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MISCELLANEOUS

Nitrogen Containing Organosilicon Compounds. Communication 142. Synthesis and Pharmacological Study of Organosilicon Derivatives of Tetrahydroisoquinoline [E. Lukevits, I. D. Segal, et al.; LATVIYSKIY KHIMICHESKIY ZHURNAL No 1, Jan-Feb 91]	28
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The Atomic Absorption Determination of Nickel in Zinc-, Aluminum-, and Copper-Based Alloys

917M0082C Kiev UKRAINSKIY KHIMICHESKIY ZHURNAL in Russian Vol 57 No 1, Jan 91 (manuscript received 12 Dec 89) pp 63-66

[Article by Ya.S. Pilipyuk, V.B. Ishchenko, and V.V. Sukhan, Kiev University]

UDC 543.422:546.74:546.47:546.621:546.56

[Abstract] A propane-butane-air flame is used to determine elements whose compounds are easily dissociated. In low-temperature flames, however, there is a high degree of interference from related elements. In view of this fact, the authors of the study reported herein attempted to clarify the effect of the matrix of nonferrous zinc-, aluminum-, and copper-based alloys on the signal emitted by nickel when it is undergoing atomic absorption determination on a Saturn spectrophotometer using a hot mixture of propane-butane with air. The authors further worked to develop a method of determining nickel in these alloys. They discovered that adding triethanolamine and strontium salt to the solutions undergoing analysis eliminates the depressing effect of the base elements of the nonferrous alloys on the absorption of nickel. The lower bound of nickel contents that can be determined amounted to $1 \times 10^{-3}\%$ with a 1.0-g weighted portion of alloy in 50 ml solution. The relative standard deviation of the determination of nickel according to the proposed method ranged from 0.02 to 0.08. The proposed method was recommended for use in laboratories involved in analyzing nonferrous alloys. Figures 3, tables 2; references 4 (Russian).

Investigation of Admixture Composition of Very Fine Refractory Nitrides From Plasma Chemical Synthesis. Communication 4. Admixture Composition of Aluminum Nitride

917M0091C Riga LATVIYSKIY KHIMICHESKIY ZHURNAL in Russian No 1, Jan-Feb 91 (manuscript received 19 Jul 90) pp 65-70

[Article by G. L. Smilshkalne, Ya. K. Vayudas, T. N. Miller]

UDC 546.82:543.53:543.064

[Abstract] Increasing use of the very fine powders results in increased demands on high purity of such material. Preparation of various end products from aluminum nitride usually requires high temperatures. The concentration of admixtures in aluminum nitride was determined by means of instrumental neutron activation analysis, while the distribution of these admixtures and their possible forms were investigated by the gradual chemical breakdown method. It was shown that the plasma chemical synthesis of aluminum nitride is accompanied by redistribution of the admixtures between different size particles. Relative concentration

changes of the admixtures expressed as a function of the specific surface ranged from -0.27 (W) to $+0.33$ (Co) m^{-2} . Individual admixture phases Sb, Hf, W, Ta, Mo were identified by gradual chemical breakdown of the very fine aluminum nitride. The surface was enriched also with C, Fe, Co, La, Ba elements, but it was not possible to identify their individual phases. Figures 5; references: 15 (Russian).

Effects of Electron Donors on Aqueous Dispersions of Graphite Oxide

907M0094A Kiev TEORETICHESKAYA I EKSPERIMENTALNAYA KHIMIYA in Russian Vol 27 No 2, Mar-Apr 91 (manuscript received 07 Jul 89) pp 201-205

[Article by V.V. Turov, G.A. Karpenko, E.A. Bakay, and A.A. Chuyko, Institute of Surface Chemistry, Ukrainian SSR Academy of Sciences, Kiev]

UDC 549.212:(542.943):538.082/083:541.183.5

[Abstract] High-resolution PMR studies were conducted on the effects of deuterium-labeled electron donors (pyridine, acetone, acetonitrile, and dimethyl sulfoxide [DMSO]) on aqueous suspensions of graphite oxide. Studies at 256 K demonstrated that the addition of 0.05 to 0.5% (by wt.) of strong electron donor (DMSO, pyridine) to a 0.14% aqueous suspension of graphite oxide significantly reduced the intensity of the broad signal, a change that was more pronounced with the relatively weaker donor (DMSO) than with the stronger donor (pyridine). The addition of acetone or acetonitrile did not result in any telling effects. In addition, pyridine did not affect the narrow signal, whereas the remaining donors evoked marked intensification. The data were interpreted to indicate pyridine- and DMSO-mediated breakdown of structured water between the planes of graphite oxide. Pyridine effects were attributed to direct reaction with phenolic hydroxide groups on graphite oxide, while DMSO acted by forming an adsorbed monolayer that screened graphite oxide from bulk solvent. Figures 2; references 9: 7 Russian, 2 Western.

The Effects of Metallic Fillers on the Composition of Volatile Products of Polyethylene Radiolysis

917M0094C Kiev TEORETICHESKAYA I EKSPERIMENTALNAYA KHIMIYA in Russian Vol 27 No 2, Mar-Apr 91 (manuscript received 14 Sep 89) pp 223-228

[Article by M.M. Aleksankin, I.P. Samchenko, Ye.G. Stetsenko, T.Z. Kolmaz, B.G. Mischanchuk, and V.P. Gordiyenko, Institute of Physical Chemistry imeni L.V. Pisarzhevskiy, Ukrainian SSR Academy of Sciences, Kiev]

UDC 541.6.15:543.42

[Abstract] Mass spectrometry was used to analyze the volatile products formed by gamma radiolysis samples of high-density polyethylene (HDPE) and HDPE that had been filled either with carbonyl iron or 30KhGSA steel. Gamma irradiation of 1-mm-thick 1-mm² pellets with a dose of 2.5 MGy showed that HDPE yielded a large variety of volatile products. HDPE samples doped with

carbonyl iron or 30KhGSA steel powder showed significantly fewer lines of diminished intensity. However, signals corresponding to 32 amu (CH₃O) and 33 amu (CH₃OH) showed a marked increase in intensity in samples with carbonyl iron. The latter phenomenon was attributed to increased oxidation of the HDPE chain termini by oxygen bound to the metal surface, thus indicating chemisorption phenomena between active groups on the two phases. Tables 1; references 4 (Russian).

**High Molecular Catalysts in Organic Synthesis.
Communication 25. Synthesis of Polymer
Supported Tetrazols**

917M0091D Riga LATVIYSKIY KHIMICHESKIY
ZHURNAL in Russian No 1, Jan-Feb 91 (manuscript
received 29 May 90) pp 79-84

[Article by A. G. Skuyinysh, R. E. Rassa, M. K. Klyavinsh, A. Kh. Zitsmanis, All Union Scientific Research Institute of Applied Biochemistry, Scientific Production Organization "Biolar", USSR Academy of Sciences]

UDC 541.128:542.951:547.796

[Abstract] Searching for multiple use effective catalysts for the acylation reaction, an attempt was made to synthesize polymer supported tetrazol by the alkylation of azol with chloromethylated styrene copolymer and divinylbenzene. In addition to the alkylation reaction, it was shown that in case of tetrazols, one could also use an acylation reaction and cyclization of tetrazol directly on the styrene-divinylbenzene polymer support. The ability to form various complexes with transition metal ions and the catalytic activity in acylation reactions of polymer supported tatr azols were investigated. Figure 1; tables 2; references 15: 12 Russian, 3 Western.

**Laser-Induced Oxidation of Ethylene to
Formaldehyde**

917M0094B Kiev TEORETICHESKAYA I
EKSPERIMENTALNAYA KHIMIYA in Russian Vol
27 No 2, Mar-Apr 91 (manuscript received 19 Apr 90)
pp 220-223

[Article by S.V. Volkov, Institute of General and Inorganic Chemistry, Ukrainian SSR Academy of Sciences, Kiev]

UDC 535.217

[Abstract] Trials were conducted on the oxidation of ethylene to formaldehyde using 3×10^5 W/m² CO₂ laser radiation by taking advantage of the overlap between ethylene's molecular vibration at 949 cm⁻¹ and laser emission at 943 cm⁻¹. Under optimum conditions (C₂H₄:O₂:N₂ = 1:1.5:5.3; P = 1,010 gPa; irradiation time, 600 seconds), the yield of formaldehyde was 11.5% (selectivity, 54.5%), and ethylene conversion amounted to 21.1%. The laser energy-mediated reaction was presumed to involve formation of the H₂C-CH₂ radical and its subsequent reaction with O₂ to form HCHO. Figures 2; references 6: 1 Ukrainian, 3 Russian, 2 Western.

**A Novel Catalytic Reaction: Oxidative
Condensation of Methane Into Cyclopropane**

917M0094D Kiev TEORETICHESKAYA I
EKSPERIMENTALNAYA KHIMIYA in Russian Vol
27 No 2, Mar-Apr 91 (manuscript received 14 Nov 90)
pp 231-232

[Article by N.I. Ilchenko, Yu.I. Shmyrko, and G.I. Golodets, Institute of Physical Chemistry imeni L.V. Pisarzhevskiy, Ukrainian SSSR Academy of Sciences, Kiev]

UDC 541.128.13

[Abstract] Oxidative dehydrocondensation of methane over titanium silicide yielded cyclopropane in a 0.20% yield in addition to a 13.4% yield of C₂ and C₃ hydrocarbons. The optimal conditions were determined to be as follows: T = 1,073 K, W = 1,800 h⁻¹, and CH₄:air ratio = 3:7. The putative mechanisms for cyclopropane synthesis may include recombination of CH₃ and CH₂ fragments adsorbed to the catalyst or the addition of CH₂ to ethylene (a major product of oxidative dehydrocondensation of methane). References 1 (Western).

**Synergistic Effect on Bimetallic Ni-Tc Catalysts
During Hydrogenation of Benzene and Toluene**

917M0105C Moscow ZHURNAL FIZICHESKOY
KHIMII in Russian Vol 65 No 1, Jan 91 (manuscript
received 13 Jan 89) pp 63-67

[Article by O. V. Petrovskaya, V. V. Matveyev, A. Ye. Chalykh, G. P. Pirogova, Institute of Physical Chemistry, USSR Academy of Sciences, Moscow]

UDC 541.128

[Abstract] Nickel compounds are highly active catalysts in hydrogenation reactions and the bimetallic catalysts are much more active than the monometallic reagents. In the present work nickel- technetium catalysts deposited on γ -Al₂O₃ were investigated in hydrogenation of cyclic hydrocarbons. All of the catalysts studied produced cyclohexane from benzene and methylcyclohexane from toluene. Using the monometallic catalysts the reaction yields were in the range of 10-25%; with the bimetallic compounds the yield was 100%. The highest activity was observed at 500° C. The activity of bimetallic catalysts was not just additive, it was definitely synergistic. It was assumed that this synergism was the result of the formation of solid Ni-Tc solutions which were identified on the surface of the catalyst by means of the spectra of diffusion imaging and electron microdiffraction. Figure 1; tables 2; references 6: 4 Russian (1 by Western author), 2 Western.

Acceptor Properties of Al^{3+} Ions in Aluminum Oxide Containing Catalysts

917M0105D Moscow *ZHURNAL FIZICHESKOY KHIMII* in Russian Vol 65 No 1, Jan 91 (manuscript received 10 Aug 89) pp 68-72

[Article by A. A. Budneva, Yu. D. Pankratyev, A. A. Davydov, Institute of Catalysis, Siberian Division, USSR Academy of Sciences, Novosibirsk]

UDC 541.183

[Abstract] A microcalorimetric method was used to evaluate the heats of adsorption of carbon monoxide at room temperature over the crystalline ($\gamma-Al_2O_3$) and the amorphous ($\alpha-Al_2O_3$) aluminum silicates. A characteristic change of the heat values of differential adsorption was observed related to the filling of the surface of the system. An attempt was made to relate the presence of fragments with different heats of adsorption to the presence of coordination-unsaturated aluminum cations in different coordination states. The low heats of adsorption (below 16 kJ/mole) related most probably to physical adsorption of CO which in the literature was erroneously assigned to the adsorption of CO on coordination unsaturated octahedral vacancies on Al^{3+} . Figures 3; table 1; references 6: 4 Russian, 2 Western.

Investigation of Formation of Nickel-Zirconium Oxide Catalyst in Process of Calcination

917M0105E Moscow *ZHURNAL FIZICHESKOY KHIMII* in Russian Vol 65 No 1, Jan 91 (manuscript received 26 Feb 90) pp 73-80

[Article by G. V. Sobolevskiy, A. P. Grechenko, I. Ye. Nemirovskaya, V. V. Lunin, Department of Chemistry, Moscow State University imeni M. V. Lomonosov]

UDC [66.097.3:546.74]:542.464

[Abstract] Zirconium was shown to be useful in hydrogenation processes; yet data on zirconium hydroxide and the Ni-Zr oxidation system are limited and often contradictory. In order to optimize physical-chemical properties of nickel-zirconium catalyst, its formation process was investigated during the calcination stage using complex thermal analysis, high temperature X-ray analysis and differential scanning calorimetry. The study material covered Ni-Zr catalysts containing 14.5, 22, 25, 29, 42 and 69.5% of nickel oxide. Co-precipitated Ni-Zr product represented amorphous material which at 170° C showed a transition to a more ordered structure followed by gradual crystallization and appearance of NiO and ZrO_2 . It appeared that the formation of ZrO_2 stabilized the hydrated nickel phase. It was assumed that after dehydration, a solid insertion solution of NiO in ZrO_2 is formed, which at a higher temperature leads to the formation of ZrO_2 . With an increase of the Ni content, the homogeneity of the solid solution is increased. Overall, the process of the formation of catalyst appeared to be occurring in stages which could be related to the ratios of individual components. The presence of nickel oxide

appeared to have a stabilizing effect on the tetragonal modification of zirconium oxide. Figures 3; references 12: 9 Russian, 3 Western (1 by Russian authors).

Hydrogenation of CO on Ultra-Dispersed Powders of Iron Group Metals. Communication 1. Catalytic Properties of Nickel Powders With Different Dispersiveness

917M0105F Moscow *ZHURNAL FIZICHESKOY KHIMII* in Russian Vol 65 No 1, Jan 91 (manuscript received 12 Mar 90) pp 81-85

[Article by O. V. Salova, N. N. Mikhaleiko, Yu. M. Serov, V. M. Gryaznov, University of Peoples' Friendship imeni P. Lumumba, Moscow]

UDC 541.128.13:546.74

[Abstract] The goal of this work was to study the relationship between the catalytic activity and selectivity in the synthesis of lower olefines from CO and H_2 and the size of ultra-dispersed particles of nickel and iron. This is an important issue in searching for new sources of ethylene and propylene alternatives to petroleum and natural gas. The products of the hydrogenation of CO over the investigated nickel catalysts were: water, CO_2 and the hydrocarbons: methane, ethylene, ethane, propylene and propane. It was shown that the oxygen containing compounds are not formed on all catalysts; methane only is formed on a catalyst with average particle size of 39 nm. Nickel powders with the average particle size of 20 nm hydrogenate CO to methane as well as to the C_2 - C_3 hydrocarbons. The particle size distribution has a definite effect on their selectivity in respect to the formation of olefines. With a temperature drop, the formation of propylene decreases in favor of the formation of ethylene. Figure 1; tables 3; references 19: 2 Russian (1 by Western authors), 17 Western.

Scientific Principles of Preparation and Technology of Catalysis and Improvement Catalytic Processes

917M0114A Novosibirsk *IZVESTIYA SIBIRSKOGO OTDELENIYA AK NAUK SSSR: SIBIRSKIY KHIMICHESKIY ZHURNAL* in Russian No 1, January 1991 pp 5

[Article by R. A. Buyanov, Institute of Catalysis, Siberian Division, USSR Academy of Sciences, Novosibirsk]

UDC 541/128.13-14:66.097

[Abstract] A new area has arisen in the general science of catalysis over the past two or three decades—the scientific principles of preparation and technology of catalysis. The basic task of the study of the scientific principles of catalyst preparation is the development of methods for preparation of catalysts and determination of conditions and permissible deviations from them which must be maintained by process equipment in each stage of catalyst manufacture.

The scientific principles of catalyst technology is based on the conclusions of the first area of the new science and includes the development of designs for equipment and units, principles of implementation of all stages and the appropriate engineering design of the equipment. Particular attention is given in this article to problems of Soviet industry. It is pointed out that companies in the industrially developed nations today have gone over to the creation of fully automated process lines, working virtually without the participation of human beings. There are many causes and justifications frequently cited as to why in the Soviet Union although they are capable of reproducing the best specimens of Western technology, these specimens frequently go directly from the big leagues to retirement. The system of certification and determination of the quality level of equipment based on its formal characteristics is said to be quite imperfect. The concept reliability or even functionality does not even exist in this system. The formal characteristics of the system are such that obsolete, at times simply nonfunctional equipment is certified as having parameters equal to the best models of Western firms. Cases are known in which models of copied Western equipment which will not work at all has been certified as equal in quality to the best Western equipment according to the formal criteria used. All of this has led to catastrophic results. Catalytic production facilities take so long to be constructed that more than one generation of catalysts intended to be produced by the facilities become obsolete before the facility is even completed. As enterprises in the Soviet Union go over to full economic independence and free-market operations, the quality and competitiveness of the industry must be improved. A new system of certification is required, indicating that a product meets the requirements of the world standards. References 16: 13 Russian, 3 Western.

Use of Cresyl Blue-Aspartic Acid System in Photogalvanic Cell for Solar Energy Conversion

917M0114B Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AK NAUK SSSR: SIBIRSKIY KHIMICHESKIY ZHURNAL in Russian No 1, January 1991 pp 155

[Article by Suresh C. Ameta, R. S. Ameta, Rakesh Bhandia, MISS Sapna Sahasi and R. K. Jain, Sukhadin University, India]

UDC 541.128

[Abstract] Results are presented from the first study of the cresyl blue-aspartic acid photogalvanic cell for conversion of solar energy. It was found that the curve of photopotential and photocurrent at the output of the cell as a function of pH has an extreme. The influence of diffusion distance, electrode area and temperature and illumination intensity was studied. The cell produced a photopotential of 267 mV, photocurrent 17.5 μ A. The dark current characteristics were measured. References 16: Western.

Liquid-Phase Oxidation of Hydrogen Sulfide by Oxygen on Catalysts

917M0114C Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AK NAUK SSSR: SIBIRSKIY KHIMICHESKIY ZHURNAL in Russian No 1, January 1991 pp 24

[Article by L. N. Fesenko, A. Babayev, Novocherkassk Polytechnical Institute]

UDC 541.138.2:546.221.1

[Abstract] Experimental data are presented from a study of the electrochemical oxidation of H_2S oxygen on various catalysts. The oxidation of H_2S and reduction of O_2 on electrodes of copper, graphite, lead, carbide, tungsten and carbon-graphite fabric was studied using a model sulfide water electrolyte with pH maintained at 6.95-7.05. The studies demonstrate the possibility of oxidizing hydrogen sulfide by the oxygen of the air in solutions on the surface of catalysts by electrochemical methods due to the functioning of the hydrogen sulfide-oxygen galvanic couple. The rate of oxidation depends on the type of material. Best results are achieved on the carbon-graphite fabric, probably due to the high catalytic activity of activated carbon. Figures 3; References 3: 2 Russian, 1 Western.

Structure of Immediate Environment of Osmium Atoms in New Liquid-Phase Paraffin Hydrocracking Catalysts by EXAFS- and XANES-Spectroscopy

917M0123D Moscow KHIMICHESKAYA FIZIKA in Russian Vol 10 No 1, Jan 1991 pp 99

[Article by A. T. Shuvayev, B. Yu. Khelmer, F. M. Ovsyanikov, I. S. Akhrem, N. M. Chistovalova, S. V. Reznichenko, M. Ye. Volpin, Scientific Research Institute of Physics, Rostov State University, Rostov-na-Donu]

UDC 537.531:535.3

[Abstract] A study is made of the electron and atomic structure of new osmium catalysts in relationship to their catalytic activity. They were synthesized by homogeneous reduction of OsO_4 in a medium of saturated or aromatic hydrocarbon at 150 or 20°C. It is shown that this method of synthesis leads to the production of active catalysts for liquid-phase hydrocracking of alkanes and cycloalkanes at 100-120°C and H_2 pressure 50 atm. The method of EXAFS spectroscopy establishes that the catalysts are low-ligand clusters of metallic osmium. The dimensions of the clusters and nature of bond of the surface cluster atoms to the stabilizing ligand surface are established. A relationship is found between the structure of the new osmium catalysts and their reactivity as a function of synthesis conditions. The mean particle dimensions of the clusters are 16 Å (150° synthesis) and 9 Å (20° synthesis). The smaller particles have great catalytic activity. Oxidation of the smaller clusters does not involve breaking up of the cluster structure, although it does increase the dimensions of the clusters by a factor of two and causes the appearance of oxygen-containing ligands with the osmium atoms. Figures 3; References 10: 4 Russian, 6 Western.

Intensification of Flotation Enrichment Process of Potassium Salts by Means of Ultrasound

917M0118A Moscow *KHIMICHESKAYA*
PROMYSHLENNOST in Russian No 2, Feb 91
pp 85-87

[Article by F. F. Mozheyko, T. G. Domovskaya]

UDC 622.765.06:66.084

[Abstract] Ultrasound treatment was proposed for carboxymethylcellulose (CMC) type solutions in an attempt to reduce the salting out effect of potassium and sodium chlorides. Ultrasound vibrations alter the CMC properties and the structure of water itself; water becomes more densely packed than in the structure of ice itself. In addition, ionization and dissociation of water molecules and dissolved gasses produces various radicals. Ultrasound leads to a destruction of CMC by the radical-chain mechanism forming carbonyl and aldehyde groups. Two parallel processes with opposite action occur in CMC during and immediately after exposure to ultrasound: destruction of supermolecular structures and destruction of polymer macromolecules forming unstable peroxides. When carbamide type inhibitors are introduced, the breakdown of the macromolecules is arrested. Laboratory results were field tested showing that treatment of potassium salts of CMC solutions with ultrasound resulted in lower consumption of CMC and amine; this flotation method gave financial savings in one plant of about 49,000 rubles per year. Figures 3; tables 3; references: 8 (Russian).

Production of Barium Carbonate by Carbonization Method

917M0118B Moscow *KHIMICHESKAYA*
PROMYSHLENNOST in Russian No 2, Feb 91
pp 90-91

[Article by B. M. Azizov, M. G. Gaynullin, S. V. Ananikov]

UDC 661.863/.868:66.069.82

[Abstract] Past methods of the production of barium carbonate were based on treatment of mother liquors containing $\text{Ba}(\text{OH})_2$, NaOH and NaCl with Na_2CO_3 . A more effective way appeared to be one based on precipitation of barium carbonate by carbonization of the mother liquor with CO_2 obtained from the fuel gasses. Based on this principle, a contact method was developed with countercurrent gas-liquid flows. This setup permits the utilization of low level CO_2 concentrations and other manufacturing byproducts; the consumption of Na_2CO_3 was lowered considerably. Figures 3; references: 5 (Russian).

Testing of Containers for Transportation of Bromine

917M0118C Moscow *KHIMICHESKAYA*
PROMYSHLENNOST in Russian No 2, Feb 91 p 92

[Article by F. A. Teslyuk]

UDC 620.165.7

[Abstract] One liter glass containers are normally used to transport bromine, which limits its large scale distribution. After a long search, larger containers were prepared from carbons steel with a protective inner surface. These containers were tested under conditions of railroad and motor-vehicle transport showing flaw-less performance. The body of the containers showed no damage in 92%, the cover in 78% when transported by railroad; during highway transfer the body was undamaged in 84% and the cover in 77%. The failures were not related to the length of the transit but rather to the frequency of use: opening and closing, filling, decanting etc. Based on these data the design of the containers was appropriately modified. Figure 1; references: 3 (Russian)

Protective Screens for Sludge Storage at Potassium Plants

917M0118D Moscow *KHIMICHESKAYA*
PROMYSHLENNOST in Russian No 2, Feb 91
pp 93-94

[Article by T. G. Rudakovskaya, F. F. Mozheyko, V. N. Verina]

UDC 628.515

[Abstract] Processing of potassium ores results in the formation of argillaceous-salty sludge which must then be stored in open fields resulting in ecological contamination. To prevent the migration of these undesirable residues into the water table, anti-filtration screens are placed on the storage sites underneath the sludge. Such screens consist of granular surfactants obtained from the byproducts of petroleum processing plants; they contain 80.4% aromatic hydrocarbons, 14.9% saturated cyclic hydrocarbons, 4.7% tars and 0.003% phenols. This material forms a highly stable emulsion with aliphatic amine salts; when mixed with the soil it covers uniformly mineral particles of ground. Experimental results were reported on the effect of this emulsion on filtration, diffusion and stability of soil exposed to such emulsion. It was shown that the filtration rate of salt solutions was decreased when the screen material was applied to the soil; the optimal concentration of the emulsion was 5%. The protective effect could be further enhanced by adding ureaformaldehyde resin (UFR) which intensified the formation of more rigid structure of the soil. Optimal results were obtained with material containing 2% of the emulsifying agent and 0.25% UFR. The field tests showed that the soil under such protective cover retained its fertility. Figures 2; table 12; references: 2 1 Russian, 1 Western.

**Possibilities of Utilization of Spiral and
Spiral-Vortical Driers in Chemical Industry**

917M0118E Moscow *KHIMICHESKAYA
PROMYSHLENNOST* in Russian No 2, Feb 91
pp 111-113

[Article by A. S. Timonin, V. I. Mushtayev, I. I.
Drozdov, A. A. Pakhomov]

UDC 66.047.004.14

[Abstract] There are many convection drying machines used in industrial applications. The surface of the material being dried can be most effectively utilized in spiral and spiral-vortex units with air transport of the particles being dried. Six different spiral-vortex driers were described, each with specific advantages designed for a particular application keeping in mind the material being used: short term drying, extended contact time, compactness, etc. Figures 7; references: 6 (Russian).

**Generalizing Technological Structures in the
Problem of Synthesizing Flexible Computerized
Manufacturing Systems To Manufacture Chemical
Reagents and Especially Pure Chemicals**

917M0122C Moscow *VYSOKOCHISTYYE
VESHCHESTVA* in Russian No 2, Mar-Apr 91
(manuscript received 18 Sep 90) pp 108-115

[Article by R.M. Malyshev, V.A. Stogar, and Yu.Ye.
Turovskiy, IREA Scientific Production Association,
Moscow]

UDC 66.048

[Abstract] The task of synthesizing technological structures for existing flexible systems for use in industry entails a large number of constraints resulting in optimization "given two fixed ends." This problem in turn entails searching for and proving the existence of even one acceptable (satisfactory) solution. The greater the number of constraints, the greater the accent on finding optimal solutions. The authors of the study reported herein examined the aforesaid problem as it applies to the case of flexible computerized manufacturing systems used to produce chemical reagents and especially pure chemicals. After analyzing the nature of the problem they conclude that in view of the incompleteness of the starting information in this field, the problem must be approached by using a problem-oriented solution method. The solution method they propose is based on a qualitative analysis and situational generalization of the individual or subprocesses entailed in the overall production processes. This generalization is in turn based on classification of the subprocesses and their semantic processing. They proceed to present an example of designing and analyzing a generalized functional structure for a flexible computerized manufacturing system. The authors consider three versions of a manufacturing process that entails 21 mechanical processes implemented in five stages (preparation, chemical transformation, liquid-phase isolation, and solid-phase isolation). A total of 30 individual routes are considered. Figures 2, table 1; references 5 (Russian).

Investigation of the System $Ti_xNb_{1-x}H_2$ in a Combustion Mode and Under Conditions of Thermodynamic Equilibrium

917M0113C Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA NEORGANICHESKIYE MATERIALY in Russian Vol 27 No 1, Jan 91 (manuscript received 11 Jan 89) pp 29-33

[Article by E.V. Agababyan, S.S. Simonyan, R.A. Karimyan, S.K. Dolukhanyan, S.S. Petrosyan, and V.S. Degtyareva, Chemical Physics Institute, Armenian SSR]

UDC 541.121:541.123.7

[Abstract] Previous research would lead one to expect that hydrogenation of alloys of Ti with Nb would result in intensification of the atomic interaction between Nb and H owing to the presence of titanium atoms in the elementary cell of the alloy's crystalline lattice and, consequently, to the high absorption of hydrogen by the alloys under relatively "softer" hydrogenation conditions. The authors of the study reported herein examined the hydrogenation of powders of alloys of Ti with Nb in a combustion mode. They also studied chemical equilibrium in the system Ti-Nb-H in the temperature interval from 20 to 800°C under isobaric pressure of 80 kPa. The studies were performed in accordance with a method described elsewhere. Alloys of Ti and Nb with an Nb content of 40 to 80 atomic percent were used. Depending on the hydrogenation conditions (synthesis method and dispersion), the hydrogenation of Ti_xNb_{1-x} alloys entails the formation of body- or face-centered crystal structures analogous to those formed during the hydrogenation of niobium. The hydrogenation of alloys with a niobium structure up to $H/M = 2$ occurs under "softer" conditions than does the hydrogenation of niobium to NbH_2 . The authors determined the breakdown temperatures of the hydrides of the alloys studied and showed that the mechanism of the decomposition of hydrides of alloys of Ti with Nb (with body- and face-centered crystal structures) is analogous to the decomposition mechanism of niobium hydrides. Figures 3, tables 2; references 7: 5 Russian, 2 Western.

Stochastic Ignition of Particles

917M0124D Moscow KHIMICHESKAYA FIZIKA in Russian Vol 10 No 2, Feb 1991 pp 238

[Article by S. P. Fedotov, M. V. Tretyakov, Urals State University imeni A. M. Gorkiy, Sverdlovsk]

UDC 536.46

[Abstract] This work studies the unsteady thermal state of combustion of an individual particle in the presence of a random external field. The analysis shows that fluctuations may lead to spontaneous transition of the thermal mode of combustion from the kinetic to the diffusion mode, i.e., to stochastic ignition and vice versa. In a situation in which the mean time of transition from the kinetic mode to the diffusion mode is less than the characteristic time of

combustion in the kinetic mode it is possible for stochastic ignition of a particle to take place and the deterministic theory yields an essentially elevated time of combustion of particles for systems of particles. This is the situation for combustion of particles in a turbulent stream, in a fluidized-bed reactor. Figures 2; References 4: Russian.

Propagation of Type Two Combustion Wave with Two Competing Exothermic Reactions

917M0124E Moscow KHIMICHESKAYA FIZIKA in Russian Vol 10 No 2, Feb 1991 pp 242

[Article by K. Yu. Voronin, B. S. Seplyarskiy, Kuybyshev Polytechnical Institute imeni V. V. Kuybyshev]

UDC 536.46

[Abstract] A study is made of the one-dimensional problem of propagation of a type two combustion wave through a nonvolatile condensed substance capable of parallel conversion from state A to states B and C. It is considered that only condensed products are formed by the reaction. Classical methods of the theory of combustion are used to study the propagation of the combustion wave for the two competing exothermic reactions. The process of wave propagation can occur in three modes: pseudoseparation of the first reaction, transient and pseudoseparation of the second reaction. Analytic expressions are derived for the basic parameters of the combustion wave in each of these three modes. The parametric areas of existence of each mode and the boundaries between them are defined. Figures 7; References 9: Russian.

Detonation of Aluminum Suspensions in Air and Oxygen

917M0124F Moscow KHIMICHESKAYA FIZIKA in Russian Vol 10 No 2, Feb 1991 pp 250

[Article by A. A. Borisov, B. A. Khasainov, B. Veyssiere, E. L. Saneyev, I. B. Fomin, S. V. Khomik, Institute of Chemical Physics imeni N. M. Semenov, USSR Academy of Sciences, Moscow; Laboratory of Energy and Detonation No. 193, National Center of Scientific Research, Poitiers, France]

UDC 534.222

[Abstract] A study of the initiation and propagation of detonation in air suspensions of aluminum was performed primarily in a horizontal shock tube 4.2 mm in length with inside diameter 122 mm. The process was recorded photographically through slot windows on the side surface of the last two meters of the tube. Pressure centers were mounted 1.25 and 3.25 m from the open end of the tube. The detonation capacity of the aluminum suspensions increased significantly with decreasing dimensions of the particles. A model is suggested to compute the structure and parameters of a nonideal detonation wave of aluminum particles in a gaseous oxidizer. Satisfactory agreement between calculated and experimental data is observed. The results indicate that suspensions of aluminum particles with dimensions of around 1 μ m are high detonable in shock tubes and in open spaces as well. Figures 11; References 21: 9 Russian, 12 Western.

Verification of Electroconductivity Theory on Methanol Solutions of Electrolytes

917M0106A Moscow *ZHURNAL FIZICHESKOY KHIMII in Russian* Vol 65 No 2, Feb 91 (manuscript received 2 Jan 90) pp 362-369

[Article by M. M. Baldanov, V. V. Tanganov, M. V. Mokhosoyev, East Siberian Technological Institute, Ulan-Ude]

UDC 541.133.08:547.36

[Abstract] The model of plasma-like state of the totality of ions in water was applied to the problem of electroconductivity in non-aqueous solutions; specifically, this model of multiple interactions of ions in solution was used to derive an equation for electroconductivity of electrolytes in methanol solutions. Molar and critical molar electroconductivity of ammonium, tetraalkyl ammonium and alkali metal halides, nitrates, perchlorates, thiocyanates and picrates were calculated. The radii and sublimation energy of normal alcohol molecules from methanol to n-octanol were calculated. The calculated results were 10-20% lower than the values reported in literature. This could be due, at least partially, to the λ_0 values used in this calculation, which were obtained by extrapolation to zero concentrations. Tables 6; references 10: 19 Russian (2 by Western authors), 1 Western.

Effect of Ultrasound Vibrations on Electrode Potential

917M0106D Moscow *ZHURNAL FIZICHESKOY KHIMII in Russian* Vol 65 No 2, Feb 91 (manuscript received 2 Feb 90) pp 469-475

[Article by N. V. Dezhkunov, A. P. Kornev, Institute of Applied Physics, BSSR Academy of Sciences, Minsk]

UDC 541.183 + 534.2

[Abstract] It was shown recently that in an ultrasound field it is possible to generate an alternating and a constant potential on non-polarized electrodes. The goal of this work was to investigate the mechanism and principal rules of this effect. Five possible mechanisms of the ultrasound effect on the electrode potential were considered: 1) change of the ionic concentration in solution; 2) change in the energy state of the electrons in metal expressed by a change in the yield of electrons; 3) acoustic-electric effect; 4) an influence on the anode and cathode reaction rate resulting from the acceleration of the diffusion process and 5) removal of the ions from the double electric layer by acoustic flow and its breakdown by cavitation. On the basis of the data obtained, the last mechanism was the most probable. In compartments where corrosive processes were possible, the action of ultrasound on the cathode and anode reactions may contribute to the increase of the potential. Figures 5; references 15: 14 Russian (1 by Western authors), 1 Western.

Variation of Image Force Energy with Electrode Charge

917M0107A Moscow *ELEKTROKHIMIYA in Russian* Vol 27 No 2, Feb 1991 pp 147

[Article by V. Yu. Izotov, A. M. Kuznetsov, Institute of General and Inorganic Chemistry, Ukrainian Academy of Sciences, Kiev; Institute of Electrochemistry imeni A. N. Frumkin, USSR Academy of Sciences, Moscow]

UDC 541.135.5

[Abstract] A study is made of the variation of image force energy as a function of electrode charge for the point charge near the interface of a metal electrode and a polar solvent. The model system used has cylindrical symmetry and the calculations are performed in a cylindrical system of coordinates. It is shown that the image force energy as a function of electrode charge has a maximum. The solvent is described using the approximation of a dielectric continuum. The boundary is assumed sharp its dielectric properties described in a model of mirror reflection of polarization waves. The metal surface is described within the local approximation of the functional density method. Figures 4; References 15: 5 Russian, 10 Western.

Photocharacteristics of SnO₂/CdSe/Au Electrolyte Structure Illuminated from SnO₂ Side

917M0107B Moscow *ELEKTROKHIMIYA in Russian* Vol 27 No 2, Feb 1991 pp 240

[Article by A. A. Nekrasov, V. F. Ivanov, A. V. Vannikov, Institute of Electrochemistry imeni A. N. Frumkin, USSR Academy of Sciences, Moscow]

UDC 541.13:772.93

[Abstract] Previous works by the authors studied the characteristic of a semiconductor photoelectrochemical photographic device based on an SnO₂/CdSe/recording layer/Pt system with various applied voltages and exposure modes. This article studies a CdSe/Au/electrolyte structure containing various redox pairs to determine the possibility of protecting the semiconductor from photoelectrochemical corrosion. The semiconductor was illuminated through a transparent conducting glass-SnO₂ substrate from the side opposite the gold layer. Covering the semiconductor CdSe photoelectrode with a layer of gold with illumination from the opposite side was found to prevent photoelectrochemical corrosion without deterioration of the properties of the semiconductor. For a number of oxidation-reduction components in the solution this causes an increase in photocurrent and thus increases photographic sensitivity. Figures 5; References 14: 9 Russian, 5 Western.

Spectral Characteristics of SnO_2/CdSe /Electrolyte Structure with Various Directions of Illumination

917M0107C Moscow ELEKTROKHIMIYA in Russian
Vol 27 No 2, Feb 1991 pp 247

[Article by A. A. Nekrasov, V. F. Ivanov, A. V. Vannikov, Institute of Electrochemistry imeni A. N. Frumkin, USSR Academy of Sciences, Moscow]

UDC 541.13:772.93

[Abstract] Previous articles by the same authors have studied the characteristics of a semiconductor photoelectrochemical camera based on SnO_2/CdSe /recording layer/Pt systems for various applied voltages. This article studies the spectral characteristics of the structure SnO_2/CdSe /solution of electrolyte with various directions of illumination and in the presence of various redox components in the solution. A layer of CdSe was used applied to transparent conducting glass- SnO_2 substrates by sputtering in a vacuum in a semienlosed volume. It was found that when the semiconductor was illuminated from the side of the transparent conducting SnO_2 layer the spectral curve of photocurrent with anodic polarization has a clear maximum at 752 nm wavelength, whereas when illuminated from the side of the electrolyte the current changes little between 400 and 700 nm. The studies indicate that the spectral characteristics of the SnO_2/CdSe /electrolyte structure with various redox components depends essentially on the direction of illumination of the semiconductor. This allows the area of spectral sensitivity, spectral selectivity and overall sensitivity of the device to be regulated. Figures 5; References 6: 5 Russian, 1 Western.

Electrodes of Synthetic Semiconductor Diamond: Estimating Homogeneity and Nature of Conductivity by Impedance Measurement

917M0107D Moscow ELEKTROKHIMIYA in Russian
Vol 27 No 2, Feb 1991 pp 263

[Article by A. Ya. Sakharova, A. E. Sevastyanov, Yu. V. Pleskov, G. L. Teplitskaya, V. V. Surikov, A. A. Voloshin, Institute of Electrochemistry imeni A. N. Frumkin, USSR Academy of Sciences, Moscow; Institute of Solid State Chemistry and Mineral Raw Materials, Siberian Division, USSR Academy of Sciences, Novosibirsk]

UDC 541.148

[Abstract] Reliable interpretation of electrochemical data requires that we know the homogeneity of the films of synthetic semiconductor diamond used. This problem was solved in this work by measuring the frequency variation of impedance of the films. Studies were performed on semiconductor diamond films grown on a tungsten substrate by chemical crystallization from an electrically activated hydrocarbon-hydrogen phase at relatively high temperatures. The film is analyzed as a microheterogeneous structure consisting of conducting diamond crystals separated by boundary areas with reduced conductivity, probably amorphous carbon. Active conductivity in a continuous grid of intercrystalline boundaries is considered improbable. The surface of the thin-film polycrystalline synthetic diamond electrode is electrically rather homogeneous. Figures 4; References 11: 9 Russian, 2 Western.

Spectrum of Initial Internal Resistance of Lithium Current Source with Discharge Currents of Various Densities

917M0107E Moscow ELEKTROKHIMIYA in Russian
Vol 27 No 2, Feb 1991 pp 284

[Article by A. Z. Chekhtman, All-Union Scientific Research Planning-Design and Technological Institute of Current Sources, Moscow]

UDC 541.136.1

[Abstract] Numerous complex factors including cracks, delamination, insoluble products and corrosion products, all influencing the internal impedance of sources of current, reduce the effectiveness of studying the processes occurring in such sources for diagnosis of problems, requiring various methods of study and testing to be used. This article suggests one such method, based on investigation of the spectrum of internal impedance of a source of current at various current densities flowing through the current source. The procedure of measuring the spectrum of initial internal impedances changes the capacity of the source of current very little, while allowing simultaneous investigation of a large number of sources of current. The process is easily automated. The spectra thus produced can be used to study the influence of mechanical, thermal and other actions on sources of current, in diagnosis of manufacturing defects and, possibly, the state of charge of current sources. Figures 3; References 6: 2 Russian, 4 Western.

Migrational Potential of Cesium-137 and Strontium-90 From Chernobyl Atomic Energy Plant Emission

917M0093F Minsk IZVESTIYA AKADEMII NAUK BSSR: SERIYA KHIMICHESKIKH NAUK in Russian No 1, Jan-Feb 91 (manuscript received 17 May 90) pp 84-88

[Article by Ye. P. Petryayev, T. G. Ivanova, T. K. Morozova, N. G. Surmach, G. A. Sokolik, Byelorussian State University imeni V. I. Lenin]

UDC 541.15:539.163:631.4

[Abstract] Vertical migration of cesium-137 and strontium-90 in soil was investigated. Twelve points (40,250 and 200 km from Chernobyl) were selected for field study in three different geochemical sites in Gomel and Mogilev Oblasts. Cores were collected to the depth of 0.5 m. Qualitative isotope composition was similar at all points, but the relative composition differed. The levels of light isotopes were higher in areas more distant from Chernobyl. Cesium-137 density was 11.8-87.9 Curie/km²; it was the principal source of γ -irradiation. The radionuclides appeared to have slowly penetrated deeper and deeper into the soil. Except for two test points, about 95% of the radioactivity was contained in the upper 2 cm of the soil layer. Based on the data obtained, self-purification of the soil due to deep penetration will be slow. The danger of the water table being contaminated during the next decades is low except for the turf-bottom land and peat-marshy soils. Figures 2; tables 2; references: 9 (Russian).

Preparation of Propargyl Alcohol From Waste Material of Chloro- organic Production

917M0118I Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 2, Feb 91 pp 77-78

[Article by T. I. Zabrodina, V. A. Revyakin, N. N. Semochkina, S. V. Levanova, V. S. Denisenkov, L. O. Rostomyan]

UDC 661.7:547.362.3

[Abstract] One of the synthetic methods for propargyl alcohol is based on hydrolysis of 2-chloroallylacetate. 2-chloroallyl alcohol is obtained by hydrolysis of 2,3-dichloropropene, which is obtained from waste material of the production of glycerine. To obtain a high yield of 2-chloroallyl alcohol, the reaction was carried out at temperature of 150° C and higher, in metal vessels; the yield obtained in 3.5 hrs was [g3]0%, in 5.5 hrs it was [g5]0%. 2-Chloroallyl alcohol was distilled out of the organic phase yielding 98.0-99.8% of the product; then it was dehydrochlorinated with solid potassium oxide to yield propargyl alcohol. It was shown that in 2 hrs, with the selectivity of almost 100%, the yield of propargyl

alcohol was 75%. Figure 1; table 12; references: 11 (Russian, 4 by Western authors).

Biochemical Purification of Triallate Effluent on an Experimental Installation

917M0118J Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 2, Feb 91 pp 84-85

[Article by R. N. Khlestkin, G. G. Yagafarova, I. Kh. Bikbulatov, L. Kh. Khalimova, B. K. Tyurin]

UDC 628.543.35

[Abstract] Production of the herbicide triallate results in an effluent with high levels of chloro-organic impurities. The goal of this work was to study biochemical purification of such effluent on an experimental installation using a natural mutant *Bacillus subtilis* var. *niger* 16. Because of the fact that chemical composition of the effluent was unstable, it was necessary to make sure that total content of chloro-organic substances did not exceed 500 mg/l; this was done by diluting the effluent. On the average, this procedure led to a 68-76% removal of individual compounds: dichloropropene, tri- and tetrachloropropene, tetrachloropropene. While the concentration of chlorine products dropped by some 25-40% in this process, the concentration of chloride ions increased by 50%. This may be of interest in understanding the mechanism of the microbiological conversion of chloro-organic compounds. Figures 2; table 1; references: 4 (Russian, 1 by Western author).

Aerodynamic Effectiveness and Selection of Optimal Parameters of Cyclone Apparatus

917M0119E Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 2, Feb 91 pp 28-30

[Article by S. V. Karpov, E. N. Saburov, Candidates of Technical Sciences]

UDC 533.6.011.6:533.527

[Abstract] The excellence of cyclone equipment units is determined by their aerodynamics, which in turn depends on the proper selection of the principal geometric parameters: total inlet surface, the diameter and the length of the outlet channel, configuration of the inlet channels, the angle of stream inlet, etc. Selection of optimal conditions for the operation of cyclone apparatus was analyzed by considering theoretical aspects of the process. Figure 1; references 12: 11 Russian, 1 Western.

Preparation of Highly Dispersed Yttrium Oxide Powder in High Temperature Gas Flow

917M0091A Riga LATVIYSKIY KHIMICHESKIY ZHURNAL in Russian No 1, Jan-Feb 91 (manuscript received 23 Jul 90) pp 5-9

[Article by Ya. P. Grabis, A. B. Letlena, Dz. M. Rashmane, Institute of Inorganic Chemistry, Latvian Academy of Sciences]

UDC 533.92:542.49

[Abstract] Yttrium oxide powder is used as an activator in sintering silicon and aluminum nitrides leading to improved characteristics of the end products. Chemical production of this powder is very complex. In the present work the possibility of production of highly dispersed yttrium oxide powders was investigated in a high temperature gas flow of a high frequency discharge, starting with various oxygen containing yttrium compounds (dioxide, oxalate, carbonate). This process yielded highly dispersed powders with spherical particles with a specific surface ranging from 8 to 70 m²/g; its value depended on the concentration of the particles in the flow, on the cooling conditions and on the time the particles spent in the high temperature zone but was not related to the composition of the starting material. X-ray analysis showed that these highly dispersed powders consist of cubic and monoclinic modifications of yttrium oxide. At 950-1000°C the monoclinic form converted to the cubic form with a specific surface area of 10-15 m²/g. Figures 5; table 1; references 5: 4 Russian, 1 Western.

Preparation of Zinc Oxide at High Temperature

917M0091B Riga LATVIYSKIY KHIMICHESKIY ZHURNAL in Russian No 1, Jan-Feb 91 (manuscript received 23 Jul 90) pp 10-12

[Article by A. P. Orlov, Ya. P. Grabis, A. A. Kuzyukovich, Institute of Inorganic Chemistry, Latvian Academy of Sciences]

UDC 541.118:669.531.6

[Abstract] Zinc oxide is used widely in traditional ceramics and in microelectronics. The possibility of preparation of highly dispersed powders of zinc oxide was investigated using high frequency discharge plasma. Depending on the starting material, zinc oxide was obtained either by oxidation of zinc powders or by decomposition of zinc carbonate. The specific surface of this powder was 15-42 m²/g and the bulk weight about 0.07- 0.1 g/cm³. Zinc oxide particles, especially those obtained by oxidation of zinc, had predominantly needle-plate shape. Figures 2; references 5: 3 Russian, 2 Western.

Numerical Investigation of Plasma-Chemical Production of Rare Earth Element Oxides From Nitrate Solutions

917M0093A Minsk IZVESTIYA AKADEMII NAUK BSSR: SERIYA KHIMICHESKIKH NAUK in Russian No 1, Jan-Feb 91 (manuscript received 19 Jan 90) pp 29-33

[Article by L. I. Krasovskaya, Institute of Heat and Mass Exchange imeni I. V. Lykov, BSSR Academy of Sciences]

UDC 536.42:519.6

[Abstract] Plasma-chemical processing of aqueous salt solutions represents a novel method of the preparation of metal oxides. Optimal conditions for this process can be established by investigating space-time characteristics of the interaction of dispersed salt solutions with the stream of a high temperature gas. A mathematical model was developed for calculating process parameters for lanthanum nitrate used as the model for this reaction. The calculation showed that for a reactor with 0.05 m diameter, at plasma temperature of 4,000-4,500 K, the droplet size should be in the range of 50-100 μm; for a reactor with 0.1 m diameter, the initial droplet size may vary from 50 to 100 μm (this may be achieved by altering the plasma temperature from 3,500 to 5,000 K). To determine optimal conditions beside the initial input of the energy, it is necessary to consider the time during which the particles remain in the reactor, the heat losses to the reactor walls and the losses due to the escaping gas, and its temperature. These findings can be applied to other rare earth elements. Figures 3; table 1; references 10: 9 Russian, 1 Western.

Physical-Chemical Properties of Neodymium Cobaltite Doped With Strontium and Calcium

917M0093B Minsk IZVESTIYA AKADEMII NAUK BSSR: SERIYA KHIMICHESKIKH NAUK in Russian No 1, Jan-Feb 91 (manuscript received 8 Aug 90) pp 37-41

[Article by V. V. Kharton, P. P. Zhuk, A. A. Tonoyan, V. V. Samokhval, A. A. Vecher, Scientific Research Institute of Physical-Chemical Problems, Byelorussian State University imeni V. I. Lenin]

UDC 541.133:537.312.6

[Abstract] The effect of doping neodymium cobaltite with alkali earth metals on its structural electric-physical and heat properties was investigated. In addition, the electric properties were studied as a function of the partial pressure of oxygen. X-ray analysis of Nd_{1-x}Sr(Ca)_xCoO₃ (X= 0-0.5) samples showed that they are monophasic with a continuous series of solid solutions with a well formed perovskite structure. The conductivity of electricity increased with increased content of the doping agent (Sr) reaching a maximum at x= 0.5,

while the symmetry of the crystalline lattice decreased. For the range of $x = 0.3-0.5$, metallic type conductivity was observed in the temperature range of 300-1,100 K. Solid solutions of $\text{Nd}_{1-x}\text{CoO}_3$ exhibit semiconductor type conductivity. Addition of the doping agent increased the conductivity 2-3 fold. The coefficient of thermal expansion ranged from 14.5 to $27.9 \times 10^{-6} \text{K}^{-1}$. Figures 3; table 1; references: 11 (Western).

Thermodynamic Properties of Mixed Yttrium and Barium Cuprates

917M0105A Moscow ZHURNAL FIZICHESKOY
KHIMII in Russian Vol 65 No 1, Jan 91 (manuscript
received 2 Aug 88) pp 13-17

[Article by Yu. Ya. Skolis, S. F. Pashin, M. L. Kovba, S. V. Kitsenko, Department of Chemistry, Moscow State University imeni M. V. Lomonosov]

UDC 536.7

[Abstract] The system $\text{Y}_2\text{O}_3\text{-BaO-CuO}$ is used in preparation of ceramic materials with high temperature superconductivity. Initial results of experimental determination of standard thermodynamic functions for two mixed cuprates, Y_2BaCuO_5 (I) and $\text{YBa}_2\text{Cu}_3\text{O}_{6.5-8}$ (II), were determined by the EDS method with solid fluorine ion electrolyte - monocrystals of BaF_2 . It was shown that at low temperature the thermodynamic stability of (II) is low in respect to the neighboring phase compositions as indicated by the most negative ΔG_6^0 value. To obtain more precise data, additional studies must be carried out in a wider temperature range; this will be reported in future publications. Calculation of thermodynamic functions of the formation of (II) from simple oxides is not possible at this time because of the absence of sufficiently accurate data of the thermodynamic properties of BaCuO_2 . A more precise investigation of the oxygen stoichiometry in the compounds of the $(\text{Y}_2)_3\text{-BaO-CuO-O}_2$ system are under way. Figure 1; tables 2; references 10: 5 Russian, 5 Western (2 by Russian authors).

Thermodynamics of Halide Insertion Into Graphite

917M0105B Moscow ZHURNAL FIZICHESKOY
KHIMII in Russian Vol 65 No 1, Jan 91 (manuscript
received 26 Jun 89) pp 38-41

[Article by V. L. Solozhenko, V. A. Mukhanov, Institute of Ultrafine Materials, UkSSR Academy of Sciences, Kiev]

UDC 546.26-162

[Abstract] An attempt was made to present a thermodynamic description of the insertion of various halides into graphite in presence of free halogen based on the model of a step-wise buildup and the condition that the charge from the graphite matrix is transferred to the layer of the

inserted material. In a generalized case this process takes place with a decrease in volume of the system. Based on the proposed model a generalized equation was developed in which the changes in isobaric-isothermal potentials observed in the course of the formation of layered graphite compounds were related to the parameters of the state of the system. This equation seemed to describe adequately all of the experimental data obtained in this process. It was observed that changes in the pressure of the halides or of the free halogen resulted in an altered composition of the inserted material. References 15: 5 Russian (1 by Western authors), 10 Western.

Investigation of Surface State of Modified Titanium Dioxide Films by Luminescent Probe Method

917M0105G Moscow ZHURNAL FIZICHESKOY
KHIMII in Russian Vol 65 No 1, Jan 91 (manuscript
received 26 Sep 89) pp 227-229

[Article by Ye. I. Vasilevskaya, V. P. Poroshkov, N. I. Kuntsevich, V. V. Sviridov, Scientific Research Institute of Physical-Chemical Problems, Byelorussian State University imeni V. I. Lenin, Minsk]

UDC 535.37

[Abstract] Results of the spectral-luminescent studies of the properties of various systems based on hydrolytic TiO_2 films modified with oxalic, malonic, ethylenediaminetetraacetic acids and silver ions were reported. The luminescent probe consisted of 2,2-difluoro-4-(4'-dimethylaminostyryl)-naphto-[2,1-e]-1,3,2-dioxaborene]. The data obtained in this study agreed with other electrochemical studies of TiO_2 films, according to which the change in the surface state due to acid modifications may be the result of the formation of new surface states in the prohibited TiO_2 zone. This is accompanied by lowered concentration of admixtures capable of acting as recombination centers for charge carriers. Additional treatment of the TiO_2 surface with silver ions leads to the formation of local energy levels on a relatively uniform surface of the semiconductor. Figures 2; references: 5 (Russian).

Thermodynamic Properties of Ruthenium in 6-310 K Interval

917M0105H Moscow ZHURNAL FIZICHESKOY
KHIMII in Russian Vol 65 No 1, Jan 91 (manuscript
received 5 Feb 90) pp 234-238

[Article by V. N. Naumov, I. Ye. Paukov, K. S. Sukhovey, Institute of Inorganic Chemistry, Siberian Division of USSR Academy of Sciences, Novosibirsk]

UDC 536.63

[Abstract] Data on heat capacity of ruthenium below 300 K are based on a number of publications and show considerable spread. In order to provide more precise

thermodynamic data, its isobaric heat capacity (C_p) was investigated by the adiabatic calorimetry method in the temperature range of 6-310 K. The test sample was ultra-purified and shown to contain 99.960% of the principal compound. The following impurities were identified: O_2 - 0.014%, Mg - 0.009%, Pt - 0.007%, Fe - 0.006%, Pb - 0.001%, Si - 0.001%; no traces of Ir, Pd, Rh, Cu, Au, Ag, Al or Ba were found. On the basis of the experimental data obtained, thermodynamic functions were calculated: the entropy, difference in enthalpies, Gibbs energy and Debay temperature as a function of absolute temperature. Figures 2; tables 2; references 9: 3 Russian, 6 Western.

Thermodynamic Properties and Oxygen Stoichiometry of $BaCu_2O_2$

917M0105I Moscow *ZHURNAL FIZICHESKOY KHIMII* in Russian Vol 65 No 1, Jan 91 (manuscript received 25 Sep 89) pp 256-259

[Article by S. F. Pashin, Yu. Ya. Skolis, Department of Chemistry, Moscow State University imeni M. V. Lomonosov]

UDC 536.7

[Abstract] To improve the synthesis of Y-Ba-Cu-O based materials, it is necessary to have data on the composition and thermodynamic properties of all phases present in this system in a wide range of temperatures and partial pressures of oxygen. In the present work, experimental data have been reported of the thermodynamic functions of the formation of $BaCu_2O_2$ in the temperature range of 976-1121 K and its oxygen stoichiometry. The EDS method with solid fluorine ion electrolyte was used in this study. $BaCu_2O_2$ is the only compound existing in the quasi-binary system BaO-Cu₂O. The experimental data showed that barium cuprite is a stoichiometric compound at high temperature and a wide interval of oxygen pressures. The oxygen index does not deviate from 2 by more than 0.02. Figures 2; tables 2; references 4: 1 Russian, 3 Western.

Calculation of Non-Stoichiometry of Ternary Solid Solutions $Ga_{1-x}Al_xS$ and $GaAs_{1-x}P_x$

917M0105J Moscow *ZHURNAL FIZICHESKOY KHIMII* in Russian Vol 65 No 1, Jan 91 (manuscript received 12 Dec 89) pp 281-283

[Article by A. I. Ivashchenko, F. Ye. Kopanskaya, V. P. Tarchenko, Kishenev Polytechnical Institute imeni Sergei Lazov]

UDC 621.315.592

[Abstract] A thermodynamic approach was presented to the evaluation of chemical non-stoichiometric composition in a crystalline solid solution based on semiconductors $A^{III}B^V$. Quantitative evaluation of the behavior of ternary solid solutions $Ga_{1-x}Al_xAs$ and $GaAs_{1-x}P_x$ was

performed in the area of homogeneity. An analytical relationship was found between the non-stoichiometry factor δ of $A^{III}B^V$ and the conditions of the thermodynamic equilibrium. The [Gd] value was calculated at the border of the homogeneity area of the above solid solutions. It was shown that these δ values did not exceed the limits of homogenetic existence of their high temperature binary components, i.e. AlAs for $Ga_{1-x}Al_xAs$ and GaP for $GaAs_{1-x}P_x$. Figure 1; references 12: 5 Russian (3 by Western authors), 7 Western (2 by Russian authors).

Effect of Residual Water Admixtures in Carrier Gas on Hydrogen Thermal Desorption From $LaNi_5$ and $LaNi_{4.5}Cu_{0.5}$

917M0106B Moscow *ZHURNAL FIZICHESKOY KHIMII* in Russian Vol 65 No 2, Feb 91 (manuscript received 31 Oct 89) pp 431-435

[Article by I. N. Naydina, L. V. Babenkova, G. V. Slobodenchuk, Institute of Organic Catalysis and Electrochemistry imeni D. V. Sokolskiy, KazSSR Academy of Sciences, Alma-Ata, Institute of Novel Chemical Problems, USSR Academy of Sciences, Chernogolovka]

UDC 541.183:541.412

[Abstract] Hydrogenation of intermetallic compounds (IMC) involves participation of surface centers at which the dissociation of molecular or recombinant atomic hydrogen takes place. Therefore it is necessary to get information on adsorption characteristics of IMC in respect to hydrogen. In the present work the decomposition kinetics of trace amounts of water contained in the carrier gas was investigated on the surface of $LaNi_5$ and $LaNi_{4.5}Cu_{0.5}$. An attempt was made to identify specific bonds in the spectra of hydrogen decomposition evolving in this process and of the hydrogen adsorbed on the surface of IMC. It was shown that during the desorption of hydrogen from IMC along with the desorption of surface-adsorbed and near-surface hydrogen forms, hydrogen is evolved from the trace amounts of water present in the carrier gas - argon. Hydrogen desorption taking place during water breakdown on $LaNi_5$ and $LaNi_{4.5}Cu_{0.5}$ surface occurs at temperatures higher than 473 K, the temperature of the breakdown of hydride phases. Replacement of a portion of Ni by Cu in $LaNi_5$ had no effect on the temperature of water breakdown. It was possible to identify spectral ranges corresponding to the evolution of surface-adsorbed and near-surface forms of hydrogen and of the hydrogen evolving during the decomposition of water. Figures 2; references 4: 3 Russian, 1 Western.

Characteristics of Oxygen Quenching of Fluorescence of Polyacene Adsorbed on Silicon Surface

917M0106C Moscow *ZHURNAL FIZICHESKOY KHIMII* in Russian Vol 65 No 2, Feb 91 (manuscript received 15 Nov 89) pp 436-441

[Article by V. V. Osipov, A. Ya. Ritter, V. N. Yankovich, Institute of Surface Chemistry, UkSSR Academy of Sciences, Kiev]

UDC 535.372:541.183.5

[Abstract] Quenching of electron excited states of organic molecules in heterogenic systems shows a number of characteristics related to possible existence of various kinetic reaction sites. Pyrene, 1,2-benzanthracene and phenanthrene were adsorbed from a solution on silica gel and aerosyl pre-calcined in air. It was shown that quenching of their fluorescence was the result of the coexistence of a dynamic and static mechanisms along with superimposition of spectra of physically and chemically adsorbed forms with various quenching rate constants. The effect observed was explained by preponderant adsorption of the oxygen in proximity of the fluorophore molecules with formation of weak surface complexes. In general, these results agree with those published by other authors. Figures 4; table 1; references 10: 3 Russian, 7 Western.

Dielectric Properties of D₂O in Ultra High Frequency Range

917M0106E Moscow *ZHURNAL FIZICHESKOY KHIMII in Russian* Vol 65 No 2, Feb 91 (manuscript received 3 Aug 90) pp 553-557

[Article by A. A. Zharkikh, A. K. Lyashchenko, V. S. Kharkin, V. V. Goncharov, A. S. Lileev, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, USSR Academy of Sciences, Moscow]

UDC 581.4:537.226.1

[Abstract] H₂O and D₂O are two liquids with many similarities in molecular and physical-chemical properties. And yet, in the area of kinetic properties these substances have not been studied to the same extent. Complex dielectric permeability of D₂O was determined for the frequencies of 7, 10.2, 16 and 23.5 GHz. The most plausible times for the dielectric relaxation in temperature range of 0-100° C were determined for heavy water. Isotope effects of the dielectric water properties were separated out when hydrogen was substituted by deuterium. It was shown that the isotope effect of dielectric permeability is expressed strongest in the area of water dispersion and increased with temperature drop; it was not related to the differences in structural configurations of light and heavy water but to the distribution of hydrogen bonds during the rotational diffusion of the molecules. Figures 3; tables 3; references 23: 10 Russian, 13 Western.

Modeling Distillation Processes for Purifying Organosilicon Compounds in the Microconcentration Range

917M0122D Moscow *VYSOKOCHISTYYE VESHCHESTVA in Russian* No 2, Mar-Apr 91 (manuscript received 28 Mar 90) pp 121-124

[Article by L.V. Protasova, A.M. Bessarabov, Ye.Ye. Grinberg, A.A. Yefremov, V.V. Makarov, G.L. Rodina,

Yu.M. Abuzin, G.Yu. Nechayeva, All-Union Scientific Research Institute of Chemical Reagents and Especially Pure Chemicals, Moscow)

UDC 66.011+66.048.32

[Abstract] In essence, a mathematical model of the distillation process is a system of differential material and heat balance equations. Many distillation purification processes merely entail simple distillation in periodic devices with intensive boiling. When this is the case, a model of ideal mixing can serve as the hydrodynamic model. The thermal model considers both the thermophysical characteristics of the boiling fluid and the design parameters of the commercial device. The set of equations modeling vapor-liquid equilibrium is one of the main blocks in the mathematical description of a distillation process. In the macroconcentration range, such modeling is currently based on a set of alternative equations derived from different models of the excess Gibbs energy. For modeling in the microconcentration range, most authors now use a Henry law linear dependence. The authors of the study reported herein propose a method that makes it possible to describe equilibrium in the micro- and macroconcentration ranges in a common combination model. They develop an approach that makes it possible to find the boundary of the regions and to draw a conclusion as to whether the transition mechanisms of the impurities in the micro- and macroconcentration ranges coincide or differ. They illustrate their proposed modeling procedure by way of the example of the process of distillation purification of hexamethyldisilazane, the main impurity of which is hexamethyldisiloxane. To describe the vapor-liquid equilibrium of this system in the macro- and microconcentration ranges, they examine the experimental temperature dependences of the density and partial pressure of the components and the temperature dependence of the mixture's boiling on its composition. Figure 1, tables 4; references 7 (Russian).

Mechanism of Photochemical Conversion of Peroxide Radicals

917M0123A Moscow *KHIMICHESKAYA FIZIKA in Russian* Vol 10 No 1, Jan 1991 pp 41

[Article by Ye. M. Korolkova, V. A. Radtsig, M. Ya. Melnikov, Moscow State University imeni M. V. Lomonosov; Institute of Chemical Physics imeni N. N. Semenov, USSR Academy of Sciences, Moscow]

UDC 541.14

[Abstract] Experimental data are presented on the photolysis of various peroxide radicals graphed to the surface of reactive silica. The products of photolysis of various types of peroxide radicals are identified, indicating that the primary event in photoconversion of peroxide radicals is dissociation at the O-O bond. Figure 1; References 19: 10 Russian, 9 Western.

Influence of Ultrasound on Kinetics of Photolysis of Chlorine in Vitreous Butyl Chloride Matrices

917M0123B Moscow *KHIMICHESKAYA FIZIKA*
in Russian Vol 10 No 1, Jan 1991 pp 64

[Article by P. G. Filippov, A. V. Kulikov, V. M. Beskovnyy, Institute of Energetic Problems of Chemical Physics, USSR Academy of Sciences, Moscow; Institute of Chemical Physics imeni N. N. Semenov, USSR Academy of Sciences, Moscow]

UDC 541.141.1

[Abstract] The selective nature of photoinduced absorption in vitreous matrices indicates that ultrasound can effectively influence the kinetics of photochemical reactions at low temperatures. This article studies this influence on the example of the reaction of photochlorination of vitreous butyl chloride matrices. EPR and low-temperature optical spectroscopy are used to study the mechanism of photolysis in the 100-20 K temperature range. The data indicate that during photolysis in the induction section changes occur in the properties of the medium which have a catalytic effect on the reaction rate. These changes are apparently related with the development of internal mechanical stresses in the matrix. It is found that with a sound power of about 0.5 W/cm², an acoustical field at a frequency of $3 \cdot 10^5$ Hz is nonthermal and reduces the induction time and changes the rate of formation of radicals before the end of the induction time by accelerating their recombination, then after the induction time the ultrasound has no influence on the kinetics of photolysis. Figures 2; References 9: 7 Russian, 2 Western.

EPR Spectrum and Reaction of Thiyl Peroxide Radicals in Low-Temperature Glasses

917M0123C Moscow *KHIMICHESKAYA FIZIKA*
in Russian Vol 10 No 1, Jan 1991 pp 93

[Article by Yu. V. Razskazovskiy, M. Ya. Melnikov, Moscow State University imeni M. V. Lomonosov]

UDC 541.515:541.14:541.124.16

[Abstract] A study is made of the reaction of thiyl radicals obtained by photolysis of cysteine with dissolved oxygen in 5 M LiCl glasses at low temperatures. The extinction factor of the radicals at the maximum of absorption at about 530 nm is determined as 400 M⁻¹·cm⁻¹. The photochemical reaction of the thiyl peroxide radicals with light at 547 or over 850 nm leads to the formation of sulfonyl radicals, a new photochemical reaction. Figures 4; References 13: 2 Russian, 11 Western.

Reactions Involving Oxides of Nitrogen at High Temperatures. Reaction of N₂O with O

917M0124A Moscow *KHIMICHESKAYA FIZIKA*
in Russian Vol 10 No 2, Feb 1991 pp 179

[Article by A. P. Zuyev, A. Yu. Starikovskiy, Moscow Institute of Physics and Technology, Dolgoprudnyy]

UDC 541.124

[Abstract] Complex measurements were performed of the kinetics of thermal decomposition of N₂O in order to refine the mechanism of the reaction, the rate constants of the corresponding elementary processes, and to determine possible sources of the dispersion of data in previous studies. The yield of NO in the process of thermal decomposition of N₂O behind a reflected shock wave in the 2.5-23 atm pressure and 1750-300 K temperature interval was measured. Additional computations were performed using the rate constants measured. The model of kinetics suggested in this work describes the results of a previous work well. No specific reaction involving O (¹D) is required. Figures 5; References 30: 12 Russian, 18 Western.

Behavior of Radicals on SiO₂ of Various Porosity

917M0124B Moscow *KHIMICHESKAYA FIZIKA*
in Russian Vol 10 No 2, Feb 1991 pp 227

[Article by A. A. Muradyan, R. R. Grigoryan, N. S. Manukyan, T. A. Garibyan, Institute of Chemical Physics, Armenian Academy of Sciences, Yerevan]

UDC 542.973:539.215.3.217:546.284-31-547.361-024

[Abstract] The task of this work was to study the interaction of radicals of various structures: CH₃O₂R, C₃H₅, C₃H₅O₂ and C₄H₉O₂ with SiO₂ catalysts of identical specific surface but different porosity, specially prepared based on materials of identical chemical composition, and also on lumps of broken quartz, γ-Al₂O₃R, pumic and aerosil. Studies were performed at $5 \cdot 10^{-2}$ Torr, 334-363 K. The probability of radical capture by the surface was found to depend on porosity, specific surface and radical structure. It is found that C₃H₅, CH₃O₂ and C₄H₉O₂ do not interact with nonporous SiO₂ radicals. As the porosity of the SiO₂ increases, the death of the radicals increases. γ-Al₂O₃ is transparent for C₃H₅ radicals regardless of porosity, whereas CH₃O₂ and C₄H₉O₂ radicals are fully captured even at room temperature. The porosity of the SiO₂ is found to determine the direction of the process of oxidation of C₃H₆ at atmospheric pressure. References 13: 10 Russian, 3 Western.

**Influence of Formation of Argon Dimers on
Supersonic Jet Parameters**

917M0124C Moscow *KHIMICHESKAYA FIZIKA*
in Russian Vol 10 No 2, Feb 1991 pp 232

[Article by V. I. Baranov, Ye. D. Belega, A. V. Lazrev, D.
N. Trubnikov, Moscow State University imeni M. V.
Lomonosov]

UDC 533.6.011

[Abstract] This work undertakes mathematical modeling of the process of nonequilibrium formation of argon dimers a supersonic jet and studies their influence on jet parameters. The free expansion of the inert gas in a vacuum is mathematically modeled considering the process of cluster formation in the continual area. The influence of argon dimer formation on the parameters of the supersonic jet is studied for various conditions in the source. Figures 3; References 14: 2 Russian, 12 Western.

Sintering of $\text{YBa}_2\text{Cu}_{3-x}\text{Ti}_x\text{O}_y$ Ceramics ($0 \leq x \leq 0.5$)

917M0093C Minsk IZVESTIYA AKADEMII NAUK
BSSR: SERIYA KHIMICHESKIKH NAUK in Russian
No 1, Jan-Feb 91 (manuscript received 27 Apr 90)
pp 45-48

[Article by V. V. Vashchuk, V. N. Meleshko, L. V. Makhnach, Institute of General and Inorganic Chemistry]

UDC 537.312.62

[Abstract] Systematic investigation of electric conductivity and sintering kinetics of $\text{YBa}_2\text{Cu}_{3-x}\text{Ti}_x\text{O}_y$ ceramic was carried out in air at temperatures of 810 and 890° C. X-ray analysis showed that the principal phase in these specimens was $\text{YBa}_2\text{Cu}_3\text{O}_y$. It was established that the solubility of titanium in the compound studied is below 0.5 of the atomic index. The transition temperature to the superconductivity state drops with an increase of x . The sintering rate reaches a maximum at $x=0.4$ for both temperatures studied. No solid solutions were formed under the experimental conditions used. Figures 3; references 6: 2 Russian (1 by Western authors), 4 Western.

Synthesis of Neodymium Silicates and Glass Prepared From Them by Laser Irradiation of Co-Precipitated Layers

917M0093D Minsk IZVESTIYA AKADEMII NAUK
BSSR: SERIYA KHIMICHESKIKH NAUK in Russian
No 1, Jan-Feb 91 (manuscript received 10 Apr 90)
pp 48-52

[Article by Kh. A. Cherches, N. I. Bliznyuk, V. Yu. Plavskiy, T. A. Poskrebko, Byelorussian Polytechnical Institute]

UDC 546.65:621.373.826

[Abstract] Neodymium glass is used widely in optical equipment including laser irradiators. In the present paper results were reported on the preparation of neodymium silicates and aluminum silicate glass containing neodymium, using laser irradiation of the co-precipitated mixed starting reagents consisting of $2\text{Na}(\text{OH})_3 \times 3\text{H}_2\text{SiO}_3 \times 0.7\text{Al}(\text{OH})_3$. A 5 min irradiation of such a blend in yttrium- aluminum-garnet laser at 120 W/cm^2 resulted in crystallization of neodymium diorthosilicate, analogously to a 2 hr thermal process at 1473-1573 K. Increasing the radiation intensity to 720 W/cm^2 led to a formation of glass in 15 min, analogously to a 2 hrs thermal production at 1823-1873 K. Figures 2; references: 12 (Russian).

Some Physical-Chemical Properties of Copper Containing Lead Borate Glasses

917M0093G Minsk IZVESTIYA AKADEMII NAUK
BSSR: SERIYA KHIMICHESKIKH NAUK in Russian
No 1, Jan-Feb 91 (manuscript received 21 Feb 90)
pp 89-91

[Article by G. V. Bychko, V. A. Grozhik, L. G. Khodskiy, Institute of General and Inorganic Chemistry, BSSR Academy of Sciences]

UDC 666.112.7:666.112.93.01

[Abstract] Thermal expansion and water resistance of the glass system $\text{PbO}-\text{B}_2\text{O}_3-\text{CuO}$ was investigated. These materials are important since they prevent formation of the micro-cracks and other defects in glass covers. The composition of these glasses which assured non-crystallization and transparency were in the following range of values: PbO : 10-80%; B_2O_3 : 20-70% and CuO : 0-20%. Optimal results were obtained with the following composition: PbO (20- 35%), B_2O_3 (40-60%) and CuO (10-20%); this corresponded to thermal expansion of $60 \times 10^{-6} \text{ } ^\circ\text{C}^{-1}$, water resistance of 0.09% mass loss and electric resistance of about $10^{18} \text{ ohm} \times \text{cm}$. Based on these results, composition limits were established for anticorrosive, protective thin layer glass covers for the electronic equipment. Figures 2; references 4: 3 Russian, 1 Western.

Intensified Fixation of Silver Halide Photolayers

917M0093H Minsk IZVESTIYA AKADEMII NAUK
BSSR: SERIYA KHIMICHESKIKH NAUK in Russian
No 1, Jan-Feb 91 (manuscript received 26 Mar 90)
pp 92-95

[Article by O. V. Sergeyeva, V. D. Stashonok, L. P. Rogach, Scientific Research Institute of Physical-Chemical Problems, Byelorussian State University imeni V. I. Lenin]

UDC 77.1

[Abstract] It is well known that not all of the silver available on a film is used up in developing an image; a good portion of it is removed in form of complex compounds during the fixation step. A new approach was developed for a more complete utilization of the available silver particles which resulted in intensified images. It was based on more effective process in which the developed film was subjected to a standard developer- fixer mixture instead to just a fixer as it is normally done. The resulting increase in the image contrast is achieved through a transfer of complexed silver particles from the non-exposed segments to the exposed loci. This method is useful in light background pictures with thin line dark images. It can find practical application in cartography and polygraphic applications. Figure 1; tables 2; references: 7 (Russian).

Investigation of the Thermal Oxidation of Silicon in the Presence of Nitrogen-Containing Compounds

917M0113A Moscow IZVESTIYA AKADEMII NAUK
SSSR: SERIYA NEORGANICHESKIYE MATERIALY
in Russian Vol 27 No 1, Jan 91 (manuscript received
6 Feb 89) pp 5-7

[Article by V.Z. Anokhin and L.A. Malevskaya, Voronezh State University]

UDC 546.28:542.943

[Abstract] Creating a high-quality multipurpose dielectric requires information on the thermal oxidation of silicon in the presence of various impurities. Because no purposive research on the effect of nitrogen-containing compounds has been conducted to date, the authors of the study reported herein performed such a study. For their study they selected the following compounds: NH_4Cl , NH_4OH , $\text{N}_2\text{H}_4 \cdot \text{H}_2\text{SO}_4$, and $\text{NH}_2\text{OH} \cdot 0.5\text{H}_2\text{SO}_4$. For the oxidation they used polished plates of type KEF silicon ($\rho = 6 \Omega\text{cm}$), $\langle 100 \rangle$. A 5% solutions of the aforementioned dopants were used, and oxygen was selected as the carrier. The resultant oxide films were measured with a precision of $\pm 1 \text{ nm}$. From the standpoint of evenness and continuity, the oxide films produced were no different from those produced by using the standard technology (oxidation in a water vapor atmosphere). From the standpoint of several electro-physical characteristics, however, they possessed significantly improved characteristics. According to the data obtained regarding current and voltage characteristics and breakdown voltages, hydroxylamine appears to be the best dopant in the series $\text{NH}_2\text{OH} \cdot 0.5\text{H}_2\text{SO}_4$, NH_4OH , NH_4Cl , and $\text{N}_2\text{H}_4 \cdot \text{H}_2\text{SO}_4$. In the next phase of their research, the authors studied the kinetics of the thermal oxidation of silicon in the presence of hydroxylamine (a 5% solution in a sparger) in the temperature range from 950 to 1,100°C. The oxidation rates of the standard specimens at 950, 1,000, and 1,050°C were virtually identical in the presence of the dopant. The effective activations of the process of the oxidation of silicon in the presence of NH_2OH and standard oxidation as determined by Arrhenius' equation were found to amount to 31 and 42 kJ/mol, respectively. Formal kinetic processing of the test results confirmed that a small amount of NH_2OH added to the oxidizing medium does not significantly alter the mechanism of the process in question. The authors hypothesize that in the presence of nitrogen-containing compounds, high temperatures induce the breakdown of the aforesaid dopants and result in the formation of ammonia. The silicon plate thus turns out to be in an NH_3 -containing medium. This likely involves NH_4^+ ions in the process of oxidation in a nitrogen-containing medium. These ions can compensate for the breaking of the Si-O bond and "heal" the defects in the oxide's structure. Figures 2, table 1; reference 1 (Russian).

The Effect of Heat Treatment on the Phase Makeup of Titanium Films on Silicon Substrates

917M0113B Moscow IZVESTIYA AKADEMII NAUK
SSSR: SERIYA NEORGANICHESKIYE MATERIALY
in Russian Vol 27 No 1, Jan 91 (manuscript received
21 Feb 89) pp 18-24

[Article by Yu.N. Makogon, Kiev Polytechnic Institute]

UDC 669.285'782:541.124.16

[Abstract] One of the main requirements set forth for materials to be used in thin-film technology is that they maintain high stability over a broad operating temperature range under the effect of such factors as high current densities and corrosive media. Disilicides of transition metals are considered the most promising compounds for these purposes. The phase makeup and structure of such films are, however, largely dependent on the technological conditions under which they were produced. The authors of the study reported herein examined the laws governing the process of silicide formation in titanium films on silicon substrates. Titanium films 200 nm thick were precipitated by electron beam vaporization onto monocrystalline plates of KDB (10) silicon with the orientations (100) and (111) as well as onto oxidized monosilicon plates onto which either a layer of polysilicon up to 1,000 nm thick or a layer of amorphous silicon 350 nm thick was deposited. X-ray phase analysis, resistometry, and secondary-ion mass spectrometry studies established that annealing Ti/Si films in a vacuum in the temperature range from 820 to 1,270 K is accompanied by processes of silicide formation. The intermediate silicide Ti_5Si_3 forms first. Then, after the formation of a metastable solution of Si in Ti, it makes a transition to the end phase TiSi_2 . Annealing between 970 and 1,070 K for 30 minutes was found to be optimal for achieving minimal surface electrical resistance. An axial texture was observed after precipitation on all types of silicon substrates. The titanium disilicide films have no texture. In Ti_5Si_3 films texture appears on monocrystalline silicon with the orientation $\langle 111 \rangle$. Figures 6; references 9: 4 Russian, 5 Western.

The Ferroelectric Properties and Electron Structure of $\text{A}_2\text{B}_2\text{O}_7$ Phases With a Layered Perovskite-Like Structure Produced Under High Pressures

917M0113D Moscow IZVESTIYA AKADEMII NAUK
SSSR: SERIYA NEORGANICHESKIYE MATERIALY
in Russian Vol 27 No 1, Jan 91 (manuscript received
1 Mar 89) pp 74-78

[Article by S.Yu. Stefanovich, T.N. Bondarenko, A.M. Sych, Yu.A. Titov, and V.M. Melnik, Kiev State University imeni T.G. Shevchenko, Physical Chemical Scientific Research Institute imeni L.Ya. Karpov, and Institute of Material Science Problems, UkSSR Academy of Sciences]

UDC 537.226+539.26

[Abstract] The search for new oxide phases with a layered perovskite-like structure and unique physical ferroelectric and superconductive properties has recently received a great deal of special attention. In a continuation of this line of research, the authors of the study reported herein examined the ferroelectric properties and electron structure of $A_2B_2O_7$ phases with a layered perovskite-like structure that have been produced under high pressures. As study objects the authors selected $Ln_2Ti_2O_7$ ($Ln = Sm, Eu$) and $CaLaTiTaO_7$ high-pressure phases. Nonlinear optical analysis of the properties of these particular high-pressure phases demonstrated that the latter are ferroelectrics and have rather high Curie temperatures ($T_c \geq 1,350$ K). Their spontaneous polarizations lie within the bounds from 2.1 to 6.0 $\mu C/cm^2$. The phase transitions for ferroelectric $A_2B_2O_7$ high-pressure phases with a layered perovskite-like structure are close to transitions of the second type. Electron probe analysis data indicated that in $Ln_2Ti_2O_7$ ($Ln = Sm, Eu$) phases, the band of filled states has a width on the order of 22 eV and consists of two subbands. The chemical bonding in $Ln_2Ti_2O_7$ phases is characterized by the traits characteristic of Ln_2O_3 and TiO_2 . The covalence of the Ti-O bond in $Ln_2Ti_2O_7$ is somewhat higher than in TiO_2 . Figures 4, tables 2; references 7: 4 Russian, 3 Western.

Investigation of the Structure and Properties of Lithium Aluminosilicate Photosensitive Pyrocerams After a Laser Radiation Effect

917M0113E Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA NEORGANICHESKIYE MATERIALY in Russian Vol 27 No 1, Jan 91 (manuscript received) pp 121-125

[Article by A.I. Berezhnoy, A.S. Krasnikov, L.I. Mirkin, Yu.I. Glushkov, N.I. Yermakov, M.D. Krasnikova, and D.V. Morin, Ryazan State Pedagogical Institute imeni S.A. Yesenin]

UDC 661.1:542.65

[Abstract] Despite the intensive research that has been done on the mechanism of the effect of laser radiation on matter, research on the process of the interaction of laser radiation and glass crystal materials remains inadequate and incomplete. For this reason, the authors of the study reported herein examined the effect of laser radiation on the structure and properties of lithium aluminosilicate photosensitive pyrocerams. For their experiments, the authors synthesized photosensitive glass with the following chemical makeup (percent by weight): AiO_2 , 73.0; Al_2O_3 , 8.0; Li_2O , 13.0; ZnO , 2.0; and K_2O , 4.0. Over and above 100%, they added the following (percent by weight): $AgNO_3$, 0.04; $CuCl$, 0.012; $Cl(NO_3) \cdot 6H_2O$, 0.11; $AlCl_3$, 0.13; NH_4Cl , 0.09; and lactose, 0.05. The specimens were manufactured in the form of flat plates 50 mm in diameter and 2 mm thick. They were irradiated with ultraviolet light for 30 minutes and then

subjected to heat treatment at 520, 585, and 780°C. They were then subjected to CO_2 laser radiation with a wavelength of $\lambda = 10.6 \mu m$ focused by an NaCl lens with $F = 10$ cm. The focal spot had a diameter of 5×10^{-2} cm. The laser radiation had a power of 25 W and a power flow density of 10^4 W/cm². Laser radiation of this type was found to induce amorphization of the surface layer of the pyroceram specimens tested, an increase in the tangent of the dielectric loss angle, a regular reduction in the microhardness of its surface layer, and the formation of surface microcracks that limit the material's strength properties. A possible mechanism of the amorphization of the structure of the surface layer of irradiated pyroceram is proposed. The amorphization effect observed is recommended for use the technology of manufacturing pyroceram products to eliminate a latent image, in synthesizing photosensitive pyrocerams with a specified content of crystalline and amorphous phases, and in designing photosensitive pyrocerams with the required physicochemical properties. Figures 3, table 1; references 10: 9 Russian, 1 Western.

The Production of Zinc Oxide Ceramic by the Hot Extrusion Method

917M0113F Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA NEORGANICHESKIYE MATERIALY in Russian Vol 27 No 1, Jan 91 (manuscript received 20 Jul 88) pp 149-151

[Article by D.N. Lelyuk and A.B. Glot, Dnepropetrovsk State University imeni 300th Anniversary of the Union of the Ukraine and Russia]

UDC 621.316

[Abstract] Free sintering at 1,370 to 1,620 K in an oxidizing atmosphere is the conventional method used to produce zinc oxide ceramic with a nonlinear voltage-current characteristic. The authors of the study reported herein examined the possibility of using the method of hot extrusion in air to produce zinc oxide ceramics at temperatures at which free sintering would make it possible to produce specimens with only linear voltage-current characteristics. They synthesized ZnO-based ceramics with Bi_2O_3 , Co_3O_4 , MnO_2 , Sb_2O_3 , and B_2O_3 additives by hot extrusion in air at temperatures of 1,070 to 1,120 K and at pressures of 15 to 50 MPa for 30 minutes. They were indeed able to produce zinc oxide ceramic with a linear voltage-current characteristic. Ceramic specimens sintered at the same temperatures but without the application of pressure were found to be characterized by an absence of nonohmic conduction. The experiments conducted thus indicated a link between nonlinearity of the voltage-current characteristic and defectiveness of zinc oxide ceramics. Figure 1, table 1; references 6: 3 Russian, 3 Western.

The Structure and Electrical Properties of Thin Films of SnTe

917M0113G Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA NEORGANICHESKIYE MATERIALY in Russian Vol 27 No 1, Jan 91 (manuscript received 9 Feb 89) pp 152-153

[Article by Yu.V. Sokolov, M. Oshvaldovski, and Kh. Shveytser, Kharkov Polytechnic Institute imeni V.I. Lenin]

UDC 548.74

[Abstract] SnTe and solid solutions based on it are used extensively in different branches of semiconductor electronics. At the same time, they are the least studied of $A^{IV}B^{VI}$ -type compounds. The authors of this concise communication report on their experiences in producing high-quality SnTe films by using the "hot wall" method with a very simple evaporator in the form of a narrow-walled ceramic tube with one open end and a spiral wound evenly around it. As their starting materials, the authors used SnTe crystals with a carrier concentration of $(2 \text{ to } 6) \times 10^{20} \text{ cm}^{-3}$. Several small crystals with a total mass up to 300 mg were placed in the tube. In each of the approximately 20 experiments conducted, an area on the order of 10 cm^2 was "dusted" with a layer from 0.05 to $2.0 \mu\text{m}$ thick. This was done at a substrate temperature of 510 K. Both amorphous materials (fused quartz and pyroceram) and monocrystals (mica and KCl) were used as substrates. The specimens' electrical and structural properties were examined. The authors demonstrated that SnTe films with a relatively high carrier mobility and small concentration of holes may be produced rather simply. The dependence of Hall mobility on hole concentration, i.e., $\mu(p)$, of both poly- and monocrystalline films was found to be of the form $\mu \approx 1/p$. The electrophysical properties of the films were found to correlate with their structure. The monocrystalline films produced on mica had a high carrier mobility. Substrates of KCl and amorphous materials were found to be less preferred for producing quality films. Figures 2; references 4: 1 Russian, 3 Western.

The Thermoelectric Properties of $(\text{GeTe})_{1-x}(\text{Sm}_2\text{Te}_3)_x$ Solid Solutions at High Temperatures

917M0113H Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA NEORGANICHESKIYE MATERIALY in Russian Vol 27 No 1, Jan 91 (manuscript received 20 Feb 89) pp 155-157

[Article by M.A. Alidzhanov and Z.M. Mukhtarova, Institute of Inorganic and Physical Chemistry, AzSSR Academy of Sciences]

UDC 546.65.289+24

[Abstract] The compound GeTe and alloys based on it are used to manufacture the p-branch of thermocouples

operating in the temperature range from 450 to 950 K. A reduction in heat conduction is the main factor increasing the thermoelectric Q of GeTe alloys during alloying. This indicator is greater in the case of GeTe-based alloys rather than GeTe. In light of these and other facts, the authors of this concise communication examined the thermoelectric properties of homogeneous polycrystalline specimens of $(\text{GeTe})_{1-x}(\text{Sm}_2\text{Te}_3)_x$ for the cases of $x = 0.005, 0.007, 0.015$, and 0.01 . The temperature dependence of the thermoelectromotive force in the temperature range from 300 to 470 K was found to be linear. Beginning at about 500 K, the thermoelectric force began increasing more quickly. This was explained by the increased contribution of the second subband with a higher effective mass. In the case of GeTe, this increase in thermoelectromotive force was found to continue to the temperature of the appearance of intrinsic conductivity. The change in thermoelectromotive force with increasing temperature was found to be identical for all of the solid-solution alloys studied. Between 300 and 500 K the increase in thermoelectromotive force corresponds to the case of metals and highly degenerated semiconductors. At $T > 480 \text{ K}$ the holes begin an overshoot into the second subband with a higher effective mass, and the thermoelectromotive force increases more rapidly than would be expected theoretically. This increase continues to temperatures somewhat higher than 700 K, after which saturation sets in and a drop occurs. The nature of the temperature change of electric conduction is analogous to the change in thermoelectromotive force. This research thus confirmed that the overall form of the band structure of GeTe is maintained in the alloys studied. Intrinsic conductivity in the solid solutions studied begins at lower temperatures than in GeTe, however. This is explained by the decrease in the thermal activation energy. Figures 3; reference 1 (Russian).

A Data Bank on Properties of Crystals for Controlling Laser Radiation

917M0113I Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA NEORGANICHESKIYE MATERIALY in Russian Vol 27 No 1, Jan 91 (manuscript received 5 Jan 88) pp 164-165

[Article by N.V. Kravchenko, G.S. Burkhanov, N.N. Kiseleva, B.N. Pishchik, and V.V. Gribulya, Metallurgy Institute imeni A.A. Baykov, USSR Academy of Sciences]

UDC 681.31:548.30:621.375:539.2

[Abstract] Crystals with electrooptic and nonlinear optical properties are used to control laser radiation. This class of crystals is continually expanding and is, at the same time, attracting the interest of an ever-increasing number of specialists from diverse branches of science and industry. In view of this fact and in view of the trend toward increasing use of computers, an automated data bank on the properties of crystals used to

control laser radiation has been created at the Metallurgy Institute of the USSR Academy of Sciences. It was developed on the basis of the BOYaZ-6 data base management system with BESM-6 and Elbrus computers. This data bank, which is described in this concise report, consists of five interconnected hierarchical files. These files contain data about compound makeups, crystal symmetry point groups, types of crystal structure, thermal expansion coefficients, heat conduction, dielectric permeability, electrooptic and nonlinear optical coefficients, dielectric losses, crystal transmission ranges, synchronism angles, solubility in water, heat capacity, and refractive index. The data bank also contains a bibliography file. The data bank's multifile structure made it possible to reduce the amount of peripheral computer memory required to store information while only slightly increasing retrieval time. The data bank was developed with simplicity and accessibility to untrained users in mind. The aforesaid data bank may be installed at any organization as an independent information system or as an information subsystem of an instrument CAD system. References 5 (Russian).

Amorphization Reactions During Alloying of Metal Powders in Mills

917M0114D Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AK NAUK SSSR: SIBIRSKIY KHIMICHESKIY ZHURNAL in Russian No 1, January 1991 pp 67

[Article by S. S. Koch, North Carolina University]

UDC 53.091+54.161

[Abstract] A brief review is presented of the reactions of amorphization occurring upon processing of materials in mechanical mills. The latest results on the development of amorphous structure in intermediate phases obtained in the author's laboratory by mechanical activation are discussed. The significance of these results for an understanding of the mechanism of transition from the crystalline to the amorphous state is discussed. During amorphization in ball mills, the free energy of the crystalline intermediate phase must equal the free energy of the amorphous alloy as a result of introduction of defects in the milling process. In some compounds, amorphization occurs due to chemical disordering and the amorphous phase grows heterogeneously on interphase boundaries. Thermodynamic and kinetic criteria are outlined for the crystalline-amorphous transition. Figures 5; References 38: Western.

The Effect of Doping Cu on the Photoelectric Properties of $\text{Bi}_{12}\text{TiO}_{20}$ Monocrystals

917M0122A Moscow VYSOKOCHISTYYE VESHCHESTVA in Russian No 2, Mar-Apr 91 (manuscript received 24 Sep 90) pp 81-87

[Article by V.M. Skorikov, V.I. Chmyrev, A.V. Yegorysheva, and V.V. Volkov, Institute of General and

Organic Chemistry imeni N.S. Kurnakov, USSR Academy of Sciences, Moscow]

UDC 543.51.546.26

[Abstract] Crystals with a sillenite-type structures are effective photoconductors and as such are used in spatiotemporal light modulators and in recording holograms. Because a number of impurity-induced local levels in the forbidden bands of these crystals affect their photo- and electric conductivity, studying the nature of the impurity centers that determine these levels is key to creating materials and instruments with specified properties. In view of this need, the authors of the study reported herein examined the effect of doping Cu on the photoelectric properties of $\text{Bi}_{12}\text{TiO}_{20}$ monocrystals. The crystals were grown by the Czochralski method as published elsewhere. Studies of the absorption spectra and photoconductivity of doped and nondoped $\text{Bi}_{12}\text{TiO}_{20}$ established that the photoconductivity of $\text{Bi}_{12}\text{TiO}_{20}$ crystals decreases as Cu is introduced into their matrix. A correlation is established between the photoconductivity spectra and the absorption spectra of the crystals examined. The existence of a 3.55-eV level with an energy greater than the width of the forbidden band is proved experimentally. The researchers also discovered a peak in the photoconductivity spectra in the range from 3.9 to 4.0 eV. This peak was linked to the curvature of bands at the crystal's surface. It is found that the coefficient of the distribution of the copper dopant in $\text{Bi}_{12}\text{TiO}_{20}\cdot\text{Cu}$ is greater than 1. The authors offer their results as visible proof that before such crystals can be used successfully in optronics they must be subjected to both optical quality control and photoelectric testing inasmuch as even small changes in dopant concentration that cannot be recorded by optical methods can result in a significant change in crystals' photoelectric properties. Figures 6; references 12: 9 Russian, 3 Western.

The Optical, Photoelectric, and Electrooptic Properties of Cd- and Mo-Doped $\text{Bi}_{12}\text{SiO}_{20}$ Monocrystals

917M0122B Moscow VYSOKOCHISTYYE VESHCHESTVA in Russian No 2, Mar-Apr 91 (manuscript received 25 Sep 90) pp 88-92

[Article by V.I. Chmyrev, V.M. Skorikov, I.V. Tsisar, A.Ya. Vasilyev, Yu.F. Kargin, and T.D. Dudkina, Institute of General and Organic Chemistry imeni N.S. Kurnakov, USSR Academy of Sciences, Moscow]

UDC 543.51.546.26

[Abstract] Thanks to their photoconductivity and electrooptic properties, wideband $\text{Bi}_{12}\text{SiO}_{20}$ monocrystals have enjoyed extensive use in optical information processing devices. Because it is critical that the crystals used in wide-aperture amplitude and phase light modulators have minimal photosensitivity, a low light absorbance, and high dark resistance while maintaining their

electrooptic properties, the authors of the study reported herein examined the spectral dependence of the absorption, photosensitivity, refractive index, and electrooptic properties of Cd- and Mo-doped $\text{Bi}_{12}\text{SiO}_{20}$ monocrystals. The crystals were grown according to the Czochralski method and doped with varying amounts of Cd and Mo. When the degree of doping with Cd and Mo was increased, the crystals' photosensitivity was quenched by almost five orders of magnitude, and they became bleached; their electrooptic properties remained unchanged, however. The electrooptical modulus and electrooptical efficiency of the doped specimens when $\lambda = 543 \text{ nm}$ amounted to $r_{41} = (4.3 \pm 0.3) \times 10^{-12} \text{ m/V}$ and $r_{41}n_0^3 = (7.7 \pm 0.6) \times 10^{-11} \text{ m/V}$, respectively. Figures 5; references 14: 12 Russian, 2 Western.

Using Fluxes To Refine Platinum

917M0122E Moscow VYSOKOCHISTYYE
VESHCHESTVA in Russian No 2, Mar-Apr 91
pp 130-132

[Article by Ye.V. Lapitskaya, M.G. Slotintseva, V.V. Vasekin, Ye.I. Rytvin, and N.M. Slotintsev]

UDC 669.018.45

[Abstract] This concise report describes a series of studies performed to assess the possibility of using fluxes to refine platinum. Specimens of platinum with undesirable Si, Al, Mg, Ti, Pb, Sn, Fe, Ni, Cr, Cu, Ag, Ge, Zn, As, and Sb impurities in amounts ranging from 0.001 to 0.1% by weight each were used as test specimens. The research conducted confirmed that using fluxes (NaCl , NaF , $\text{Na}_2\text{B}_4\text{O}_7$, and mixtures thereof with and without SiO_2 and MgO additives) when melting platinum in an induction furnace may indeed be looked upon as an efficient method of removing As, Zn, Si, Al, Mg, Ti, and selected other impurities from platinum. Single remelting with fluxes reduced the content of silicon impurities by a factor of 17, the content of zinc impurities by a factor of 20, the content of arsenic impurities by a factor of 3, and the contents of magnesium and aluminum impurities by a factor of 6. Thanks to treatment with fluxes in an induction furnace, most of the impurities in the platinum specimens tested were reduced to 0.001% by weight. Tests on platinum specimens refined with the fluxes tested revealed that such refining did not lead to any worsening of the specimens' heat resistance characteristics. In some cases, using fluxes appeared to improve heat resistance characteristics. Tables 2.

Refining Powders of Molybdenum and Its Salts and Oxides by the Magnetic Separation Method

917M0122F Moscow VYSOKOCHISTYYE
VESHCHESTVA in Russian No 2, Mar-Apr 91
(manuscript received 14 Nov 90) pp 133-138

[Article by G.S. Burkhanov, M.I. Bychkova, V.M. Kirillova, N.A. Gershkovich, and R.M. Mikhridinov, Metallurgy Institute imeni A.A. Baylov, USSR Academy of Sciences, Moscow]

UDC 669.01:061.3

[Abstract] Producing high-purity refractory metal monocrystals such as tungsten and molybdenum monocrystals requires that the starting material have a minimal amount of impurities. In a number of instances, the tungsten and molybdenum powders produced by the generally accepted commercial technology cannot be used in manufacturing monocrystals and wires for use in circuit engineering in view of their large numbers of impurities. In an effort to develop ways of further refining molybdenum and tungsten powders the authors of the study reported herein conducted an experimental examination of the process of refining powders of molybdenum, its salts, and its oxides by the method of high-gradient magnetic separation. The refining was performed by the method of wet magnetic separation in a laboratory drum electromagnetic separator in a vertical channel. Steel spheres 5 mm in diameter were used as the ferromagnetic bodies. An external magnetic field was created by a uniform electromagnetic system. The experiments demonstrated that the optimal conditions for removing iron-based inclusions are created upon induction of an external magnetic field of 1 to 1.5 T whereas the optimal conditions for removing silicon-, calcium-, magnesium-, and cobalt-based inclusions are created by induction of an external magnetic field of 2 to 2.5 T. Powder losses in both cases do not exceed 5 to 6%. Further increases in magnetic field induction entail significant losses of molybdenum powder. The magnetic separation method tested was most efficient in removing iron- and silicon-containing inclusions. On average these inclusions were found to constitute about half of the magnetic fraction, with inclusions containing aluminum, calcium, magnesium, and titanium accounting for the other half. The most typical inclusions (quartz, iron-containing minerals, calcites, feldspars, and titanomagnetite, which are detected in ammonium paramolybdate) were observed in the molybdenum powders and oxides examined. Quartz was found to predominate in the iron-based inclusions. The authors thus succeeded in establishing the impurities' sources of entry into the molybdenum powders and ways of eliminating them. Figures 2; references 8: 7 Russian, 1 Western.

Producing Magnesium Fluoride for Optical Ceramics

917M0122G Moscow VYSOKOCHISTYYE
VESHCHESTVA in Russian No 2, Mar-Apr 91
(manuscript received 30 Jul 90) pp 139-143

[Article by I.V. Pulyayeva, A.S. Seredenko, V.N. Sokolov, Ye.P. Smirnaya, N.V. Bondareva, and L.I. Filippovich, Monokrystallreaktiv Scientific Production Association, Kharkov]

UDC 546.46:543

[Abstract] Thanks to its high transparency in a broad range of IR wavelengths, radiation resistance, and high mechanical strength, magnesium fluoride is well suited

for use as a basis for optical ceramics. The aforesaid properties are, however, largely determined by the quality of the starting material and the technology used to produce the magnesium fluoride powder. The pressability, degree of packing, and other significant mechanical properties of magnesium fluoride powder are in turn dependent on its granulometric state and specific surface. With these facts in mind, the authors of the research reported herein set out to develop a method of producing calcium-doped magnesium fluoride that would have a reduced content of organic impurities (up to $5 \times 10^{-3}\%$) and that would be suitable for use in manufacturing ceramics with a high degree of transmission (up to 90%) in the wavelength range from 0.6 to 6 μm . The proposed method is based on the reaction of an aqueous suspension of basic magnesium carbonic and hydrofluoric acid. The research conducted demonstrates that increasing the calcium content in magnesium fluoride powder helps increase the transparency of the ceramic for which it is used. Increasing the temperature at which the powder is roasted during the powder production process to 500°C is found to result in a reduction of the carbon content to 0.005%. The powder produced by the proposed technique was deemed suitable for use in the manufacture of optical ceramics. Figure 1, tables 5; references 9 (Russian).

The Effect of Atmospheric Makeup on the Process of Autoepitaxial Electrocrystallization of Tungsten From Tungstate Melts

917M0122H Moscow VYSOKOCHISTYYE
VESHCHESTVA in Russian No 2, Mar-Apr 91
(manuscript received 13 Nov 90) pp 176-179

[Article by A.Yu. Khvatov and A.N. Baraboshkin, Electrochemistry Institute, Ural Department, USSR Academy of Sciences, Sverdlovsk]

UDC 541.135.3:546.78

[Abstract] The tungstate melt $\text{Na}_2\text{WO}_4\text{-WO}_2$ is convenient (from a technological standpoint) for use in producing polycrystalline tungsten precipitates on various metal substrates. This is because it permits the conduct of electroprecipitation in an air atmosphere over an electrolyte. The authors of the study reported herein examined the effect of the makeup of the atmosphere over the surface of the aforesaid melt on the kinetic parameters of the process of autoepitaxial electrocrystallization of tungsten from tungsten baths. The authors conducted microscope and goniometric studies of the surface of autoepitaxial tungsten precipitates produced by electrolysis of an $\text{Na}_2\text{WO}_4\text{-}10\text{ mol}\% \text{WO}_3$ melt at a temperature of 850°C in an atmosphere of air and argon. Replacing the air atmosphere over the melt with an argon atmosphere was found to result in a change in the surface morphology of the growing precipitate. This was especially true on the (III) plane of the tungsten substrate). The galvanostatic method was used to establish that polarization of both mono- and polycrystalline

W-substrates in an argon atmosphere is two- to threefold the polarization that occurs in an air atmosphere. The values of the electrode capacitances determined on the basis of the slope of the initial leg of the galvanostatic inclusion curves were reduced by a factor of 5 to 10 when the air atmosphere was replaced by an argon atmosphere. Air over the melt surface results in significant corrosion rates of the tungsten in the electrolyte (about 0.25 $\text{mg}/\text{cm}^2\text{h}$). In an inert atmosphere, on the other hand, the tungsten was found to remain stable. The corrosion and kinetic studies conducted confirmed that oxidizing agents such as oxygen and water are dissolved in a tungsten melt with an air atmosphere over it. These oxidizing agents are adsorbed on the substrate and may discharge on the cathode at the moment when the current is switched on. Polarization in the case of longer current pulses (for example, a stationary process) was not found to be significantly dependent on the atmosphere over the melt. Rather, they were controlled primarily by diffusion of W (VI) ions in the melt. Figure 1; references 6 (Russian).

Processes During Ion Implantation in Semiconductor Heterostructures

917M0122I Moscow VYSOKOCHISTYYE
VESHCHESTVA in Russian No 2, Mar-Apr 91
(manuscript received 22 Nov 90) pp 185-190

[Article by Yu.A. Danilov and D.I. Tetelbaum, Scientific Research Physical Technical Institute of Nizhegorod State University imeni N.I. Lobachevskiy]

UDC 621.315.592:539.1.04

[Abstract] The creation of heterostructure-based semiconductor instruments is one of the most promising directions in electronic technology. As in other directions of microelectronics, the ion implantation method is unrivaled as a technique for producing semiconductor heterostructures. The ion implantation method provides high controllability, a high degree of selectivity in three measurements, and multifunctionality. Despite general recognition of the advantages of ion implantation in producing semiconductor heterostructures, the specific nature of such structures necessitates extensive research on the behavior of impurity atoms and defects as well as on the behavior of superlattices and heterostructures themselves during the ion implantation process. Such research has been underway for about 10 years abroad. Information about similar studies in the Soviet literature is lacking, however. After attributing this lack of information to a lag in works on the technology of superlattices and quantum heterostructures in general, the authors of this article proceed to examine the following topics: methods of calculating the distributions of implanted ions in heterostructures and superlattices, the distinctive features of their distribution, and the effect of thermal annealing on this distribution; the effect of ion implantation on mechanical stresses in heterostructures

and superlattices; laws governing the mixing of superlattices' layers during ion implantation and subsequent annealing; the formation of insulating layers by introducing ions (including chemically active impurities); and the use of ion implantation in the technology of manufacturing heterojunction- and superlattice-based instruments. They call for further research in six specific areas,

including mechanisms of diffusion and mixing, kinetics of the accumulation of radiation defects and amorphization, radiation-accelerated solid-phase epitaxy of amorphized layers and its effect on the distribution profiles of elements in heterojunctions, and ion implantation of superlattices based on specific elements and compounds. Figures 3; references 24: 2 Russian, 22 Western.

Physical-Chemical and Heat-Engineering Properties of Khandinsk Lignite Deposit Coal

917M0101A Moscow *KHIMIYA TVERDOGO TOPLIVA* in Russian No 1, Jan-Feb 1991 pp 42

[Article by G. I. Khromykh, M. A. Matveyeva, N. P. Lopayeva, N. N. Gorbunova, All-Union Scientific Research Institute of Heat Engineering imeni F. E. Dzerzhinskiy (Urals Affiliate)]

UDC 662.66.001.5

[Abstract] The physical, chemical, and heat-engineering properties of Khandinsk deposit lignite from Irkutsk oblast are studied. The means and extremes of the quality characteristics are determined. Recommendations are given for the use of this fuel at power plants. These are low-grade power fuels. They should be burned in chamber boilers with hard slag removal, a closed wash cycle and direct powder injection, with mill fans and dust concentrators. Figures 4; References 11: Russian.

Electrophysical Properties of Coal Interacting with Sorbed Gas

917M0101B Moscow *KHIMIYA TVERDOGO TOPLIVA* in Russian No 1, Jan-Feb 1991 pp 49

[Article by A. V. Astakhov, L. N. Ekonomova, S. P. Khazov, Moscow Institute of Mining]

UDC 662.02:537

[Abstract] A study is made of the influence of condensation of sorbed gas on the resistivity of specimens of anthracite and coal from the middle stage of metamorphism with carbon dioxide gas. Specimens were gas treated in a special chamber allowing the gas pressure and temperature to be varied quite widely. Coal specimens did not exceed 2-3 cm in diameter. The temperature variation of resistivity of coal specimens not exposed to carbon dioxide was also studied. It was found that particles of the condense sorbate significantly influence the transfer of charge carriers in the coal, manifested as a spontaneous increase in resistivity. The metastable liquid-phase states of carbon dioxide in the pores of the coal was found to be quite stable. After degassing of the specimens the resistivity returned to the same order of magnitude as the initial values. Figures 2; References 7: Russian.

New Concepts of Role and Physical State of Coal Stratum Gases

917M0101C Moscow *KHIMIYA TVERDOGO TOPLIVA* in Russian No 1, Jan-Feb 1991 pp 71

[Article by N. F. Batrakov, E. A. Bineyev, Novocherkassk Engineering-Land Reclamation Institute]

UDC 622.815

[Abstract] A system of physical concepts related to the roll and state of gases in coal strata is outlined, explaining all the specifics of gas manifestations in coal strata and potentially answering a number of basic questions relating to the theory of sorption. It is considered that all of the gas contained in coal strata under natural bedding conditions is absorbed in the intermolecular space (structural volume) of the coal polymer. This is proven by the fact that the natural gas content of coal strata is directly proportional to the structural volume of the coal composing the strata. A physical model of the absorption interaction in the coal-gas system is formulated. References 15: 14 Russian, 1 Eastern European.

Rapid Method of Determining Sorption Methane Capacity of Coal

917M0101D Moscow *KHIMIYA TVERDOGO TOPLIVA* in Russian No 1, Jan-Feb 1991 pp 77

[Article by N. F. Batrakov, Novocherkassk Institute of Engineering and Land Reclamation]

UDC 553.93:552.578.14.058:542.3

[Abstract] It has been experimentally established that the dynamics of the process of methane absorption by coal can be described by a hyperbolic function. This fact is used to determine the equilibrium pressure by calculation, reducing the time required for each determination by more than an order of magnitude and increasing accuracy. Results are presented from sorption determinations performed by the new method. The new method allows for the first time studies to be performed on large fractions of coal, thus answering the basic question of the desirability of continuing to study the sorption properties of coal powder. This method has the ability to make a radical change in the approach to the study of disruption properties of coal, leading to a new understanding of the physical nature of reactions in the coal-gas system. Figures 3; References 3: Russian.

Relationship of Iodine Characteristic and Structural-Chemical Specifics of Organic Coal Mass in Explosion-Dangerous Zones

917M0101E Moscow *KHIMIYA TVERDOGO TOPLIVA* in Russian No 1, Jan-Feb 1991 pp 81

[Article by G. D. Frolov, N. V. Svekolkina, P. V. Belikova, G. V. Malova, V. A. Doni, Novocherkassk Polytechnical Institute, Shakhty affiliate]

UDC 662.654

[Abstract] The iodine characteristic represents about 80% of the useful information of the 11 characteristics used to predict the danger of explosions in coal mines.

This article discusses factors which can reduce the informative nature of the iodine characteristic for this prediction. It is demonstrated that an increase in the characteristic does not necessarily mean a true increase in explosion danger in a seam, but may result from an increase in the content of aromatic-phase coal with structural disruptions in the organic coal mass. This factor must therefore be considered as an adjustment to the iodine characteristic to predict the danger of explosion in coal mines. Figure 1; References 10: Russian.

Use of Humate Preparation in Ceramic Production

917M0101F Moscow KHIMIYA TVERDOGO
TOPLIVA in Russian No 1, Jan-Feb 1991 pp 100

[Article by N. K. Neronin, V. A. Sapunov, Institute of Physical-Organic Chemistry and Coal Chemistry, Ukrainian Academy of Sciences]

UDC 552.57:666.3.022.69

[Abstract] Experimental studies were performed of the influence of a modified coal-alkali reagent on the liquefaction of ceramic slip. The coal-alkali reagent, liquid glass, calcined soda and a ceramic slip were used. One part of the coal-alkali reagent, one part calcined soda and two parts liquid glass as dry matter were mixed with four parts water and ball milled for one hour. The resultant mixture was then mixed with dry ceramic slip and water. It was found that its use could increase the fluidity of the slip by 40% and reduce its moisture content by 15%. References 3: 2 Russian, 1 Eastern European.

Catalyst for Liquefaction of Coal in Methanol

917M0101G Moscow KHIMIYA TVERDOGO
TOPLIVA in Russian No 1, Jan-Feb 1991 pp 107

[Article by P. N. Kuznetsov, Ya. Bimer, P. D. Salbut, Institute of Chemistry and Chemical Technology, Siberian Division, USSR Academy of Sciences Krasnoyarsk; Institute of Organic Chemistry, Polish Academy of Sciences, Warsaw]

UDC 662.75

[Abstract] The effect of a wide range of catalysts in the process of liquefaction of coal in methanol are studied. Catalysts include the chloride and hydroxides of various transition metals and hydroxides and carbonates of alkali and alkali-earth metals. Coal from deposits in Poland and the USSR was studied. It was found that the effect of sodium hydroxide is related to an increase in the hydrogen-donor activity of the alcohol due to the formation of sodium methylate. A synergic effect of a mixture of low-activity sodium carbonates and calcium hydroxide or oxide was found, related to the formation of active sodium hydroxide. Transition metal chlorides

and hydroxides do not increase the H-donor activity of the alcohol. With transition metal compounds and hydrogen present methanol does not influence the liquefaction of the coal, but improves the properties of the liquid product by increasing the fraction of maltenes and their hydrogen content. Liquefaction in methanol increases with decreasing stage of metamorphosis of the coal. Figures 4; References 21: 3 Russian, 18 Western.

Production of Coal-Petroleum Gas Oil

917M0101H Moscow KHIMIYA TVERDOGO
TOPLIVA in Russian No 1, Jan-Feb 1991 pp 119

[Article by D. Chakhovska-Kozlovskaya, E. Kozlovski, Institute of Chemistry, Oil and Coal, Polish Academy of Sciences; Institute of Coal Processing, GIGD]

UDC 662.74:552

[Abstract] Results are presented from hydrogenization of distillate fractions from liquefaction of coal and mixtures of coal and petroleum gas oil fractions in order to produce gas oil and diesel fuel meeting Polish standards. Experiments were performed on fractions of coal distillate obtained at the IPU GIGD experimental plant by hydrogenation of coal from the "Yanina" mine. Work is now under way on preparation of catalyst specimens for hydrocracking of coal oil by precipitation of nickel on a commercial aluminosilicate carrier. Work at the Institute of Coal Processing is concentrating on studies of catalytic hydrocracking of coal oil, encompassing the entire range of hydrogen enriching processes used in the oil refining industry, including hydropurification, hydrogenation and reforming of coal fractions boiling in the range of gasoline and hydropurification and catalytic hydrocracking of coal oils. References 7: Russian.

Calculation of Basic Process Parameters of Gasifying Kansk-Achinsk Coal in Powder State

917M0101I Moscow KHIMIYA TVERDOGO
TOPLIVA in Russian No 1, Jan-Feb 1991 pp 127

[Article by S. R. Islamov, Scientific Research and Planning-Design Institute of Problems of Development of Kansk-Achinsk Coal Basin]

UDC 666.747

[Abstract] A study is made of the autothermic process of gasification of Kansk-Achinsk coal in the powder state with temperature of products at the reactor exit at least 950-1000°C at moderate pressures (up to 3 MPa). Equations are suggested for calculation of the specific gas flow, its heat of combustion and temperature, as well as the efficiency of air-oxygen gasification of Kansk-Achinsk coal. The equations are recommended for evaluation of various versions of the process of autothermic gasification. Figure 1; References 2: Russian.

**Nitrogen Containing Organosilicon Compounds.
Communication 142. Synthesis and
Pharmacological Study of Organosilicon
Derivatives of Tetrahydroisoquinoline**

917M0091E Riga LATVIYSKIY KHIMICHESKIY
ZHURNAL in Russian No 1, Jan-Feb 91 (manuscript
received 10 May 90) pp 106-112

[Article by E. Lukevits, I. D. Segal, S. K. Germane, M.
M. Veveris, Institute of Organic Synthesis, Latvian
Academy of Sciences]

UDC 615.21/22:547.833.3

[Abstract] Various derivatives of tetrahydroisoquinoline were synthesized containing a silicon atom in the ring or in the side chain. Pharmacological investigation of their hydrochlorides and methyl iodides was carried out. In general, these compounds did not exhibit any curare-like activity but showed some ganglion blocking action on parasympathetic heart ganglia and in several cases lowered the arterial pressure. Also, they showed neurotropic activity although with some toxicity. Several of the synthesized compounds exhibited moderately high anti-hypoxia activity. Tables 3; references: 3 (Russian).

**Synthesis and Investigation of Antiarrhythmic
Activity of Alkoxyaminoalcohol Salts of
Cyclohexane Series**

917M0093E Minsk IZVESTIYA AKADEMII NAUK
BSSR: SERIYA KHIMICHESKIKH NAUK in Russian
No 1, Jan-Feb 91 (manuscript received 14 Sep 90) pp
55-59

[Article by N. S. Kozlov, I. A. Frankov, K. A. Zhavnerko,
I. I. Krapivko, V. M. Prishchepenko, L. S. Katash,
Institute of Physical Organic Chemistry, BSSR Academy
of Sciences]

UDC 547.593.221

[Abstract] Structure-activity relationship of a series of cyclohexane alkoxyaminoalcohol salts was investigated in respect to their antiarrhythmic activity. Respective trans-1,4; 2,3,4- alkoxy-2-aminocyclohexane-1,3-diols

and trans-1,3,;2,4-2-alkoxy-4- aminocyclohexane-1,3-diols and their hydrogen chlorides were prepared by published methods. In addition to these hydrochlorides, a known reagent capable of lowering arterial pressure, the trans-1,4;2,3-2,4-diacetoxy-1,3-cyclohexylene-bis-trienylammonium)-diiodide was prepared. Pharmacological properties were investigated on rats and mice. All compounds exhibited ability to control heart arrhythmia caused by various arrhythmogenic agents, but individual indicators of this effect changed characteristically for each compound when different models were used. Toxicity of these reagents was low. Tables 5; references 10: 7 Russian, 3 Western.

**Complexing of Nitrogen-Containing Calcium
Antagonists With Phosphatidylcholine and
Calcium Ions**

907M0094E Kiev TEORETICHESKAYA I
EKSPERIMENTALNAYA KHIMIYA in Russian Vol
27 No 2, Mar-Apr 91 (manuscript received 18 Nov 87)
pp 249-251

[Article by I.V. Nizhenkovskaya, V.A. Samarskiy, and
T.G. Samarskaya, Kiev Medical Institute imeni A.A.
Bogomolets]

UDC 541.749+615.22.547

[Abstract] UV spectrophotometry and NMR spectroscopy were used to assess complexation of verapamil, fendiline, and nifedipine in binary (with phosphatidylcholine) and ternary (with calcium ions and phosphatidylcholine) systems. A comparison of the reactivity of the drugs demonstrated that electron donor function of the nitrogen atoms diminished in the following sequence: verapamil > fendiline > nifedipine. The stability of the ternary complexes exceeded that of the binary complexes and increased in the following sequence: nifedipine > fendiline > verapamil. The latter ranking was interpreted as indicating that electrostatic interactions were more important than electron donor factors in complexing. In addition, the results provided an inkling as to the mechanism of action of the calcium antagonists routinely used in cardiology. Tables 1; references 3: 2 Russian, 1 Western.

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