnés linéaires. C. R. (Doklady) Acad. Sci. URSS (N.S.) 52: 475-478 (1946).

This paper concerns the analytical representation of a certain type of nonlinear operator  $u$  with domain and range in partially ordered linear vector spaces  $X, Y$  with a unit (the spaces  $X, Y$  satisfy the axioms I-V of Kantorovitch). The function  $u$  is partially additive if  $u(x_1 + x_2) = u(x_1) + u(x_2)$  whenever  $x_1$  and  $x_2$  are disjoint; it is disjoint if  $u(x_1)$  and  $u(x_2)$  are disjoint whenever  $x_1$  and  $x_2$  are. The function  $u$  is uniformly continuous if, for every constant  $C$ ,  $\lim_{x \rightarrow x'} |u(x) - u(x')| = 0$  in the  $(o)$ -topology where  $|x - x'| < \delta \cdot 1$  and  $|x|, |x'| < C \cdot 1$ . A partially additive disjoint uniformly continuous operator is called an operator (ADC). If in addition the  $(o)$ -convergence of  $x_n$  to  $x$  implies

that  $u(x_n)$  to  $u(x)$  then  $u$  is an operation (ADCO). A function  $\varphi$  which maps quasi-units in  $X$  into quasi-units in  $Y$  is called unitary if  $\varphi(e_1 + e_2) = \varphi(e_1) + \varphi(e_2)$  for  $e_1, e_2$  disjoint and if the  $(o)$ -convergence of  $e_n$  to  $e$  implies the  $(o)$ -convergence of  $\varphi(e_n)$  to  $\varphi(e)$  it is called a measure function. In terms of these notions it is stated without proof that the general analytical expression for an operation (ADC) (ADCO, respectively) is given by the Radon integral  $u(x) = \int Y(\lambda) d\varphi(e)x$ , where  $Y(\lambda)$  is uniformly continuous on each finite segment whose values lie in  $Y$ ,  $\varphi$  is a unitary function (a measure function, respectively) and  $Y(0) = 0$ . If in addition  $Y(\lambda) = \int_0^\lambda Z(t) dt$ , where  $Z(t)$  is uniformly continuous on each finite segment, then for each  $x$  in  $X$  the differential  $d_u u(h)$  of  $u$  exists. N. Dunford.

Source: Mathematical Reviews, 1948, Vol 9, No. 2

VOLIKH, B. Z.

Vulfb. B. Z. Concrete representations of linear partially ordered spaces. Doklady Akad. Nauk SSSR (N.S.) 58, 731-736 (1947). (Russian)

Let  $X$  be a linear space of type  $S$  (i.e., one satisfying the axioms (U)-(O) of Kantorovich [Rec. Math. (Nat. Sbornik) N.S. 2(44), 121-165 (1937)]). The author indicates a proof of the fact that if  $X$  has a unit (i.e., an element  $1$  such that  $\inf(x, 1) > 0$  for all  $x > 0$ ) then it is isomorphic to a "normal" subspace of the space  $C_m(Q)$  of all "generalized" continuous real functions on a compact Hausdorff space  $Q$ . Here a normal subspace is one which contains a unit  $\gamma$  whenever  $|\gamma| \leq \gamma'$  and a generalized continuous function is continuous except for being allowed to take on the values  $+\infty$  and  $-\infty$  in a nowhere dense subset of  $Q$ . The proof indicated leans heavily on the related representation theorem of Krein and Nikutani. The author asserts that in general the space  $C(Q)$  of all continuous real-valued functions on a bicompact Hausdorff space  $Q$  is of type  $S_1$  if and only if  $Q$  has the property that the closure of every open subset is open and that if this is the case  $C_m(Q)$  is of type  $S_1$ . He also states a theorem to the effect that every space of type  $S_1$  is imbeddable in a certain way in a space with a unit.

In the second paragraph the author states theorems relating upper bounds and  $(\phi)$ -convergence in the space  $C_m(Q)$  to the pointwise behavior of the functions concerned. In the third paragraph he indicates how his representation theorem may be used to define multiplication and division in spaces of type  $S_1$ . In a final paragraph he states a converse theorem that  $C(Q)$  is of type  $S_1$  when  $Q$  is the bicompact Hausdorff space associated with a Boolean algebra by Stone's theorem.

G. W. Mealy (Cambridge, Mass.)

SMW  
BZ

Source: Mathematical Reviews,

Vol. 7

No. 5

VULIKH, B. Z.

Vulikh, B. Z. The product in linear partially ordered spaces and its application to the theory of operations. I. Mat. Sbornik N.S. 22(64), 27-78 (1948). (Russian)

Vulikh, B. Z. The product in linear partially ordered spaces and its application to the theory of operations. II. Mat. Sbornik N.S. 22(64), 267-317 (1948). (Russian)

The author presents a detailed exposition, with a number of extensions, of results previously announced (C. R. (Doklady) Acad. Sci. USSR (N.S.) 16, 850-854, 855-859 (1940); 41, 142-144, 187-190 (1943); 57, 95-98, 383-386, 475-478 (1946); these Rev. 2, 221, 222; 6, 139, 8, 468, 9, 41]. Close connections exist between the theory expounded here and earlier results obtained by Freudenthal, Kantorovich, M. and S. Krein, and Kakutani [Freudenthal, Akad. Wetensch. Amsterdam, Proc. 39, 641-651 (1936); Kantorovich, Rec. Math. [Mat. Sbornik] N.S. 2(44), 121-168 (1937); 7(49), 209-284 (1940); M. and S. Krein, Rec. Math. [Mat. Sbornik] N.S. 13(55), 1-38 (1943); Kakutani, Ann. of Math. (2) 42, 523-537, 994-1024 (1941); these Rev. 2, 317; 6, 276; 2, 318; 1, 205]. Let  $X$  be a partially ordered linear space over the real numbers (which are denoted by  $R$  in the sequel) of type  $S_1$ : i.e., (I) for some  $x \neq 0$ ,  $0 < x$ ; (II)  $0 < x$  and  $0 < y$  imply  $0 < x + y$ ; (III) for every  $x \in X$ , there exists an  $\lambda \in R$  such that  $\lambda x = 0$ ; (IV)  $0 < x$ ,

and  $0 < \alpha$  imply  $0 < \alpha x$ ; (V) every subset of  $X$  bounded above admits a least upper bound. The author first proves a number of relations which obtain in all spaces of type  $S_1$ ; for example, if  $A$  is a bounded set in  $X$  and  $x \in X$ , then  $\inf(x, \sup_{a \in A} a) = \sup_{a \in A} \inf(x, a)$ .

Next, a further restriction is placed upon the spaces considered. A positive element in  $X$ , which may be denoted by the symbol  $1$ , is said to be a unit if  $\inf(x, 1) > 0$  for all positive  $x \in X$ . It is supposed that  $X$  contains a unit element and that this unit is fixed once and for all. An element  $e \in X$  is said to be unitary if  $\inf(e, 1 - e) = 0$ , and the set of all unitary elements in  $X$  is denoted by  $\mathcal{U}(X)$ . It is proved that unitary elements behave generally like projection operators in Hilbert space. For every  $x \in X$ , let  $e_x$  (the "characteristic" of  $x$ ) be the least element in  $\mathcal{U}(X)$  with the property that  $\inf(x, 1 - e_x) = 0$ ; it is shown that  $e_x$  exists for all  $x \in X$  and that  $e_x = \sup_{a \in A} \inf(a, 1)$ . Various other formal properties of  $e_x$  are also established.

Next, for all  $x \geq 0$ , let  $S(x)$  be the set of all sums  $\sum_{i=1}^n \alpha_i e_i$ , where the  $\alpha_i$  are nonnegative real numbers,  $e_i \in \mathcal{U}(X)$ , and the entire sum is less than or equal to  $x$ . For  $x, y \in X$  and nonnegative, consider the set  $B$  of all sums  $\sum_{i=1}^n \alpha_i \beta_i \inf(e_i, e_i)$ , where  $\sum_{i=1}^n \alpha_i e_i \in S(x)$  and  $\sum_{i=1}^n \beta_i e_i \in S(y)$ . If  $B$  is bounded above, the element  $\sup_{a \in B} a$  is defined to be the product  $xy$  of the elements  $x$  and  $y$ . If  $B$  is unbounded, then the product  $xy$

Source: Mathematical Reviews, Vol 10, p. 1

V B 2



does not exist. For  $x$  and  $y$  nonpositive, the product  $xy$  is defined as  $\sup(x, 0) \cdot \sup(y, 0) + (-1) \inf(x, 0) \cdot (-1) \inf(y, 0) - \sup(x, 0) \cdot (-1) \inf(y, 0) - (-1) \inf(x, 0) \cdot \sup(y, 0)$ . If all four products exist, otherwise  $xy$  does not exist. It is proved that  $xy = yx$  if either  $xy$  or  $yx$  exists; that  $x(y+z) = xy + xz$  if  $xy$  and  $xz$  exist; that  $x \cdot 1 = x$  and  $x \cdot 0 = 0$ ; that  $(xy)z = x(yz)$  if  $xy, yz,$  and  $(xy)z$  exist; that  $xy = 0$  if and only if  $\inf(|x|, |y|) = 0$ .

The author next considers the existence of inverse elements, as follows. If for an  $x \in X$ , there exists  $y \in X$  such that  $xy = 1$  and  $yx = 1$ , then  $y$  is said to be inverse to  $x$  and is denoted by  $x^{-1}$ . It is immediate that  $(x^{-1})^{-1} = x$  for all  $x \in X$  (in particular,  $(1^{-1})^{-1} = 1$ ) and that  $(x^{-1})^{-1} = x$ . A number of the usual formal properties of inverses in commutative rings are established, and it is shown that the product is a continuous function of both variables in the topology of  $\mathcal{C}$ -convergence.

The next topic treated is that of spaces  $X$  which are rings under the operations  $+$  and  $\cdot$ . An element  $x \in X$  is said to be bounded if  $\|x\| \leq C$  for some  $C \in \mathcal{C}$ ; the set of all such  $x$ 's for a given nonnegative  $C$  is called a segment in  $X$ , and the set of all segments is denoted by  $\mathcal{E}_C$ . Then  $\mathcal{E}_C$  is clearly a space of type  $S_1$ ; if  $X$  is a ring, and if  $X$  admits the norm  $\|x\| = \inf \{C \in \mathcal{C}, x \in C \cdot X\}$ . Then the results obtained

Source: Mathematical Reviews, Vol 10, 1961

by a number of authors [see, for example, I. M. Gelfand, *Rec. Mat. Ser. 3*, (1941); these functions defined on a certain compact Hausdorff space  $Y$ . [Reviewer's note:  $X$  is identifiable with the real-valued continuous functions defined on  $Y$  if it is complete in its norm, and if this is the case, it enjoys a very strong disconnectivity property, in the sense of V. See also B. Z. Vulih, *Akad. Nauk SSSR (N.S.)* 58, 733-736 (1947); *v. 9, 290.*] It is also proved that any exact  $X$  can be embedded in a ring  $\tilde{X}$ , by means of a construction due to P. H. (Doklady Acad. Sci. USSR (N.S.) 21, 6-9 (1938); every space of type  $S_1$  can be identified with a space of real-valued continuous functions on a compact Hausdorff space  $Y$ . [Reviewer's note: very similar considerations apply, of course, to Gâteaux spaces satisfying Kakutani's axioms for an  $M$ -space (loc. cit.). Much of the interest of the present paper lies in the fact that multiplication is defined without recourse to a representation theory.] A number of applications of the constructions outlined above are discussed, e.g., to  $L_p$ ,  $l_p$ , and the space of all infinite sequences of real numbers. In each case,

the product turns out to be the multiplicative inverse of  $x$  and the inverse of  $x$  is the element  $1/x$ . The product and inverse are defined only where these constructions yield elements of the original space.

A final section of part I deals with the calculation of positive linear functionals in spaces  $X$  of type  $S_1$  which satisfy a certain countability restriction. Here it is remarked that the conjugate space  $X'$  of  $X$  is of type  $S_1$  and that, if  $X$  contains a unit element  $1$ , then every continuous positive linear functional  $\phi(x)$  on  $X$  can be written as the integral  $\int \phi(x) \mu(dx)$ , where  $\mu$  is a certain positive measure on  $X$ . Using this result, the author exhibits the general continuous linear functionals on  $L_p$  and  $L_\infty$ . [See: S. Banach, *Théorie des Opérations Linéaires*, Warszawa, 1931, pp. 61 et seq.] It is shown also that  $X$  can be identified with a certain subset of  $X'$  only when  $X$  is a space admitting an inner product.

Part II of the paper deals with mappings  $\phi$  of a space  $X$  into a space  $Y$  (where  $X$  and  $Y$  are both of type  $S_1$  and both contain unit elements) such that  $\inf \{|\phi(x)|, |\phi(y)|\} = 0$  implies that  $\inf \{|\phi(x)|, |\phi(y)|\} = 0$ . Such operations are called disjunctive. Most operations considered are in addition additive and continuous either in the  $\sigma$ -topology or  $t$ -topology. The first section deals with general properties of these operations. It is shown that a linear operation is disjunctive if and only if it is a linear operation of type  $S_1$ .

The second section deals with mappings  $\phi$  of a space  $X$  into a space  $Y$  (where  $X$  and  $Y$  are both of type  $S_1$  and both contain unit elements) such that  $\inf \{|\phi(x)|, |\phi(y)|\} = 0$  implies that  $\inf \{|\phi(x)|, |\phi(y)|\} = 0$ . Such operations are called disjunctive. Most operations considered are in addition additive and continuous either in the  $\sigma$ -topology or  $t$ -topology. The first section deals with general properties of these operations. It is shown that a linear operation is disjunctive if and only if it is a linear operation of type  $S_1$ .

It is proved that an additive, multiplicative, continuous mapping of  $X$  into itself has the property that  $\phi(x) = 0$  if and only if  $x = 0$ . Other identities involving additive and multiplicative operations are discussed, among them being the theorem that a linear operation is additive and multiplicative if and only if it admits an inverse having all of these properties.

It is next proved that all  $\sigma$ -continuous additive and multiplicative operations  $\phi$  mapping  $L_1$  (the space of all bounded measurable functions on  $[a, b]$ ) into itself have a particular property, namely,  $\phi(x) = \phi(y)$  for all  $x, y \in L_1$  if and only if  $\phi(x) = \phi(y)$  for all  $x, y \in L_1$ .

It is next proved that all  $\sigma$ -continuous additive and multiplicative operations  $\phi$  mapping  $L_1$  (the space of all bounded measurable functions on  $[a, b]$ ) into itself have a particular property, namely,  $\phi(x) = \phi(y)$  for all  $x, y \in L_1$  if and only if  $\phi(x) = \phi(y)$  for all  $x, y \in L_1$ . A similar result is proved for mappings of  $L_1$  into itself.

The author then exhibits a theory of the Radon integrals on spaces  $X$  of type  $S_1$  having a unit element. A spectral function for  $x \in X$  is first defined,  $\phi(x, R)$  is the characteristic element for  $\inf \{x - \lambda 1, 0\}$ . Let  $\phi$  be a function defined on  $X$  and with values in  $\mathcal{C}(Y)$ , where  $Y$  is another space of type  $S_1$  with unit element. For  $e_1, e_2 \in X$  and  $\inf \{e_1, e_2\} = 0$ , suppose that  $\phi(e_1 + e_2) = \phi(e_1) + \phi(e_2)$ . Let  $\gamma$  be a function with domain included in  $R$  and range included in  $Y$ . The integral  $\int \gamma(t) \phi(t) dt$  is defined as the  $\sigma$ -limit of sums  $\sum \gamma(t_i) \phi(t_i)$  where  $t_i \in X$  and  $\inf \{t_i, t_j\} = 0$  for  $i \neq j$ .

*Ullrich, B. Z.*

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proved that any  $\sigma$ -continuous multiplicative operation mapping  $X$  into  $Y$  has a representation of this kind, and conversely. A similar representation for more general functions  $\sigma(x)$  is produced for mapping  $X$  into  $Y$ . Such an operation  $u(x)$  has the form  $\int \sigma(y) d\mu(x)$  if  $\sigma$  is additive for disjoint elements, is  $\sigma$ -continuous in a certain exact sense, and is distributive. The author closes with the construction of a theory of approximation to operations of general type by means of additive and multiplicative operations, which reduces to the classical Weierstrass approximation theorem for the case  $X \text{ and } Y = \mathbb{R}$ .

Active operations are an integral part of the theory of operations using operations of general type. The author closes with the construction of a theory of approximation to operations of general type by means of additive and multiplicative operations, which reduces to the classical Weierstrass approximation theorem for the case  $X \text{ and } Y = \mathbb{R}$ .

It would be useful, in the reviewer's opinion, to investigate the theory when vector  $V$  is replaced in the axiom by a stronger one that rules out many of the commonest partially ordered linear spaces.

*L. Heintz (Seattle, Wash.)*

*Handwritten notes*

Source: Mathematical Reviews, Vol. 17, No. 1

VULIKH, B. Z. NOVOE  
25337

Dokazatelstvo Odnoy Teoremy Kreynor. Uchen Zapiski (Dnepr. Gos. Ped.  
In-T IM Gertsena) T. LXIV, 1948, S. 9-15

SO: LETOPIS NO. 30, 1948

YULIYA B-Z

Karamzina, L. V., Yuliy B. Z., and Zhukovskiy, A. G. Funktsional'nyi analiz v poluneprotivopolozhnykh prostanstvakh. [Functional Analysis in Partially Ordered Spaces]. Gosudarstvennoye izdatel'stvo literatury, Moscow, Leningrad, 1950. 225 pp.

The volume under review contains an encyclopedic discussion of the theory of partially ordered linear spaces, as developed by Freudenthal [Atkaid, Wetsensch. Amsterdam, Proc. 39, 641-651 (1936)], Kantorovich [Z. S. (Doklady) Acad. Sci. URSS, (N.S.) 12 (1936 III), 9-14; Rec. Math. [Mat. Sbornik] N.S. 2(44), 121-165 (1937)], and many other writers. For a basic list of original memoirs, cf. G. Birkhoff, Lattice Theory, Amer. Math. Soc. Colloquium Publ., v. 25, 2d ed., New York, 1948, these Rev. 10, 623.] The work is divided into an introduction, thirteen chapters, and two appendices. In the introduction there is an extended historical sketch in which the work of non-Soviet mathematicians in the field of functional analysis is covered in several places. The scientific portion of the book has as its basic object the study of complete vector lattices. Such spaces are here referred to as  $K$ -spaces [homogeneous lattice spaces].

The authors change their axioms whenever convenient and succeed in defining, in the course of the exposition, no fewer than twenty different types of vector lattices. Chapter I deals with the elementary properties of  $K$ -spaces. Great numbers of identities involving  $\vee$ ,  $\wedge$ ,  $\oplus$ ,  $\otimes$ ,  $\ominus$ ,  $\oplus$ , and  $\otimes$  are proved; convergence and  $\sigma$ -convergence, here referred to as  $\tau$ -convergence, are defined and discussed, and a few standard examples of  $K$ -spaces are produced. In chapter II, certain special subspaces of  $K$ -spaces, called components, are introduced. A linear subspace  $L$  of a  $K$ -space  $X$  is called a component if  $x \in L$  and  $|x| \in L$  imply  $x \geq 0$ , and if  $L$  is maximal with respect to all subsets of  $L$  which are bounded above in  $X$ . It is shown that every  $K$ -space  $X$  is in a certain sense a subdirect sum of pair-wise lattice disjoint components. Chapter III presents Freudenthal's results on integral representation of elements of  $K$ -spaces, here considerably extended. A theorem of G. Birkhoff (Proc. Natl. Acad. Sci. U.S.A. 24, 154-159 (1935)) is proved, to wit, that the set of all components of a  $K$ -space is a complete Boolean algebra, is also proved. In chapter IV, we find results in part new, concerning extensions of  $K$ -spaces. It is first shown that any complete Boolean algebra can serve as the Boolean algebra of components of a  $K$ -space. This is done by a construction introduced by Kakutani [Ann. of Math. (2) 42, 522-537 (1945); these Rev. 2, 318]. Next, it is shown that every  $K$ -space can be imbedded in another  $K$ -space having a certain strong completeness property. It is also shown that every such complete  $K$ -space admits a natural definition of multiplication for every pair of ele-

sources: Mathematical Reviews

means, making it a commutative and associative algebra over the real field. Chapters V and VI treat  $X$ -spaces in which various additional axioms are supposed satisfied, such as the existence of a metric, a norm, etc. Chapter VII deals with additive homogeneous operators carrying a given  $X$ -space into another. Four types of continuity are defined and treated in great detail; and as one would expect, the set of all  $X$ -spaces satisfying a certain axiom is shown to be a  $X$ -space. Chapter VIII presents representation theorems for various additive, homogeneous, and continuous operators. The usual integral representations for linear functionals on spaces of continuous real functions,  $L^p$ ,  $L^\infty$ , etc., are shown to have their abstract analogues. A large number of special examples are worked out. Chapter IX begins with an obvious analogue of the Hahn-Banach theorem for mappings of any linear space into a  $X$ -space, and proceeds to a long collection of theorems dealing with extensibility of operators of various kinds, with the preservation of various properties. The Daniell construction of the Lebesgue integral (in the case of functions vanishing outside of bounded sets) from the Riemann integral for continuous functions appears as a very special case of one of these extensions; this is a noteworthy fact in that Lebesgue's theorem on Lebesgue-term integration are already contained in the general theorem employed. The classical moment problems for the real line for bounded intervals are also solved by application of the same general theorem. Chapters X, XI and XII deal with convergence of sequences of additive, homogeneous, and continuous operators, with operators continuous in a certain strong sense, and with application of these results to integral and differential

Sources: *Mathematical Reviews*

equations. Here the principal tools are a number of fixed point theorems for abstract operators. Chapter VIII presents a survey of the known results concerning the concrete representation of  $K$ -spaces, as well as some new facts concerning such representations. For example, it is shown that every  $K$ -space can be represented as a linear subspace of the space of (possibly infinite-valued) real continuous functions on a certain extremally disconnected compact Hausdorff space. The linear subspace in question contains with  $x$  all  $y$  such that  $|y| \leq |x|$ . It is also shown that  $K$  spaces of other types are really spaces  $L_1$  for suitable measure spaces [see Kalužni, loc. cit.].

Reviewer's remarks: This book seems to suffer from a number of shortcomings. First, as to omissions. Nowhere is there even a definition of the weak topology, about which, presumably, some interesting facts could be established. Moore-Smith limits in  $K$ -spaces, which are not a natural device, have been ignored. Furthermore, the complete examples presented are all of a perfectly standard kind, providing little real illumination for the general theory expounded. Second, the proliferation of definitions and axioms systems is so great that concentrated attention is required to keep track of what has been proved and under what restrictions. Third, the applications to analysis, which are stated to be the great achievement of the theory, seem for the most part quite standard. Most of the proofs on extensibility and fixed points appear to be obtained by restating known proofs from classical analysis in a form amenable to  $K$ -spaces. It appears that no important new analytic facts have been obtained. The typography is excellent, and only a few trivial misprints were detected by the reviewer.  
E. Hewitt (Seattle, Wash.).

VULIKH, B. Z.

Kantorovič, I. V., Vulih, B. Z., and P  
ially ordered groups and linear partial  
Uspëhi Matem. Nauk (N.S.) 6, no. 3  
(Russian)

This paper is a survey of the present status of the theory of lattice-ordered groups and linear spaces, with special emphasis on those in which the lattice ordering is complete. Most of the material considered is also found in the authors' Funktsionalny: analiz v poluporyadokom [Gosudarstv. izdat. Tehn.-Teor. Lit. M., Moscow-Leningrad, 1950; these Rev. 12, 346]. An extensive and accurate bibliography is appended; see many results, complete and accurate historical references are given.

ster, A. G. Par-  
lly ordered spaces.  
43), 31-98 (1951)

Source: Mathematical Reviews,  
Vol. 13 No. 4

870



USSR/Mathematics - Modern Algebra, 11 May 51  
Lineals

"Concrete Representation of Semiordeed Lineals,"  
B. Z. Vulikh

"Dok Ak Nauk SSSR" Vol LXXVIII, No 2, pp 189-192

In the theory of linear semiordeed spaces (K-spaces) the possibility has been established of realizing such spaces by means of real continuous functions. A similar realization is established here for the more general linear semiordeed sets, namely, K-lineals. The main difference

222745

between K-lineal and K-space is that we do not assume the existence of facet (margin) in each bounded set. Submitted by Acad V. I. Smirnov  
12 Mar 51.

222745

VULIKH, B. Z.

USSR/Mathematics - Topological Spaces Jan/feb 52

"Concerning the Extension of Continuous Functions in Topological Spaces," B. Z. Vulikh, Leningrad

"Matemat Sbor" Vol XXX (72), No 1, pp 167-170

Demonstrates the following theorem relating to topological spaces: Let S be a topological space; A in S is complete set in S; in order that every real function given and continuous in A can be extended with preservation of continuity to the entire space S, it is necessary and sufficient

203749

USSR/Mathematics - Topological Spaces Jan/feb 52  
(Contd)

that any 2 sets  $A_1$  and  $A_2$  contained in A and functionally sep in A possess disjunctive closures in S. Cf. E. Hewitt, "Rings of Real-Valued Continuous Functions," Trans Amer Math Soc, 64, 1948, 45-99. Submitted 28 Jun 51.

203749

VULIKH, B. Z.

VULIKH, B. Z.

USSR/Mathematics - Modern Algebra, Jul/Aug 53  
Ordered Sets

"Certain Problems in the Theory of Linear Semi-Ordered Sets," B. Z. Vulikh

Iz Ak Nauk SSSR, Ser Mat, Vol 17, No 4, pp 365-388

Discusses a number of problems touching on the structures of linear semi-ordered sets. Bases his method of investigation on the representation of linear semi-ordered sets by means of continuous functions in a bicompactum. Presented by Acad V. I. Smirnov, 16 Jun 52.

274T66

VULIKH, B.Z. (Leningrad).

Generalized partially ordered rings. Mat.sbor. 33 no.2:343-358 S-0 '53.

(MLA 6:9)

(Algebra, Universal)

~~VULIKH, B.Z.~~

Characteristic properties of a product in linear semiordered spaces.  
Uch. zap. Fed. inst. Gerts. 89:3-8 '53. (MIRA 11:3)  
(Functional analysis)

VULIKH, B.Z.

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Imbedding of a normed semiordered space in the second conjugate  
space. Usp.mat.nauk 9 no.1:91-99 Ja-I '54. (MIRA 7:2)  
(Topology)

Vulikh, B. Z.

Call Nr: AF 1108825

Transactions of the Third All-union Mathematical Congress\* (Cont.) Moscow, Jun-Jul '56, Trudy '56 V. 1, Sect. Rpts., Izdatel'stvo AN SSSR, Moscow, 1956, 237 pp.

Vulikh, B. Z. (Leningrad). Semiordered Rings.

20-21

Mention is made of Domrachev, G. I.

There are 2 references, both of them USSR.

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21

There is 1 USSR reference

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Grantmakher, F. R. (Moscow). On Structural Lattice Stability of the Sum of Two Polynomials.

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Gurevich, G. B. (Moscow). Algebra of a Group of Automorphisms of an Arbitrary Standard Zero-algebra.

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There are 2 references, both of them USSR.

Zavalo, S. T. (Cherkassy). Operator Free Groups.

22-23

Card 8/80

\*

VULIKH, B.Z.

Boolean dimension. Uch. zap. Ped. inst. Gerts. 125:  
95-114 '56.

(MLRA 9:12)

(Algebra, Abstract)



VULIKH, B.Z.

SUBJECT USSR/MATHEMATICS/Functional analysis CARD 1/1 PG - 750  
AUTHOR VULICH B.Z.  
TITLE The application of the theory of partially ordered spaces to  
the investigation of selfadjoint operators in the Hilbert  
space.  
PERIODICAL Uspechi mat.Nauk 12, 1, 169-172 (1957)  
reviewed 5/1957

The great analogy of the proofs and results of the theory of partially ordered spaces (lattice theory) and the theory of selfadjoint operators induces the author to apply directly the theory of partially ordered spaces to the investigation of the selfadjoint operators. Without proof beside of some own results the author enumerates several well-known results of Stone, Sobolev, Ljubowin etc. Most of the results relate to bounded operators.

VULIKH, Boris Zakharovich

VULIKH, B.Z.

Partial order in rings of bounded self-conjugate operators [with  
summary in English]. Vest.LGU 12 no.13:13-21 '57. (MIRA 10:11)  
(Operators (Mathematics))

PHASE I BOOK EXPLOITATION

656

Vulikh, Boris Zakharovich

Vvedeniye v funktsional'nyy analiz (Introduction to Functional Analysis) Moscow, Gos. izd-vo fiziko-matematicheskoy lit-ry, 1958. 352 p. 7,500 copies printed.

Ed.: Akilov, G. P.; Tech. Ed.: Volchok, K. M.

**PURPOSE:** This book is intended for those interested in the fundamentals of functional analysis who do not have previous training in the more specialized branches of mathematics, and it may also be useful to engineers.

**COVERAGE:** The author gives only the fundamentals of functional analysis and their applications to problems in various fields of mathematics. Therefore the basic concepts of Euclidean, metric, normed, Hilbert and  $L^2$  spaces are given. A short theory of operators in various spaces, as well as their properties, are presented. As particular applications of functional analysis, the basic theorems of integral equations are presented. Various problems are studied, such as the problem of the best approximation, boundary value problem of differential equations, approximate methods of the solution of equations, generalized methods of the summability

Card 1/10

Introduction to Functional Analysis

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of series and others, There are 11 Soviet references including 2 translations.  
No personalities are mentioned.

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AVAILABLE: Library of Congress (QA320.V8)

IK/gmp  
10-31-58

Card 10/10

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RYVKIN, A.Z., red.; DOLGOPOLOV, V.G., red.

[Problems and exercises in mathematical analysis] Zadachnik-praktikum po matematicheskomu analizu. Moskva, Uchpedgiz. Pt.1.[Introduction to analysis; differential calculus of functions of a single variable] Vvedenie v analiz; differentsial'noe ischislenie funktsii odnoi peremennoi. Izd.2., isp. i dop. 1962. 168 p.

(MIRA 17:9)



VULIKH, B.Z.

Linear structures equivalent to structures with a monotone  
norm. Dokl. AN SSSR 147 no.2:271-274 N 162. (MIRA 15:11)

1. Leningradskiy gosudarstvennyy pedagogicheskiy institut  
im. A.I. Gertsena. Predstavleno akademikom V.I. Smirnovym.  
(Banach space)

AKILOV, G.P.; VULIKH, B.Z.; GAVURIN, M.K.; ZANGALLER, V.A.; NATANSON,  
I.P.; PINSKER, A.G.; FADDEYEV, D.K.

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