JPRS-UCH-90-005
12 JUNE 1990

FOREIGN
BROADCAST
INFORMATION
SERVICE

# JPRS Report

# Science & Technology

## USSR: Chemistry

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL INFORMATION SERVICE
SPRINGFIELD, VA. 22161

# Science & Technology
## USSR: Chemistry

*JPRS-UCH-90-005* *12 June 1990*

## CONTENTS

### ANALYTICAL CHEMISTRY

### CATALYSIS

### CHEMICAL INDUSTRY

## COLLOID CHEMISTRY

## COMBUSTION, EXPLOSIVES

## ELECTROCHEMISTRY

## ENVIRONMENTAL CHEMISTRY

## FERTILIZERS

## INORGANIC COMPOUNDS

## LASER MATERIALS

## ORGANOPHOSPHOROUS COMPOUNDS

## PESTICIDES, HERBICIDES

## POLYMERS, RUBBER

## RADIATION CHEMISTRY

## WOOD CHEMISTRY

## MISCELLANEOUS

UDC 543.422:546.26-162

### X-ray Electron Study of Diamond and Graphite Surface

*907M0014B Kiev TEORETICHESKAYA I EKSPERIMENTALNAYA KHIMIYA in RussianVol 25 No 4, Jul-Aug 89 (Manuscript received 29 Sep 86), pp 490-495*

[Article by I. M. Lukyanov, A. V. Shchukarev, Ye. P. Smirnov, V. B. Aleksovskiy, Leningrad University]

[Abstract] X-ray electron spectroscopy is used to study the chemical structure of oxyfunctional groups of diamond and graphite in powders of natural diamond and GSM-1 graphite as well as graphite quasisingle crystals following heat treatment in a vacuum, in helium, and in hydrogen and treatment by oxidation in nitric acid. Heat treatment not only decreases the concentration of oxygen on the surface but also changes the mean bond energy of oxyfunctional groups with the base. As the concentration of oxygen decreases, the chemical structure of the groups changes. The spectroscopic method used allows identification of the oxyfunctional groups on the diamond and graphite by the cluster approach. Figures 4; References 8: 4 Russian, 4 Western.

UDC 613.183

### Thermographic and Mass-Spectrometric Study of Dehydration and Deammonation of Zeolites

*907M0014D Kiev TEORETICHESKAYA I EKSPERIMENTALNAYA KHIMIYA in Russian Vol 25 No 4 Jul-Aug 89 (Manuscript received 30 Jul 86), pp 490-495*

[Article by A. I. Prilipko, V. G. Ilin, N. V. Turutina, V. A. Nazarenko, deceased, G. N. Melnichenko, Institute of Physical Chemistry imeni L. V. Pisarzhevskiy, Ukrainian Academy of Sciences, Kiev]

[Abstract] A comparative thermographic and mass spectrometric study is presented of the dehydration and deammonation of synthetic faujasite and mordenite and natural mordenite in both cationic and dealuminated forms. The dehydration temperature of the synthetic specimens is found to be little dependent on the cationic form of the zeolites. As the dimensions of the input windows decrease and the Si/Al ratio increases in the zeolite framework, the dehydration, deammonation, and dehydroxylation temperatures also increase. Figures 4; References 10: 8 Russian, 2 Western.

UDC 542.91:548.737:541.69:547.898

### Structure and Properties of Diphenylacetylbenzo-12-Crown-4

*907M0022C Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 9, Sep 89 (manuscript received 28 Jun 88) pp 2020-2023*

[Article by O. A. Rayevskiy, V. V. Tkachev, V. P. Kazachenko, A. N. Razdolskiy, V. Ye. Zubareva, and I. I. Bulgak, Institute of Physiologically Active Substances, USSR Academy of Sciences, Chernogolovka, Chemical Physics Institute imeni N. N. Semenov, USSR Academy of Sciences, Chernogolovka, and Chemistry Institute, MSSR Academy of Sciences, Kishinev]

[Abstract] The molecular structure of benzo-crown esters was researched to determine a correlation between the structure and pharmacological properties of these compounds. It was shown that benzo- 12-crown-4 (B12C4) is an anticonvulsant. The addition of an acetyl group to the benzene ring of B12C4 reduced the effectiveness of this derivative due to the differences in the conformation states of these ligands in solutions, thus affecting their complex-forming properties and physiological activity. The molecular structure of diphenyl acetate B12C4 in its crystal state and in solutions was studied by using x-ray analysis and infrared spectroscopy. Infrared spectra were obtained by using suspensions of crystalline substances in petroleum jelly, carbon tetrachloride, $CHCl_3$, $(CH_3)_2CO$, and $CH_3CN$. Diphenyl acetate B12C4 was crystallized in solution from ethyl acetate in the form of colorless, transparent, elongated, rhomboid crystals. The arrangement of unshared electron pairs of oxygen atoms in the macrocycle is very important for the complex formation and physiological activity of macrocyclic ligands. The "separated nature" of unshared electron pairs in crystalline diphenyl acetate B12C4 is likely a factor determining the absence of psychotropic properties in this compound. The spatial structure of the diphenyl acetate group does not affect the macrocyclic conformation. Calculations performed suggest that the basic effect of the diphenyl acetate group is tied to the electron effect of this substituent in the electron donor and complex-forming properties of veratrole oxygen atoms in the macrocycle. Figures 3, references 10: 8 Russian, 2 Western.

UDC 536.7:541.183.26:549.67

### Thermodynamics of Adsorption of Xe and Kr on Zeolite NaX at High Pressures

*907M0022E Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 9, Sep 89 (signed to press 15 Dec 1988) pp 2137-2139*

[Article by A. A. Fomkin, N. I. Regent, and V. V. Serpinskiy, Physical Chemistry Institute, USSR Academy of Sciences, Moscow]

[Abstract] The results of various studies on the thermodynamics of the adsorption of Xe and Kr on zeolite NaX at high pressures are summarized. The heat for adsorption was shown to depend significantly on the temperature. The behavior of other thermodynamic characteristics of Xe and Kr adsorbed on the zeolite NaX can be calculated, and the curves that are obtained calorimetrically and by isosteric heating at low pressures can be compared. The isosteric adsorption heat is about equal to the absolute differential calorimetric adsorption heat. It was shown that the enthalpy of each substance

depends on the temperature and amount of adsorption and that enthalpy decreases with an increase in adsorption. The enthropy of gases being adsorbed is below the enthropy of the equilibrium phase, and it depends on the temperature. It decreases as the micropores of the zeolite are being filled, and then when they are close to being completely filled, the enthropy of the adsorbate approaches the enthropy of the equilibrium stage, which is probably due to a change in the structure of the substance being adsorbed in the zeolite micropores. Figures 4, references 8: 7 Russian, 1 Western.

UDC 537.533.35

## Scanning Tunneling Microscopy of Nucleation Process of Gold Films on Graphite

*907M0028F Moscow POVERKHNOST: FIZIKA, KHIMIYA, MEKHANIKA in Russian No 9, Sep 89 (manuscript received 2 Aug 88; after revision 21 Nov 88) pp 158-160*

[Article by S. D. Alekperov, S. I. Vasilyev, S. S. Yelovikov, A. Ye. Semenov, and Yu. V. Sushkova, Physics Department, Moscow State University imeni M. V. Lomonosov]

[Abstract] Scanning tunneling microscopy complements translucent and grating electron microscopies well, and it was used to research gold films applied to graphite by thermal evaporation in a vacuum. Before being sprayed with gold, the graphite substrate was marked with gummed tape and examined by scanning tunneling microscopy. Research was conducted for 1 day and repeated weeks later, with no structural changes noted. It was demonstrated that the film has uniformly distributed islets of gold. The dimensions of the clusters composing the islets were analyzed by their arrangement. Research conducted by scanning electron microscopy confirms this structure for gold films. Figures 2, references 4: 1 Russian, 3 Western.

UDC 546.92+546.681

## Extraction-Absorptiometric Assaying for Microgram Amounts of Platinum

*907M0033C Yerevan ARMYANSKIY KHIMICHESKIY ZHURNAL in Russian Vol 42 No 5, May 89 (manuscript received 27 Sep 88) pp 289-94*

[Article by N. O. Geokchyan, E. N. Ovsepyan, and A. G. Khachatryan, Yerevan State University]

[Abstract] The feasibility of using a dye from the oxazine series—Nile blue "B"—to assay for platinum by using the extraction- absorptiometric method was studied. A standard solution of platinum (IV) was prepared, along with solutions with lesser platinum (IV) concentrations that were diluted with hydrochloric acid. It was shown that dichloroethane extracts the simple salt of the dye as well as its compound with bromoplatinate. Maximum light absorption of the aqueous solution of Nile blue "B", Nile blue "B" bromoplatinate extracts, and the simple salt of the dye was observed at 630 nm, thus indicating the formation of an ionic associate. The relationship of the optical density of the extracts to the acidity of the aqueous phase was studied by using sulfuric acid. The ratio of the optical density of the extracts to the concentration of anion-ligand and dye was studied, and it was shown that those obtained in optimal conditions remain unchanged for 20 hours. An extraction-absorptiometric method of assaying for platinum in catalysts has been developed. Figures 3, tables 2, references 5 (Russian).

UDC 535.341:546.28

## Determination of Boron, Phosphorus, and Gallium in Silicon Crystals Doped With Gallium

*907M0051F Moscow VYSOKOCHISTYYE VESHCHESTVA in Russian No 5 Sep-Oct 1989 (Manuscript received 9 Aug 88) pp 49-53*

[Article by B. L. Shklyar, Yu. V. Dankovskiy, and Yu. V. Trubitsyn]

[Abstract] A study is made of the possibility of using infrared spectroscopy to monitor the concentration of gallium, boron, and phosphorus in gallium-doped silicon single crystals. Transmission spectra taken at room temperature indicated that with increasing gallium concentration, transmission decreases and that, at a concentration of $9 \cdot 10^{15}$ $cm^{-3}$ or more for specimens 10 mm thick in the 10-50 50 μm wavelength, transmission becomes near zero. However, when the temperature drops to below 100 K, transmission improves, and at about 20 K the values characteristic for relatively high-resistance, undoped silicon appear. The level of boron and phosphorus impurities can thus be measured in silicon single crystals. The values of boron and phosphorus concentrations are compared before and after gallium doping. IR spectroscopy at low temperatures can be used for quantitative determination of the concentration of gallium in silicon at $5 \cdot 10^{13}$-$5 \cdot 10^{15}$ $cm^{-3}$. Figures 2; References 4: 3 Russian, 1 Western.

UDC 546.791.4.151:[539.27+539.192.+539.194]

## Electronographic Determination of Uranium Tetraiodide Molecular Structure

*907M0051G Moscow VYSOKOCHISTYYE VESHCHESTVA in Russian No 5 Sep-Oct 1989 (Manuscript received 16 Feb 89) pp 197-200*

[Article by V. I. Bazhanov, Yu. S. Yezhov, S. A. Komarov, V. G. Sevastyanov, and F. Yuldashev, Institute of High Temperatures, USSR Academy of Sciences, Moscow]

[Abstract] The structure of the $UI_4$ molecule is studied by a method of gas electronography using a preparation of uranium tetraiodide containing excess iodine. The molecule has the $C_t$ configuration. The structural parameters are determined and oscillating frequencies estimated. Figure 1; References 10: 8 Russian, 2 Western.

UDC 542.943.7:547.535.3

## Catalytic Properties of Polyvanadium Molybdic Acid in Oxidation of 1,2,4-Trimethyl Benzene by Peracetic Acid

*907M0022A Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 9, Sep 89 pp 1967-1969*

[Article by L. A. Petrov, N. P. Lobanova, V. L. Volkov, G. S. Zakharova, I. P. Kolenko, and L. Yu. Buldakova, Chemistry Institute, Ural Department, USSR Academy of Sciences, Sverdlovsk]

[Abstract] The catalytic properties of polyvanadium molybdic acid in the oxidation of trimethyl benzene by peracetic acid are studied. Polyvanadium molybdic acid compounds were checked by using chemical, thermal, infrared spectroscopy, and x-ray analysis. The oxidation-reduction and chemisorption properties of polyvanadium molybdic acid with respect to oxygen were determined electrochemically by using sulfuric acid. Oxidation of trimethyl benzene with peracetic acid is a complex process, and the selectivity for trimethyl benzoquinone, an intermediate product, depends on the ratio of the rates of the subsequent reactions of hydroxylation of trimethylbenzene and the oxidative cleavage of trimethyl benzoquinone. The catalytic effect of polyvanadium molybdic acid is tied to its acidity as well as to its oxidation-reduction properties. Polyvanadium molybdic acid is easily oxidized and reduced, and with an increase in the substitution of vanadium for molybdenum, the amount of weakly bonded oxygen decreases, while the amount of chemically bonded oxygen increases. Molybdenum apparently stabilizes peroxide compounds of vanadium on account of its higher energy value for bonding oxygen. Figures 2, table 1, references 10: 6 Russian, 4 Western.

UDC [66.094.17-911.4:661.7::547.532]:541.127

## Liquid Phase Hydrogenation of Benzene Using a Nickel-Chromium Catalyst

*907M0065F Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 89 pp 654-656*

[Article by D. Yu. Murzin, N. A. Sokolova, N. V. Kulkova, and M. I. Temkin]

[Abstract] The kinetics of liquid phase hydrogenation of benzene with an industrial nickel-chromium catalyst was researched. Other catalysts were used for comparison, and all experiments were conducted with an oscillating steel reactor. The catalytic activity of the nickel-chromium catalyst was much greater than that of others tested. Table 1, references 10: 9 Russian, 1 Western.

UDC 541.128.3'35:541.127:542.943.7:546.181.
1:546.562'131-386

## Effect of Nature of Oxide Carrier on Composition and Catalytic Activity of Cu(II) Chloride Complexes in Reaction of Oxidizing Phosphine With Oxygen

*907M0078C Moscow KINETIKA I KATALIZ in Russian Vol 30 No 5, Sep-Oct 89 (manuscript received 8 Apr 88) pp 1084-1088*

[Article by T. L. Rakitskaya, N. N. Abramova, and T. D. Redko, Odessa State University imeni I. I. Mechnikov]

[Abstract] The composition and catalytic activity of Cu(II) chloride complexes applied to silica gel and diatomite were compared in a low-temperature reaction by oxidizing phosphine with oxygen. The Cu(II) chloride complexes were obtained by coating silica gel and diatomite with a solution of $CuCl_2$-LiCl-$H_2O$. A comparison of results shows that under identical experimental conditions the activity of the Cu(II) chloride complexes applied and the effect of the chloride ion concentration on the reduction of Cu(II) with phosphine and the equilibrium change as a function of the nature of the carrier. The reaction and catalytic activity of the metal complex compounds applied depend on the nature of the ligands in the inner coordinate sphere. The data obtained can be used to predict catalytic activity in a reaction of oxidizing phosphine with the oxygen from Cu(II) chloride complexes that are applied to other oxide carriers if the thermodynamic properties of the components being applied are known. Figures 3, tables 1, references 25: 15 Russian, 10 Western.

UDC 541.128.3:542.943.7:547.534.1:542.
978:546.723'267

## Dual Function of Complex Compounds of $M_m'[M(CN)_6]_n$ in Oxidizing Reaction of Ethylbenzene

*907M0078D Moscow KINETIKA I KATALIZ in Russian Vol 30 No 5, Sep-Oct 89 (manuscript received 10 May 88) pp 1089-1094*

[Article by N. T. Silakhtaryan, Yu. D. Norikov, and I. P. Skibida, Institute of Chemical Physics imeni N. N. Semenov, USSR Academy of Sciences, Moscow]

[Abstract] A number of ferricyanides, sodium nitrosoferricyanide, and complex copper compounds were studied to establish the role of the inter- and intraspheric metal ion in manifesting the catalytic and inhibiting effect of catalysts for oxidizing ethylbenzene. Ethylbenzene was oxidized at 90° in a glass reactor with a device for supplying gas and taking samples. Chromatography was used to determine products of the reaction. Study of the catalytic properties of metal ferricyanides showed that most of the complexes effectively catalyze the oxidation of ethylbenzene. Co(II) and Cu(II) ferricyanides have the highest oxidizing rates, while the speed for

oxidizing ethylbenzene in ferricyanides of alkali metals is three to four times less. Oxidizing ethylbenzene in potassium ferricyanide showed that the change in concentration has practically no effect on the rate of oxidation and, at $[ROOH]_0 = 10^{-3}$, the critical concentration of $K_3[Fe(CN)_6]$ is not reached. The critical concentration of copper ferricyanide depends on the beginning concentration of hydrogen peroxide, so the dual function of potassium ferricyanide and the presence of the critical concentration of this catalyst with the large decrease in the content of hydrogen peroxide in ethylbenzene was expected. The nature of the interspheric ion also determines the effects of catalysis and inhibition quantitatively. Copper ferricyanide, copper hexacyanochromiate, and copper hexacyanocobaltiate have a high inhibiting activity. A decrease in the hydrogen peroxide concentration in solution decreases the critical concentration of the catalyst. Special experiments showed that stable products of the reaction (water, acetophenone, methylphenylcarbinol) have practically no effect on the catalyst's activity. One of the possible results of catalyst modification may be changing the rate of dissociating ROOH and the ratio of the rates of the radical and molecular direction of its dissociation. Decreasing the portion of radical dissociation should decrease the speed of formation and the concentration of hydrogen peroxide in solution. Figures 3, tables 2, references 4 (Russian).

UDC 541.128.3.541.124-145:542.924:547.
534:546.723'267:541.515

## Effect of Agents on Catalytic Dissociation of α-Phenylethyl Hydrogen Peroxide in Insoluble Metal Ferricyanides

*907M0078E Moscow KINETIKA I KATALIZ*
*in Russian Vol 30 No 5, Sep-Oct 89 (manuscript received 10 May 88) pp 1095-1100*

[Article by N. T. Silakhtarin and I. P. Skibida, Institute of Chemical Physics, USSR Academy of Sciences imeni N. N. Semenov]

[Abstract] The mechanism of catalyzing oxidation reactions with ferricyanides was established by studying the basic kinetic laws of dissociating α-phenylethyl hydrogen peroxide in $M_m[Fe(CN)_6]_n$. The experiments were conducted in a glass reactor, and hydrogen peroxide and products of its dissociation were analyzed by gas-liquid chromatography. Several of the chemical reactions involved are presented, and a comparison of the expressions showed that replacing the inert solvent with a hydrocarbon should decrease the rate of ROOH dissociation and the accumulation of both products of the reaction. In the catalytic dissociation of ROOH in the presence of silver (I) and manganese (II) ferricyanides, replacing chlorobenzene with ethylbenzene as the solvent decreases the dissociation rate of α-phenylethyl hydrogen peroxide and the accumulation of methylphenylcarbinol and acetophenone. Adding an inhibitor (ionole) to the reaction of dissociating α-phenylethyl hydrogen peroxide with copper ferricyanide in an inert solvent increases the rate of hydrogen peroxide dissociation. It was shown that ionole dissociates hydrogen peroxide to a much greater degree than does ethylbenzene. The role of the solvent and inhibitor is determined to a large degree by the possibility of donor-acceptor modification of the catalyst when adsorbing molecules of the solvent, inhibitor, or hydrogen peroxide on the surface of the catalyst with the intermediate formation of tertiary complexes. The role of donor molecules lies in changing the rate of dissociation for hydrogen peroxide in a tertiary complex. The constant of the rate of forming the complex and the ratio of the rates of diffusion and intracellular recombination are not sensitive to the type of donor used. Figures 3, table 1, references 8: 7 Russian, 1 Western.

UDC 541.128.13'124.2:541.127:542.924:547.
217.1:546.4'131+66.092.147

## Kinetic Simulation of Catalytic Pyrolysis of n-Heptane in Chlorides of Alkali Earth Metals

*907M0078F Moscow KINETIKA I KATALIZ*
*in Russian Vol 30 No 5, Sep-Oct 89 (manuscript received 4 Apr 88) pp 1107-1111*

[Article by S. V. Kolesov, M. A. Tsadkin, Ye. I. Kulish, S. R. Ivanova, S. I. Spivak, Al. Al. Berlin, and K. S. Minsker, Bashir State University imeni 40th Annerversary of October, Ufa]

[Abstract] Heterogenic catalysts, simple and complex metal chlorides, were used to increase the degree of transforming raw materials at temperatures of thermal pyrolysis or to accomplish sufficient transformation at lower temperatures. $C_4$ hydrocarbons dominate, while the content of olefins such as ethylene and propylene is relatively low in the first group of catalysts (chlorides of Li, Al, $NaAlC_4$, etc.), and pyrolysis occurs at lower temperatures. The second group of catalysts includes chlorides of alkali earth metals (Mg, Ca, Sr, Ba) that are catalytically active at temperatures above 450°, and the composition of the gaseous products of dissociation is different, thus indicating a difference in the mechanism of the catalytic action of various metal chlorides when pyrolyzing hydrocarbons. Catalysts of the first group are electrophilic, and the dissociation of hydrocarbons proceeds by the carbonium ion mechanism. When using the second group of catalysts, the relative distribution of the main products in the gases is the same as in the noncatalytic high-temperature gas phase pyrolysis of hydrocarbons, which proceeds according to the free radical mechanism. Heptane dissociates easily at 450-550° in chlorides of alkali earth metals with a conversion into gaseous products of 90 mass percent or greater. The relative distribution of the yields of the main gaseous products changes little and is similar to the distribution of products in the noncatalytic thermal pyrolysis of hydrocarbons. The catalytic role of chlorides of alkali earth metals consists mainly of accelerating the stage of

forming primary radicals in the dissociation of hydrocarbons on the surface of the catalyst, which results in reducing the temperature threshhold by 300-400 K in comparison to strictly thermal pyrolysis. Tables 3, references 13: 11 Russian, 2 Western.

UDC 541.128.3:541.183:542.952.1:547.313.4:546.185-326'284-31:543.42

## Effect of Active Component of Phosphoric Acid Catalyst on Silica Gel

*907M0078G Moscow KINETIKA I KATALIZ in Russian Vol 30 No 5, Sep-Oct 89 (manuscript received 9 Mar 88) pp 1117-1122*

[Article by N. S. Kotsarenko, V. P. Shmachkova, I. L. Mudrakovskiy, and V. M. Mastikhin: Institute of Catalysis, Siberian Department, Soviet Academy of Sciences, Novosibirsk]

[Abstract] The catalytic properties of samples produced by coating various $H_3PO_4$ silica gels, acid phosphate, and silicon pyrophosphate and the state of phosphorus and protons in them were studied to explain the chemical nature of the active component of the $H_3PO_4$ silica gel catalyst. The catalysts were made by coating pure silica gel with a solution of phosphoric acid. Thermal analysis of the dried samples containing 3 and 10 percent $H_3PO_4$ demonstrated the presence of endoeffects at 140° in both samples and at 250° in the second sample. This was apparently associated with the removal of water. Freshly calcined preparations were used to measure the nuclear magnetic resonance spectra of the $^{31}P$ samples. The catalytic properties were studied in the isomerization of butene-1 and butene-2. Reacting $H_3PO_4$ with silica gel reduces the specific surface from 30 to 65 percent due to blocking of the $H_3PO_4$ pores and products of its reaction with silica gel or dissolution of fine particles in $H_3PO_4$. The activity of the samples calcined at 250° at first slowly increases during the reaction and then remains constant for a long time, whereas the samples calcined at 500° and 700° decrease in activity over time. The $[H_3PO_4]$ and calcining temperature are the main factors affecting the activity of the catalysts. The amount of free acid in all of the samples studied decreases with an increase in the calcining temperature and is not fixed at $T = 500°$. The state of protons and their amounts in the catalysts and in individual compounds of acid phosphate and silicon pyrophosphate were studied. The hydroxyl coating of the catalyst surfaces is made of SiOH- and POH-groups. The total concentration of hydroxyl groups in the catalysts exceeds the concentration of SiOH-groups on the silica gel surface at an identical calcining temperature. The activity of POH-groups of silicon pyrophosphate and the catalysts being applied may be calculated on the basis of the results obtained. It was shown that all types of POH-groups formed in the reaction are active and that POH groups of silicon acid phosphate are the most active. Figures 2, tables 2, references 8: 4 Russian, 4 Western.

UDC [66.071.7:62-278].002.237:661.96

## Energy Technology of Membrane Gas-Separating Systems

*907M0031C Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 9, Aug 89 pp 603-07*

[Article by I. M. Britan and I. L. Leytes]

[Abstract] The rational energy and technological design of a system for obtaining a 90 percent concentration of hydrogen from a nitrogen-hydrogen mixture with 40 percent $H_2$is examined. The energy cost of producing a cubic meter of product and the exergic efficiency, which depends on the pressures used, were selected as the criteria to be improved. The energy costs increase with an increase in pressure, and they decrease when the stream of mixture through the membrane is increased. With an increase in pressure, however, the desired concentration of the component is reached. Regulating the pressure and choosing the selectivity of membranes significantly improved hydrogen extraction. Adding an evaporation stage to the system increases the degree of hydrogen extraction, which, in addition to exergic efficiency, increases while the minimum energy costs decrease. It was shown that in evaluating the system variations using exergic efficiency, the simple stage was preferable. A two-stage system with evaporation is most effective in working with low-selectivity membranes. With highly selective membranes, this system surpasses the rest only from the standpoint of its degree of $H_2$ extraction.

UDC 66.023:621.929

## Reactor-Mixer for Making Composite Materials

*907M0031D Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 9, Aug 89 pp 630-31*

[Article by I. N. Lipunov, N. I. Suslov, S. B. Kotlik, and M. V. Biryukov]

[Abstract] A mixer with two horizontally rotating rotodynamic rollers was used as the base, and empying and mixing screw conveyors that create a force on the particles being processed were added to it. Experiments were conducted using a specially made laboratory instrument in which the processes of geometric and physical compression were imitated. Wood shavings and ground shavings of textolite and getinax were used. The mode of operation of the reactor-mixer is described in detail. Heating and cooling are sometimes used with the reactor-mixer. A pulsing force is created while other forces on the products being processed are reduced, and a partial dislocation and change in the position of the particles occurs. This covers the particles better with the binding component, compacts them better, and increases the density of the pressed material, thus increasing its technological properties. This mixer combines simultaneous chemical reaction of components with a high degree of covering solid ground particles with a binding agent.

UDC 631.3[631.867+631:829]:631.95

## Experimental Development of Bioenergy Devices

*907M0034A Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 9, Sep 89 pp 19-20*

[Article by I. V. Semenenko, L. I. Manoylenko, candidate of technical sciences, S. I. Yakushko, and V. I. Dzyuba, candidate of technical sciences]

[Abstract] One of the ways of using wastes from stock breeding is methane fermentation. It deodorizes, removes helminths, suppresses the germination of weeds, etc. Refining large amounts of discharge accumulated by the stock breeding complexes daily requires developing bioenergy devices with large-capacity reactors. The design, manufacture, and operation of the Biogaz-301C and Biogaz-2-302C devices were discussed. The use of microflora to accelerate methane genesis reactions is planned. The solid, liquid, and gas products are all used as organic fertilizers. The Biogaz-2-302C was an improvement over the Biogaz-301C that was made after researching the corrosion problems experienced with the 301C model. Figure 1, references 2 (Russian).

UDC [661.717.3+661.7::547.551]:66.088

## Dissociation of Nitrogen-Containing Organic Compounds Into Electrical Discharges

*907M0065H Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 89 pp 656-659*

[Article by A. P. Petrusenko, O. Yu. Pesin, and N. S. Pechuro]

[Abstract] Results obtained in the dissociation of aliphatic and aromatic amines into electrical discharges are presented. The dissociation of tert-butylamine was studied to explain the effect of branching of the hydrocarbon skeleton of primary saturated amine. The decay of secondary and tertiary amines was studied to establish the connection between the number of hydrocarbon radicals in the amine being decomposed and the state of the products being formed. Increasing the number of hydrocarbon radicals in the original amine increases the fraction of methane, acetylene, and ethylene among the electrocracking products. It was concluded that laws typical for electrocracking of saturated hydrocarbons are also true for electrocracking of saturated amines. Electrocracking of aromatic amines was studied by using the electrocracking of aniline and its derivatives and compounds with two benzene rings. Equations based on experimental data are presented for aromatic amines. Tables 3, references 6 (Russian).

UDC 661.42:547.496.07

### Refining Sodium Chloride From Amines

*907M0065I Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 89 pp 681-682*

[Article by R. N. Zagidullin]

[Abstract] A salt solution containing polyethylene polyamines was treated with carbon bisulfide and salts of heavy metals to refine it from amines. Heavy metals were removed at the same time. The amines from the salt react with carbon bisulfide to form dithiocarbamic acids, which subsequently combine with heavy metals to form fungicides. The salt produced can be used in electrolysis, and the dithiocarbamates may also be used for stabilizing polyvinylchloride and accelerating rubber vulcanization, etc. Figure 1, table 1, references 10 (Russian).

UDC 622.244.7-52

### New Clamp Construction of Automatic Boring Wrench With Double Self-Adjusting Grooved Elements

*907M0108B Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 1 Nov 89 pp 6-8*

[Article by N. P. Umanchik, V. P. Belugin, and A. G. Shestov, candidates of technical sciences]

[Abstract] Boring wrenches are subject to excessive wear because of the repeated intrusion of the screw teeth into the body of the lock mechanism. The present design of the boring wrench clamps with rigidly attached grooved elements cannot adjust to the shape of the external surface of worn pipe locks. A new pipe-locking device was developed with double self-adjusting, grooved clamp elements in which each jaw is supported by springs. Located inside each jaw is another grooved clamp that rests on a spring. In this fashion it is possible to achieve a more effective grip of the grooved teeth on the surface of the clamped pipe when the load is distributed uniformly on all teeth. This leads to longer performance of the locks and the boring pipes between the servicing times. Figures 4; references: 2 (Russian).

UDC 66.045.1.001.63

### Experience in Design and Production of Competitive Heat Exchange Apparatus

*907M0108C Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 1 Nov 89 pp 8-10*

[Article by G. A. Dubinina]

[Abstract] In recent years the All-Union Scientific Research Institute of Oil Machinery entered agreements with several foreign companies, notably the Japanese, for the development of competitive heat exchange equipment to be produced for these companies for hard currency and marketed under their trade names. The principal aim proposed by the Japanese firms was to be able to provide top- quality technical equipment corresponding to present technical and operational specifications. The equipment must be produced at the rate common in foreign countries, much faster than in the USSR. The equipment must pass western standards (most of those mentioned were U.S. standards). The equipment ordered by the Japanese is aimed at the production of acetic aid, ammonia, ethylene glycol, acrylate complex, etc. Some technical specifications were listed.

UDC 536.24:621.592.71

### Analysis of Losses in Static Magnetic Refrigerator for He II

*907M0108D Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 1 Nov 89 pp 12-14*

[Article by V. A. Shaposhnikov, A. P. Grafov, and L. N. Yefimova, candidates of technical sciences, and A. V. Kortikov]

[Abstract] In the ideal case a static magnetic refrigerator (SMR) performs by the Carno cycle. In addition to the losses in the magnet, additional losses in real SMR result from the imperfections in heat transfer processes due to limited heat transfer. In this work SMR losses were analyzed. Theoretical analysis of a number of factors led to the conclusion that the principal means of increasing the efficiency of SMR is to lower losses caused by heat input $Q^*$ to the gadolinium gallium garnet (GGG) from the He I side. This can be achieved by the addition of a heat diode on the GGG surface in contact with He I. During the demagnetizing process, this prevents the access of He I to the respective GGG surface. Practical heat diodes are characterized by nonideality, i.e., a heat resistance $R_\pi$ different from zero for direct heat flow (from GGG to He I) and a heat resistance $R_o$ different from infinity for reverse heat flow. Obviously, the best results are obtained from a diode whose $R_{o_\pi}$ ratio is the greatest. Figures 4; references: 3 (Western).

UDC 539.385:536.48:669.295

### Effect of Low Temperature on Cyclic Longevity and Resistance to Cracking of Titanium Alloy VT5-1kt

*907M0108E Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 1 Nov 89 pp 14-17*

[Article by Ye. N. Aleksenko, L. F. Yakovenko, and N. M. Grinberg, doctors of technical sciences, A. V. Mozhayev and V. I. Zmiyevskiy, candidates of technical sciences, and I. A. Arinushkin]

[Abstract] Because of the wide use of titanium alloys in cryogenic technology, the effect of low temperatures on their fatigue characteristics is being evaluated continuously. An attempt was made to determine the effect of low temperatures on cyclic longevity and resistance to cracking of a BT5-1kt alloy in a single medium over a wide range of temperatures. An analogous alloy, Ti-5Al-2.5Sn, exists in the United States. It was shown that in vacuum the cyclic longevity of the test material was three to four times that in air. A temperature drop from 293 to 93 K increased the cyclic longevity three- to eightfold, but a further temperature decrease to 11 K had no additional effect. The rate of crack formation also diminished as the temperature dropped. It was stressed that only data obtained in the same medium can be compared; values from different media (high vacuum vs. air) may lead to erroneous conclusions. Figures 3; references 18: 8 Russian, 10 Western (1 by Russian authors).

UDC 621.512.01

## Electronic Mechanical Pressure Stabilizer for Piston Compressors

*907M0108F Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 1 Nov 89 pp 18-19*

[Article by V. G. Kontsevich, candidate of technical sciences, and M. F. Mesha]

[Abstract] The pressure in an operating compressor may vary for a number of reasons. In scientific research experiments it is necessary to stabilize this compression pressure as much as possible. A pressure stabilizer was developed at the Scientific Production Organization imeni M. V. Frunze. It consists of an electonic-mechanical part that will periodically correct the performance of the compressor by means of a bypass valve. It is possible to achieve a high uniformity of pressure with this unit. Figures 2.

UDC 697.94.002.5

## Utilization of Microprocessor Technology in Gas Purification Equipment

*907M0108G Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 1 Nov 89 pp 23-25*

[Article by N. I. Dudkin, V. I. Danilov, A. S. Dmitriyev, V. A. Fomin, and S. M. Vechtomov]

[Abstract] Automating production processes is one of the principal conditions for technical progress in industry. The Gas Purification Scientific Research Institute studies ways of introducing microprocessor technology into gas purification equipment. The applications of domestically produced control units in gas purification processes are reviewed, and some of the basic problems are pointed out. A specialized control unit that is based on the monocrystal microcomputer K1816 is described. It should solve the problems that have been encountered with more generalized equipment. References 5: 4 Russian, 1 Western.

UDC 620.193.4:669.71

## Corrosion of Radiator Construction Materials in air Stream Containing Hydrogen Fluoride

*907M0108H Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 1 Nov 89 p 26*

[Article by I. M. Shevchuk, candidate of chemical sciences, G. I. Agapov, candidate of technical sciences, and T. A. Markelova]

[Abstract] Special equipment was used to show that the rate of corrosion of AD-1 aluminum and St3 steel samples in an air stream containing 0.35 $mg/m^3$ hydrogen fluoride at a relative humidity of 60 percent does not exceed 0.004 and 0.001 mm/year. With increased humidity this corrosion rate increased, but even at 100 percent relative humidity it was only 0.006 and 0.002 mm/year for aluminum and steel, respectively. Hence it was shown that the KSK radiators can be used as heat exchangers when process gases with a hydrogen fluoride content up to 0.4 $mg/m^3$ are used. Figure 1.

UDC 621.694:621.135.74:62-225.8.001.5

## Preparation of Nozzles for Buster Pumps by Plasma Spraying

*907M0108I Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 1 Nov 89 pp 28-29*

[Article by Ye. Ye. Averyanov, candidate of chemical sciences, R. R. Ziganshin and R. A. Shagiakhmetov, candidates of technical sciences, and K. Z. Glyazova and R. A. Ibragimov]

[Abstract] Plasma spraying is an advanced technological process for the preparation of various details; its potential application in the production of thin-walled complex components has been examined with respect to finishing buster pump nozzles. The spraying was performed on a UMP-6 plasma cover deposition unit. The details of the procedure for preparing components to be sprayed and some physical properties of the finished product were described. The metal unit covered with powder can easily be worked, cut, molded, etc. The quality of the cover depends on the powder used in the process. Comparison of the finished product showed that the plasma-sprayed nozzles satisfied the technical requirements placed on them and compared favorably with the nozzles produced by the normal technology. In addition, the plasma- spraying method resulted in savings of about 10 rubles per unit. Figures 5; references: 4 (Russian).

UDC 541.18.537+66.067.33

## Influence of Pore-Size Distribution in Membrane on Reverse Osmosis

*907M0020B Kiev KHIMIYA I TEKHNOLOGIYA VODY in Russian Vol 11 No 9, Sep 89 (manuscript received 17 Apr 89) pp 776-781*

[Article by A. E. Yaroshchuk and Ye. V. Meshcheryakova, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Dumanskiy, Ukrainian Academy of Sciences, Kiev]

[Abstract] A study is made of several models of transport of a nonelectrolyte solution through a membrane. The methods differ from the standpoint of the possibility of a mutual influence of the transport solution in various membrane sectors depending on the nature of lateral heterogeneity. Each model is the limiting case of the description of membranes with different pore structures. Two of the models can be used to compute selectivity for the entire range of Peclet numbers, assuming relatively little lateral heterogeneity. Another is suitable for greater values of heterogeneity. Figures 4; References: 5 Western.

UDC 541.183

## Carbon-Mineral Sorbents: Production, Properties, and Use in Water Purification

*907M0020C Kiev KHIMIYA I TEKHNOLOGIYA VODY in Russian Vol 11 No 9 Sep 89 (manuscript received 18 Apr 89) pp 789-804*

[Article by Ye. I. Tarasevich, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Dumanskiy, Ukrainian Academy of Sciences, Kiev]

[Abstract] This review of the Soviet and Western literature discusses the creation of sorbents combining the useful properties of hydrophilic mineral and hydrophobic carbon sorbents. The mechanism of the reactions occurring upon carbonization and activation of the carbon layer on carbon-mineral sorbents is discussed. The most economical methods are considered for producing these sorbents, and the promise of using this new class of sorbent for water purification instead of simple mechanical mixtures of organic and mineral solvents is discussed. Figures 2; References 127: 107 Russian, 20 Western.

UDC 628.162.8

## Oxidation of Natural Water Fulvoacids by Ozone

*907M0020D Kiev KHIMIYA I TEKHNOLOGIYA VODY in Russian Vol 11 No 9, Sep 89 (manuscript received 2 Feb 89) pp 804-808*

[Article by V. D. Grevenyuk, N. P. Strizhak, G. V. Slavinskaya, G. V. Lantukh, G. M. Popovich, V. V. Goncharuk, A. V. Grechko, and A. O. Samsoni-Todorov, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Dumanskiy, Ukrainian Academy of Sciences, Kiev]

[Abstract] Results are presented from ozone processing of fulvoacids obtained from Neva water by a method based on concentration of the fulvoacids on a porous anionite of low basicity and subsequent elution with a salt-alkali solution. It is found that combined utilization of ozone and UV radiation provides deeper decoloration of the solution, complete destruction of high-molecular mass fulvoacid fractions, and the formation of carboxylic acids and other low-molecular mass products. Figures 5; References 11: 7 Russian, 4 Western.

UDC 628.54

## Thermolysis of Organic Matter in Treated Domestic Waste Water Used in Steam-Water Cycle of Power Plants and Boiler Shops

*907M0020E Kiev KHIMIYA I TEKHNOLOGIYA VODY in Russian Vol 11 No 9, Sep 89 (manuscript received 3 Mar 89) pp 816-820*

[Article by I. A. Malakohov and V. D. Agayev, AzSSR Institute of Oil and Chemistry imeni M. Azizbekova]

[Abstract] A study was made of the decomposition of dissolved organic substances in treated domestic waste water under the operating conditions of steam-generating installations. The kinetics of the process of thermolysis is described, and optimal usage conditions are determined. The results showed that the decomposition of organic matter increases with increasing temperature and occurs primarily in the first 60 minutes. It is recommended that the deaeration time of feed water be increased to reduce the intake of volatile substances, particularly acidic compounds. Condensate from turbines operating at lower temperatures can be used to feed turbines operating at higher temperatures and pressures. Figures 5; References: 7 Russian.

UDC 628.543.45:621.802

## Purification of Ballast Water to Remove Petroleum Products

*907M0020F Kiev KHIMIYA I TEKHNOLOGIYA VODY in Russian Vol 11 No 9, Sep 89 (manuscript received 11 Jan 89) pp 840-843*

[Article by Z. N. Shkavro, M. I, Medvedev, G. V. Lantukh, and V. V. Trachevskiy, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Dumanskiy, Ukrainian Academy of Sciences, Kiev]

[Abstract] In order to develop methods for effective treatment of ballast waters to remove petroleum products, various methods were studied in combination with adsorption on active carbon. A process was devised for further purification of ballast waters to meet the maximum permissible concentrations of petroleum products and ionogenic surfactants, including preliminary purification with products of the hydrolysis of magnesium salts and final purification with powdered active carbon. The side products of the purification can be utilized as fillers in the manufacture of composite materials. Figures 2; References: 6 Russian.

UDC 628.543.004.14:66.013

### Influence of Suspended Matter in Air and Additional Water on Their Content in Water Supply Recycling System Water

*907M0020G Kiev KHIMIYA I TEKHNOLOGIYA VODY in Russian Vol 11 No 9, Sep 89 (manuscript received 26 Dec 88) pp 852-853*

[Article by M. A. Atanov and L. L. Negoda, Kuybyshev Construction Engineering Institute imeni A. I. Mikoyan]

[Abstract] Using data presented in another work and not repeated here, the authors calculate the concentration of suspended matter in recycling systems as a function of the initial suspended matter in the intake air. The quantity of pollutants at the input must be considered in its influence on the quantity of suspended matter in the water that has passed through the system. The major source of suspended water in the recycling system is found to be the biocenosis of the biological film on the tower sprinkler. References: 2 Russian.

UDC 541.127:541.124.2:542.921.4:[547.211+547.222]

## Kinetic Laws Governing Simultaneous Pyrolysis of Methyl Chloride and Methane

*907M0078A Moscow KINETIKA I KATALIZ in Russian Vol 30 No 5, Sep-Oct 89 (manuscript received 31 May 88) pp 1020-1025*

[Article by S. S. Abadzhev, I. P. Dzikh, and V. U. Shevchuk, Lenin Komsomol Lvov Polytechnical Institute]

[Abstract] The kinetic laws governing the simultaneous pyrolysis of methyl chloride and methane were studied at atmospheric pressure and 1,223-1,373 K. Pyrolysis of methyl chloride in methane was conducted in a noncirculating reactor placed in an electric oven. From the reactor, the gas from pyrolysis enters the tap sampling apparatus of the two LKhM-72 chromatographs, which calculate $H_2$, $CH_4$, $C_2H_6$, $C_2H_4$, $C_2H_2$, $C_3H_8$, and $CH_3Cl$. Methyl chloride was synthesized from methanol and concentrated HCl, while methane was dried in a column with silica gel and cleaned with activated charcoal. Both columns were cleaned with a mixture of acetone and dry ice. The main products of the thermal dissociation of methyl chloride and methane are hydrogen chloride, ethylene, acetylene, ethane, and hydrogen. The kinetic curves of the transformation of methyl chloride and yields of ethylene, acetylene, and hydrogen are presented, and it is seen that the concentration of ethylene in the gases from pyrolysis is much greater than that of acetylene and the yields of $C_2H_2$, $H_2$, and ethylene increase with an increase in the reaction time. Increasing the temperature and decreasing the concentration of $CH_3Cl$ in the original mixture increases the selectivity of forming $C_2$ hydrocarbons from methane by reacting with active particles from the $CH_3Cl$ dissociation. The sequence of elementary stages was investigated to explain the thermal transformation of methyl chloride. The rates for breaking chains were calculated by using known concentrations of radicals. The kinetic model suggested agrees well with experimental data and can be used for calculating $C_2$ hydrocarbons in the pyrolysis of methyl chloride and methane. Figures 2, tables 2, references 11: 8 Russian, 3 Western.

UDC 541.127:543.878:[547.532'525+547.299]

## Kinetics of Oxidizing Aromatic Hydrocarbons With Alkanesulfoneperacids

*907M0078B Moscow KINETIKA I KATALIZ in Russian Vol 30 No 5, Sep-Oct 89 (manuscript received 24 May 88) pp 1040-1044*

[Article by R. L. Safiullin, L. R. Yenikeyeva, and V. D. Komissarov, Bashkir Branch Institute of Chemistry, Soviet Academy of Sciences, Ufa]

[Abstract] The oxidation of aromatic hydrocarbons with sulfonacetic acids was studied by using decanesulfoneperacid and benzene and its derivatives. Aromatic hydrocarbons (benzene, toluene, ethylbenzene, isopropylbenzene, n- and m-xylenes, and chlorobenzene were treated with concentrated sulfuric acid, washed with water, dried with KOH, and distilled in argon. The content of the compounds was determined by using an iodometer, spectrophotometer, potentiometric titration, and chromatography. Kinetic experiments were performed in a quartz thermostatically controlled reactor. The oxidation of benzene was studied at 278.5-321.5 K. The comparative reaction ability of substituted forms of benzene was also discussed. The kinetics of oxidizing substituted forms of aromatic hydrocarbons were studied by using toluene, ethylbenzene, isopropylbenzene, phenetole, and n- and m- xylenes at 290 K. The reaction ability of aromatic hydrocarbons increases with the introduction of donor electron-substituted forms into the aromatic ring. Figures 3, tables 2, references 11: 9 Russian, 2 Western.

UDC 541.138.3:621.357.1

## Titanium-Palladium Cathodes for Acidic Agents

*907M0093A Moscow ELEKTROKHIMIYA in Russian Vol 25 No 11, Nov 89 (manuscript received 18 August 88) pp 1455-1460*

[Article by V. N. Fateyev, K. O. Ragimov, V. P. Rakhomov, M. Ya. Bakirov, B. G. Vladimirov, and N. P. Aparina, Division of Radiation Research, AzSSR Academy of Sciences, Baku]

[Abstract] The effect of alloying titanium electrodes with palladium ions on the cathode characteristics of the electrodes was studied. The electrode surface is degreased, scoured, and then cleaned again with an ion beam. It is then alloyed. The temperature of the electrode surface is controlled by a thermocouple. The electrodes were studied in a standard cell in $H_2SO_4$ at 18°C. The palladium content in the surface layer and formation of the Ti + Pd alloy with greater amounts of palladium increase in proportion to the increase in the dose of palladium ions. The appearance of anode peaks and shift of the cathode peak in respect to pure palladium testify in favor of the formation of a very catalytically active chemical compound that may also cause radiation modification of the surface. Alloying with palladium ions substantially increases the electrocatalytic activity of electrodes in reactions of separating $H_2$. Titanium alloyed with carbon has an activity similar to that of pure titanium, but adding carbon atoms to a palladium coating reduces its activity. The continuous change in the energy characteristics of the surface and especially the energy for binding adsorbed hydrogen atoms is due to a change of the phase state. Tests showed that the alloyed electrodes are very active and stable when working in sulfuric acid. Porous titanium-palladium electrodes in contact with solid polymer electrolytes were also studied in cells used for water electrolysis. Test results showed that the behavior of porous titanium-palladium electrodes was much like that described in a previous article and that the higher stability of potential values was tied to the absence of screening the working surface with the gas being separated. Figures 5, references 10: 6 Russian, 4 Western.

UDC 541.183.12

## Connection Between Electroosmotic and Selective Properties of Ion- Exchange Membranes

*907M0093B Moscow ELEKTROKHIMIYA in Russian Vol 25 No 11, Nov 89 (manuscript received 23 Nov 88) pp 1467-1472*

[Article by N. P. Berezina, O. A. Demina, N. P. Gnusin, and S. V. Timofeyev, Kubanskiy State University, Krasnodar]

[Abstract] The concentration dependence of potentiometric transport numbers of counterions for membranes of varying structural types and establishing a connection between the transport numbers for the counterions and water were studied. The transport numbers of the counterions through the membrane were calculated by using a two-chambered cell made of organic glass and equipped with standard silver chloride electrodes, and the experiments were performed in a circulating regime. The dependence of membrane potentials on the concentration gradients of the outer solution of electrolyte was studied. The transport numbers decrease with an increase in the concentration gradient as a result of diffusion. In dilute solutions all of the membranes are highly selective materials regardless of their functional groups or beginning specific moisture content, but in more concentrated solutions, selectivity decreases. The true transport numbers were calculated for all membranes by using the concentration dependencies of transport numbers for water, which allowed the difference between the true and apparent transport numbers in relation to the equilibrium concentration of the solution and the structural type of the membrane to be assessed. The differences are not substantial in dilute solutions, but the contribution of the electroosmotic current increases in concentrated electrolytes. An increase in the amount of water transported occurs with an increase in the transport number of counterions in membranes with a greater specific moisture content. Differences in the specific moisture content of membranes and the change in the ratio of free and bound water in their structure easily explain the differences in various samples. Figures 4, table 1, references 32: 19 Russian, 13 Western.

UDC 541.138.2

## Vicissitude in Stages in Anode-Cathode Microplasma Processes

*907M0093C Moscow ELEKTROKHIMIYA in Russian Vol 25 No 11, Nov 89 (manuscript received 22 Feb 89) pp 1473-1479*

[Article by G. A. Markov, V. I. Belevantsev, A. I. Slonova, and O. P. Terleyeva, Institute of Inorganic Chemistry, Siberian Department, USSR Academy of Sciences, Novosibirsk]

[Abstract] Forming curves are informative in the complex approach to analyzing anode-cathode processes. This is mainly because they can be regarded as a reflection of changes in the effective resistance of coatings that occur when selecting beginning conditions. Vicissitude is clearly reflected in anode-cathode microplasma processes. The stage of electrochemically forming a dielectrical film without changes begins immediately after turning on the current. With this combination of conditions, an $SiO_2$ coating is finally applied. As the forming stress increases, the number of discharges burning simultaneously decreases. At the same time their sizes increase, and the small red sparks are gradually replaced by larger white ones. Crackling is replaced by uniform noise, and the silicon on the surface is coated with an oxide film. The uniform rise in stress is mainly associated with an increase in the effective thickness of the

coating. The mass and thickness of the coating increase proportionally. Figures 6, references 5 (Russian).

UDC 541.272.1:662.94

### Electromotive Force of Electrochemical Solid Electrolyte Cells With Electrodes of Varying Catalytic Activity

*907M0093D Moscow ELEKTROKHIMIYA in Russian Vol 25 No 11, Nov 89 (manuscript received 10 Jul 85; after revision 7 Jul 87) pp 1519-1521*

[Article by A. N. Volkov, A. G. Gavrilov, and A. D. Neuymin, Institute of Electrochemistry, Ural Scientific Center, USSR Academy of Sciences, Sverdlovsk]

[Abstract] This article presents results related to the development and tests of electrochemical solid electrolyte cell-transmitters designed for calculating the content of oxygen in gases and controlling the completeness of fuel combustion. Zirconium dioxide test tubes stabilized with yttrium dioxide were used as the solid electrolyte. A porous platinum electrode was attached to the inside and supplied with air or some other gas with a known partial pressure of oxygen. The electrodes are made of porous platinum and a composite of copper oxide and silicon carbide. If there are fuel components in the gas being analyzed, they will be oxidized on the catalytic (platinum) electrode and not on the noncatalytic (composite) one, thus permitting the amount of oxygen in the gas to be calculated. The optimal operating temperature of this device was determined to be 700-850°C. Results show that the content of oxygen and components being oxidized in unbalanced gas mixtures can be accurately measured simultaneously by using electrochemical transmitters. The electrochemical characteristics of the noncatalytic electrode need to be improved to reduce the operating temperature of the transmitter and its internal resistance, which will increase accuracy, longevity, and the operational capabilities of the transmitter. Figures 3, table 1, references 2 (Western).

UDC 541.135

### Features of Electrochemical Regeneration of Mixed Layer of Ion Exchangers in Desalinization in Magnetic Field

*907M0093E Moscow ELEKTROKHIMIYA in Russian Vol 25 No 11, Nov 89 (manuscript received 14 Jun 88) pp 1526-1528*

[Article by T. A. Krasnova, Kemerovo Food Industry Technological Institute]

[Abstract] The effect of magnetic treatment on mass transport in the electrochemical regeneration of a mixed layer of ion exchangers and the feasibility of using magnetism to increase the effectiveness of the process were studied. Research was performed in a three-chamber electrodialysis device placed between two constant electromagnetic poles. A mixture of cationite in potassium form and anionite in chlorine form in a 1.4:1 ratio by volume was used. Acid and base solutions were circulated through the cathode and anode chambers from the bottom up. Layer-by-layer analysis was performed in the chamber with the mixed layer. Regeneration of the cationite and anionite was not observed following the magnetic treatment of the mixed layer without an electric current with and without water flowing through the central chamber. In the electrochemical regeneration of an ion exchanger mixture through a desalinizing circuit without water flowing, applying a magnetic field equalizes the degree of regeneration of the cationite and anionite along the height of the chamber by increasing it in the upper layers of the cell. Magnetic treatment reduces the degree of ion exchanger regeneration when water flows through the mixed layer that is in the desalinization chamber. The magnetic field has no effect on regenerating cationite in the upper layers of the chamber, while anionite regeneration does increase. Concentration polarization in the membrane-solution interface is the main source of regenerated ions in regenerating the mixed layer of ion exchangers in the desalinization chamber, and removal of the salt ions is provided mainly by ion migration (caused by the electrical field) into the electrode chambers. When applying the magnetic field, partial dehydration of the salt ions occurs and results in an increase in the effective concentration, and electrical conductivity of the solution between the grains of the ion exchangers and the ion convective mechanism of mass transport also makes its contribution to ion mass-exchange in applying the magnetic field, intensifying the process, and contributing to agitation of the solution. The latter equalizes the degree of regeneration by using the height of the desalinization chamber. The effect of magnetic treatment on the electrochemical regeneration of the cationite and anionite may be due to the fact that the magnetic field affects the properties of calcium and chlorine ions differently. The flow of water through the desalinization chamber changes the nature of the dependence of the degree of regeneration by height in connection with the removal of salt ions from the system. Magnetic treatment is recommended for the electrochemical regeneration of a mixed layer of ion exchangers in a desalinization circuit. Figures 3, references 11: 10 Russian, 1 Western.

UDC 541.138

### Electrochemical Determination of Surface of $LaNi_5H_n$ Hydride

*907M0093F Moscow ELEKTROKHIMIYA in Russian Vol 25 No 11, Nov 89 (manuscript received 30 Jul 88) pp 1535-1537*

[Article by G. V. Fedorov, R. Kh. Ibrasheva, R. G. Baisheva, V. N. Zhuravleva, L. I. Altentaller, and A. A. Michri, Kazakh State University imeni S. M. Kirov, Alma-Ata]

[Abstract] An electrochemical method of determining the true surface of a working electrode catalyst was

developed. $LaNi_5$ samples were dispersed by cathode-anode polarization and had an absorption capacity for hydrogen up to 1,200 C/g. Nickel gauze was used as the electrode, and a calculated amount of the catalyst was wrapped in it. The experiments were performed in a 7N solution of KOH at 298 K. The slope of the curve of potentials of 0.5-1.0 W remained unchanged for all amounts used, and the only electrode reaction is the formation of chemisorbed oxygen. The oxidized surface of the catalyst is completely reduced during subsequent sorption of hydrogen. A certain amount of sorbed hydrogen in the metal protects its surface from extensive, irreversible oxidation. The limiting stage of the process of chemical or electrochemical dehydrogenation of the alloy-adsorbent was calculated by using the amount of hydrogen sorbed by the electrode. The yield of hydrogen from the inside to the surface is not a limiting factor in the sum process of oxidation, and the size of the average pseudocapacity is a measure of the amount of adsorbed and absorbed hydrogen. Polarizing the electrode to 1.0 W causes irreversible oxidation of the surface. Figures 2, tables 2, references 4 (Russian).

UDC 541.138:547

## Hastening Electrochemical Synthesis of Tetraethyl Lead in Nonstandard Regimen

*907M0093G Moscow ELEKTROKHIMIYA in Russian Vol 25 No 11, Nov 89 (manuscript received 25 Aug 88) pp 1540-1542*

[Article by Yu. I. Rozin, S. M. Makarochkina, L. V. Zhitareva, and A. P. Tomilov]

[Abstract] Nonstandard electrolysis regimens are being used to improve the structure and quality of coatings, reduce the time required to charge batteries, and hasten electrochemical synthesis. The electrochemical synthesis of tetraethyl lead in a pulse regimen would increase the resulting cathode density of the current. Anode polarization of the lead cathode contributed to stable operation of the electrode, and a positive pulse sent to the cathode after a negative one decreases the abatement time of the cathode potential. The feasibility of hastening the electrochemical synthesis of tetraethyl lead when using an asymmetrical alternating sinusoid current was also studied. Even a large increase in the density of the cathode current in the negative semiperiod of the alternating component does not substantially increase the yield of hydrogen. The optimal parameters of the electrochemical synthesis of tetraethyl lead and the maximum and minimum values of the density of the cathode current were determined. Using an asymmetrical alternating sinusoid current increases the productivity of the electrolysis cell by 5.5 times. Figures 1, tables 2, references 8: 7 Russian, 1 Western.

UDC 541.135.5

## Effect of Conditions for Forming a Coating Made of Palladium Oxides on Composition and Electrochemical Activity of Anodes

*907M0093H Moscow ELEKTROKHIMIYA in Russian Vol 25 No 11, Nov 89 (manuscript received 7 Dec 88) pp 1553-1555*

[Article by V. S. Sorokendya, R. U. Bondar, Dnepropetrovsk Chemical and Technological Institute imeni F. E. Dzerzhinskiy]

[Abstract] Results are presented on calculating the effect of the scorching temperature, nature of the solvent, and the titanium and platinum base on the composition and properties of anodes with an active coating made of palladium oxide. The active coating was made by thermally dissociating aqueous and alcohol solutions of palladium chloride in air. The samples were dipped in the solutions, dried, and then scoured at 160-580°C in 20° intervals. This procedure was repeated to make five layers of the coating. Four series of electrodes were made: series 1 and 2 were titanium anodes with coatings made of aqueous and alcohol solutions of palladium chloride, series 3 were platinum anodes calcined at various temperatures, and series 4 were platinum anodes with an aqueous palladium chloride coating. The optimal temperature for forming an oxide layer on the titanium base was 420-460°C. Oxidation of the titanium base occurs at higher temperatures, thus worsening the electrochemical properties of anodes, and at lower temperatures, in which case complete transformation of palladium chloride into oxide does not occur. References 6: 5 Russian, 1 Western.

UDC 541.138.3

## Effect of Cation Nature and Concentration of Background Electrolyte on Electrical Reduction of Chloroform in 18-Crown-6-Ester

*907M0093I Moscow ELEKTROKHIMIYA in Russian Vol 25 No 11, Nov 89 (manuscript received 18 Nov 88) pp 1567-1569*

[Article by S. G. Mayranovskiy, S. Kh. Yerbekov, and R. U. Vakhobova, N. D. Zelinskiy Institute of Organic Chemistry, USSR of Sciences, Moscow; Tadzhik State University imeni V. I. Lenin, Dushanbe]

[Abstract] The effect of the cation nature and background electrolyte concentration on accelerating the electrical reduction of chloroform was studied. Polarograms were taken by using a three-electrode circuit at 25°C. Oxygen in the air was removed from the solutions being studied by passing them through argon. A kinetic prewave appears before the main wave and grows when adding gradually increasing amounts of the crown-ester to the chloroform solution in 0.1 M KCl. This causes the total height of the wave to decrease. Increasing the KCl concentration with unchanged concentrations of chloroform and the crown ester decreases the altitude of the prewave and increases that of the main wave. The potassium ions apparently compete with chloroform for the cavity of the crown ester, and this competition probably depends on the nature of the background cation. Reducing the size of the ion of the alkali metal increases its tendency to form a complex with the crown ester due to the higher intensity of the electrical field of the ion. It was noted that barium chloride greatly facilitates the formation of a complex between chloroform and the crown ester. Increasing the concentration of the crown ester shifts the prewave and the main wave to the more negative potentials. With the background salt of lithium, the greatest shift of the prewave potential with respect to the main wave potential is observed. Lithium is able to enter the cavity of the crown ester along with chloroform, unlike the other cations. Figures 4, references 9: 8 Russian, 1 Western.

UDC 541.182.3

## Distribution of Dispersed Aerosol Phase in Sleeve Filter

*907M0013A Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 9, Sep 89 pp 21-22*

[Article by V. P. Kurkin and I. K. Goryachev]

[Abstract] The distribution of the dispersed phase of an aerosol in a sleeve filter is studied for the case of long sleeves, which widely used to trap dust. The study is based on mean axial air speed and dust content values, with the assumption that these parameters change along the length of the sleeve. The mass of the dispersed phase of the aerosol is found to decrease exponentially along the length of the sleeve, which places practical limits on sleeve length. Figure 1; References: 5 Russian.

UDC 621.791.052:620.193

## New Materials for Welding of 06CrNi28MoDyTi Alloy and 03Cr21Ni21Mo4MnB Steel

*907M0013C Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 9, Sep 89 pp 26-28*

[Article by V. N. Lipodayey, K. A. Yushchenko, doctors of technical sciences, Ye. V. Loshakova, Yu. N. Kakhovskiy, and Yu. S. Sidorkina, candidates of technical sciences]

[Abstract] A new type of electrode has been developed for manual arc welding of high-alloy corrosion-resistant structural materials. This article presents a study of the resistance of the welded seam metal to intercrystalline corrosion. Good results are achieved by applying a coating based on natural potassium-sodium aluminosilicate to EK75 metal rods. This process yields good seams, easily removed slag crusts, stable arcs, and minimum spray. The new OZL-17U and OZL-37 electrodes have an austenitic structure with a dispersed $\sigma$-phase through the grain body. They have been industrially tested and are recommended for manual arc welding of steels and bimetallic structures with corrosion-resistant layers. Figures 2; References 11: 10 Russian, 1 Western.

UDC 699.715.018.841:620.193

## Corrosion Resistance of Aluminum in Concentrated Acids

*907M0013D Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 9, Sep 89 pp 28-29*

[Article by L. V. Zaypseva, E. K. Malakhova, L. A. Kiseleva, A. V. Meshcheryakov, and L. B. Berezoveskiy]

[Abstract] A study is made of the corrosion resistance of aluminum and its welded joints of high and technical-grade purity. The joints were made by manual argon-arc welding in 98.9 percent nitrogen and 99.9 percent acetic acid at 25, 50, and 80 °C. The test base was 1,000 hours. No significant difference was observed in the behavior of aluminum of technical-grade and higher purity or in its welded joints in strong nitric acid. High-purity aluminum did have a clear advantage over technical-grade aluminum in terms of resistance to intercrystalline corrosion. High-purity aluminum also has a longer life in glacial acetic acid. Figures 3.

UDC 699.15.846.221:622.279.05

## High-Strength Hydrogen Sulfide-Resistant Steel for Oil and Gas Extraction Equipment

*907M0013E Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 9, Sep 89 pp 29-31*

[Article by M. A. Kablukovskya, candidate of technical sciences, V. N. Zikeyev, doctor of technical sciences, Ye. P. Turkovskaya, A. R. Iskhakov, M. K. Starostina, candidates of technical sciences, and T. V. Serevryakova]

[Abstract] A study was made of the influence of molybdenum, vanadium, niobium, zirconium, and titanium together with boron and nitrogen on the structure, mechanical properties, and cracking resistance of chromium-molybdenum steel following normalization at 920 °C for 20 minutes, hardening at 890 °C in oil for stress relief, and high tempering at 630-700 °C for 1.5 hours with cooling in air. A new steel, type 30 Kh2MFTsA, with the following chemical composition (in mass percent) has been developed: 0.25-033 C, 0.5- 0.8 Mn, 0.17-0.37 Si, 1.4-18 Cr, 0.45-0.65 Mo, 0.05-0.15 V, 0.003- 0.08 Zr, not over 0.015 S, not over 0.025 P, and 0.01-0.06 Al. The alloy satisfies the requirements for use in new, deep, high- pressure oil wells with high hydrogen sulfide contents. Figures 3; References: 5 Russian.

UDC 621.865.8

## Robot Process Systems Using MP-9S Industrial Robot

*907M0013G Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 9, Sep 89 pp 33-34*

[Article by R. Z. Gataullin]

[Abstract] The All-Union Scientific Research Institute for Process Pump Machinery had developed several robot process systems based on the MP-9S robot. This article shows two such systems designed to automate thread rolling on pins of various sizes. One significant feature is the use of a vibrating hopper with an original design to support operation of the system for up to 4 hours. Figures 2.

UDC 541.182.3

## Distribution of Dispersed Phase of Aerosol in Bag Filter

*907M0034B Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 9, Sep 89 pp 21-22*

[Article by V. P. Kurkin and I. K. Goryachev]

[Abstract] Distribution of an aerosol flow during filtration in a bag filter depends on a feature of the operation of this type of dust-trapping apparatus. During dust-trapping in the bag filter, transport of aerosol particles to the filter surface reduces the mass flow rate along the bag. Studying the mass flow rate in long bags, which are widely used in trapping dust, is interesting from a practical standpoint. The average axial speed and dust content of the aerosol stream were used to examine the one-dimensional problem that occurs when these parameters change along the axis of the bag. Several formulas were used in solving this problem. It was concluded that the distribution of the mass of the dispersion phase of the aerosol along the bag does not depend on the time required for dust to collect but is determined by the speed of the gas stream. The distribution of the solid dispersion phase of the aerosol during filtration was measured along the height of the bag to test the conclusions made about the character of the distribution. Exponential reduction of the mass of the aerosol dispersion was established by the measurements made. In addition, the maximum length of the bag and its diameter are limited by the speed of the gas entering the bag and its speed of filtration. Figure 1, references 5 (Russian).

UDC 66.074:631.859.13

## Refining Gases in Ammonia Phosphate Fertilizer Production

*907M0034C Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 9, Sep 89 pp 22-23*

[Article by Z. V. Chagina, candidate of technical sciences, Ye. B. Konyukhova, candidate of chemical sciences, F. Ye. Dubinskaya, candidate of technical sciences, A. F. Epshteyn, and S. B. Goncharov]

[Abstract] The waste gases from ammonia phosphate fertilizer production contain fluoride, ammonia, and ammonia phosphate fertilizer dust, which are formed in various apparatuses. The content of gaseous ammonia and dust can be reduced by using a BGS apparatus in which the waste gases and gaseous impurities are refined from the dust in two sequential one-step absorbers. The first absorber traps dust and ammonia, which are then returned to production, and the second traps fluoride. Research showed that the effectiveness of trapping ammonia was 90 percent in one-step refining, while that of the dust was 94.3 percent. A cyclone dust separator demonstrated a 73-77 percent efficiency in refining gases that form in fluidized bed apparatuses from dust. The ARKN apparatus was not as effective as the others in trapping gases and dust, and it was therefore recommended for use in conjunction with other apparatuses. Figures 2, table 1, references 3.

UDC 66.067.38

## Using Ultrafiltration and Complex Formation To Purify Stagnant Waters on Surfactants

*907M0065J Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 89 pp 683-686*

[Article by N. V. Kochergin, U. B. Besterekov, A. A. Kamshibaev, and K. Zh. Abdiev]

[Abstract] The feasibility of separating solutions that contain surfactants in concentrations less than the critical micelle formation concentration by using the complex formation and the ultrafiltration method was discussed. Adding complex-forming polyelectrolyte makes the bifilar molecules of the surfactant larger due to micelle formation as well as formation of the surfactant-polymer polycomplex. The ratio of the component being removed and the complex former affects the complex formation and ultrafiltration processes. A sharp drop in the effectiveness of separation accompanied by an increase in micelle surfactant in the solution support the hypothesis that surfactant in solution with a surplus of polydimethyl diallyl ammonium chloride has two forms. Increasing the operating pressure in the process of ultrafiltration of the surfactant-polymer polycomplex does not reduce the amount of detergent extracted like with ultrafiltration of a binary polymer-metal complex. The problem of refining the concentrate in the complex formation and ultrafiltration process is discussed. It is both ecologically and economically effective. Solutions with concentrated surfactants and polydimethyl diallyl ammonium chloride can be used to stabilize active additives, thus increasing the strength of concrete. This method is highly recommended for purifying solutions that contain surfactants. Figures 5, references 11: 6 Russian, 5 Western.

UDC 66.074.34:661.635.213

## Waste-Free Technology of Ammonia Phosphate Fertilizer Production

*907M0065A Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 89 pp 666-668*

[Article by F. Ye. Dubinskaya, A. F. Epshteyn, Z. V. Chagina, A. D. Mitrofanov, and S. B. Goncharov]

[Abstract] The need for reducing and recycling industrial wastes and means of doing so are summarized. A number of devices for trapping wastes and methods of improving their productivity are suggested. Figures 2, table 1.

UDC 661.842.002.237

## Producing Synthetic Calcium Fluoride From Fluorosilicic Acid

*907M0065B Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 89 pp 668-670*

[Article by V. V. Tumanov, V. I. Rodin, V. A. Zaytsev, L. P. Belova, T. A. Zyrina, and T. A. Sokolova]

[Abstract] Experimental and industrial results of producing calcium fluoride by using a high-temperature method are presented. The conversion of natural chalk into calcium fluoride by using ammonium fluoride was discussed. Another method of refining oxygen, nitrogen, carbon dioxide, etc., was evaporative absorption with solutions of phosphoric acid. Absorption of a gas containing water vapor, ammonia, and nitrogen was studied. Research demonstrated that the high-temperature method of synthesizing calcium fluoride is fast and is therefore suggested for refining fluorosilicic acid. During the experiment, structural problems with the scrubbing and dust trapping systems were discovered, and the systems are being improved. The end product was tested as a substitute for naturally occurring fluorite concentrate to be used in casting steel. The use of calcium fluoride may be expanded into other industrial fields. Figures 2, tables 3, references 4 (Russian).

UDC 631.893.002.237

## Studying Physical and Chemical Properties of Nitrophosphate Fertilizer

*907M0065C Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 89 pp 671-673*

[Article by Z. A. Tikhonovich, A. Ya. Syrchenkov, V. F. Kabanov, A. I. Gripas, and I. M. Gurman]

[Abstract] Results are presented from studies that culminated in searching for ways of improving the physical and chemical properties of nitrophosphate fertilizer. Experiments were conducted on the effect of dispersion of nitrophosphate fertilizer produced by two different factories on its compaction. Special additives to the fertilizer that modify the surface of the granules were tested. The effectiveness of modifying nitrophosphate fertilizers with hydrophobic powders depends on their moisture and dispersion. Figure 1, tables 3, references 6 (Russian).

UDC 661.632.12.001.5

## Physical Properties of Diammonium Phosphate

*907M0065D Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 89 pp 674-676*

[Article by I. M. Kuvshinnikov, A. V. Kononov, V. A. Frolkina, S. A. Troitskaya, M. P. Lobacheva, and L. I. Yevdokimova]

[Abstract] Detailed research of the physical and mechanical properties of diammonium phosphate was conducted to assess its quality. Diammonium phosphate samples produced by a single factory for several years were tested for moisture content and compactibility. Fertilizer samples with varying amounts of moisture were stored in bulk and in packaged form for six months and then tested. Recommendations were made on drying the fertilizer in order to ensure the best results. The grade of diammonium phosphate tested was determined to be a high-quality fertilizer according to its physicochemical and physicomechanical properties. The diammonium phosphate moisture content should be limited to 1.5 percent. Figure 1, tables 2, references 3 (Russian).

UDC 661.257.66.074.32

## Using Titanium To Refine Sulfuric Acid of Nitrogen (III) Oxides

*907M0065E Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 89 pp 676-677*

[Article by V. S. Epifanov, N. A. Maskaeva, and M. V. Lobova]

[Abstract] The properties of iron and its sulfate oxide were researched for the feasibility of using them as reagents to denitrate sulfuric acid and develop and implement one means of product conditioning. Results of researching the process of refining sulfuric acid of nitrogen (III) oxides by using titanium were studied. The speed of the process increases linearly with an increase in nitrogen (III) oxide content and the surface area of titanium. It was demonstrated that sulfuric acid also oxidizes titanium. The product becomes like battery acid with further drying of the sulfur dioxide from sulfuric acid. It was shown that titanium may be used for stripping sulfuric acid and oleum of nitrogen oxides to yield a high-quality product. Figures 2, table 1, references 5 (Russian).

UDC 542.91:546.74:537.311.3

### First Electricity-Conducting Cation Bis-Dithiolene Complexes of Ni and Au

*907M0022F Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 9, Sep 89 (manuscript received 1 Jun 89) pp 2158-2159*

[Article by E. B. Yagubskiy, A. I. Kotov, L. I. Buravov, A. G. Khomenko, V. E. Shklover, S. S. Nagapetyan, Yu. T. Struchkov, L. Yu. Ukhin, and L. V. Vetoshkina, Chemical Physics Institute imeni Semenov, USSR Academy of Sciences, Chernogolovka, Heteroorganic Compounds Institute imeni A. N. Nexmeyanov, USSR Academy of Sciences, Moscow]

[Abstract] Cation complexes of Ni and Au with 5,6-dihydro-1,4- dithiine-2,3-dithiol (H2dddt) that conduct electricity were synthesized. Salts of [Au(dddt)2]$_+$ and [Ni(dddt)2]3 (BF4)2(I) were produced by electrochemical oxidation of the respective neutral complexes. Cation salts are of great interest as they are metal-complex analogues of organic superconductors. References 6: 1 Russian, 5 Western.

UDC 539.211+537.226

### Reconstruction of Surface of Silicon and Germanium (001)

*907M0028D Moscow POVERKHNOST: FIZIKA, KHIMIYA, MEKHANIKA in Russian No 9, Sep 89 (manuscript received 16 Jun 88; after revision 15 Jul 88] pp 52-54*

[Article by E. E. Tornau and V. Ye. Zubkus, Semiconductor Physics Institute, LiSSR Academy of Sciences, Vilnyus]

[Abstract] The condition of the surface of Si and Ge (001) with free bonds of atoms is metastable. It becomes stable when neighboring atoms approach one another and form a coupled diatomic complex-dimer Si- Si (Ge-Ge). Phase transitions to reconstruction phases occur following a temperature reduction on Si and Ge (001) surfaces with various deviations of the axis of the dimer to the surface. The parameters of the model hamiltonian used in this study were assessed, and it was determined that dipole interactions make the main contribution to the size of the interaction between the dimers. Figures 2, references 8.

UDC 621.315.592;539.211

### Temperature Transitions of the Superstructure on 100 GaAs and InA Surfaces Grown by Using Molecular-Radiation Epitaxy Method

*907M0028E Moscow POVERKHNOST: FIZIKA, KHIMIYA, MEKHANIKA in Russian No 9, Sep 89 (manuscript received 11 Jul 88; after revision 28 Sep 88) pp 156-68*

[Article by V. V. Preobrazhenskiy, D. I. Lubishev, and V. P. Migal, Semiconductor Physics Institute, Siberian Department USSR Academy of Sciences, Novosibirsk]

[Abstract] The temperature relation of surface structures on 100 GaAs and InAs and the precise measurement of their transition temperatures were studied. Research was conducted by using fast electron diffraction on the surfaces of epitaxial films grown on substrates of semi-isolated 100 GaAs. The experimental technique and equipment used provided homogeneity of the temperature throughout the surface of the substrate, precise measurement, and changing of the surface temperature. A homoepitaxial film was grown on a substrate surface at 550° to reproduce the results. The transition of one surface structure into another was discussed, and the coincidence of temperature transitions in two directions indicated the existence of a number of substrate structures. The surface structures of InAs were observed on heteroepitaxial films grown on GaAs at 515°. InAs has the same series of surface structures as GaAs but fewer temperature transitions. A number of basic structures were found on 100 GaAs and InAs surfaces, and the precise temperature at which they appear was determined. The results obtained can be used as reference points for calculating surface temperatures of 100 GaAs and InAs in a superhigh vacuum. Figure 1, table 1, references 6 (Western).

UDC 661.862.369(088.8)

### Studying Reaction of Aluminum Fluoride and Sodium Hydroxide

*907M0033A Yerevan ARMYANSKIY KHIMICHESKIY ZHURNAL in Russian Vol 42 No 5, May 89 (manuscript received 12 Nov 87) pp 284-88*

[Article by Z. A. Gevorkyan, S. S. Karakhanyan, S. A. Sagarunyan, and Ye. M. Khechumyan, Institute of General and Organic Chemistry, ArSSR Academy of Sciences, Yerevan]

[Abstract] Experiments on the interaction of aluminum fluoride and sodium hydroxide were conducted to reveal the mechanism of the leaching of individual useful components. Research was conducted in a thermostatic three-neck flask with a stirrer and reverse condenser. Sodium hydroxide and aluminum fluoride were mixed in the flask that had a filtering attachment connected to a vacuum pump. The content of fluoride ion and the degree to which the reaction proceeded were calculated. Preliminary experiments were conducted by varying the temperature, time, and mixing speed. Results showed that within the indicated limits of mixing speeds and at 40°, the reaction rate had no relation to the mixing speed. The reaction rate is a result of the slowest stage of the process, i.e., the dissolution of aluminum fluoride into sodium hydroxide. Experiments were also conducted on the relationship of the degree to which the reaction occurs to the temperature at a constant time of the phase contact. It was shown that the reaction is completed at 180° and with 45 minutes of phase contact. Figures 5, table 1, references 5 (Russian).

UDC 541.124.7+542.944.03+66.040.27

## Transformation of Anatase into Rutile Under Effect of Chain Gas Reaction of Oxidizing Natural Gas

*907M0033B Yerevan ARMYANSKIY KHIMICHESKIY ZHURNAL in Russian Vol 42 No 5, May 89 (manuscript received 23 Nov 87) pp 332-34*

[Article by A. A. Mantashyan, G. Ts. Varderesyan, and I. A. Davtyan, Yerevan Polytechnic Institute imeni K. Marks]

[Abstract] Reducing the transformation point of other structural forms of titanium oxide into rutile to produce high-quality manufactured products is an important problem. Rapid transformation of solid inorganic compounds was observed under the influence of chain gas reactions. It served as the basis for studying the feasibility of reducing or transforming structural forms of titanium oxide under similar conditions. Experiments were conducted in flowing conditions in a heated reaction vessel with powdered titanium oxide. It takes 1.5 hours for the anatase in titanium oxide to be transformed into rutile when using a methane-air jet at 700-900°. Complete transformation of anatase into rutile occurs at 900°. Figure 1, table 1, references 6: 4 Russian, 2 Western.

UDC 666.11.01

## Solubility of Halides of Heavy Metals in Glass

*907M0035A Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 15 No 4, Jul-Aug 89 (manuscript received 24 Dec 87) pp 520-25*

[Article by M. Myuller, D. Pfayfer, A. Krilts, and V. Fogel, Otto Schott Institute, Chemistry Section, Friedrich Schiller University, Jena]

[Abstract] A structural model of the incorporation of $X^-$ ions into the glass lattice was examined by using alkali borate glasses activated by CuX crystals. Concepts of the kinetics of the growth of separating crystals are also discussed. Research was conducted on glasses activated with a combination of halides and heavy metals—$Cu(II)/Cd(II)/Sn(II) + Cl^-$, $Br^-$, $Cu(I)/Sb_2O_3/Sn(II) + Cl^-$. The molecular structure of the original glass affects the content of the components that enter into it, and it is easier to incorporate heavy metals than halides. The $BO_{3/2}$ groups that compose the boroxol ring are transformed into tetraborate or diborate structural units containing $BO_{4/2}$ complexes. Bonds with $BO_{3/2}$ groups are weaker than those with $BO_{2/2}O^-$ groups. The probability of dissolving halide ions into glass is greater in glasses that have a higher-oxide modifier and $BO^-_{4/2}$ group content, and the incorporation of halide ions into the glass lattice can be controlled by changing the concentration of $BO^-_{4/2}$ groups capable of transformation. Oxidation and evaporation are the main cause of loss of halide and heavy metal ions. The content of halide remaining in the glass is proportional to the concentration of $BO^-_{4/2}$ groups. At the same beginning molecular content in a melt, more chloride than bromide will be retained. Glasses with high basicity are especially suited for incorporating halides, but they still do not have good photochromic properties. This can only be compensated for by adding fluoride ions. Photochromic properties can be controlled by using the optimal conditions of thermal processing. Based on the proposed structural model for describing the incorporation and isolation of components of heavy metals and halides, the synthesis of the respective photochromic glasses of the NaBAlSi system can be planned. The chemical individuality of the components and their effect on the molecular structure of the glass in simple and complex glasses needs to be considered. Figures 5, tables 2, references 14: 3 Russian, 11 Western.

UDC 666.112.2:535.212:539.12.043

## Photostimulated Recombination of Hole Dye Centers in Silicate Glasses

*907M0035B Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 15 No 4, Jul-Aug 89 (manuscript received 21 Jan 88) pp 526-32*

[Article by L. B. Glebov, V. G. Dokuchayev, M. A. Petrov, and G. T. Petrovskiy]

[Abstract] A number of glasses with the formula $22Na_2O\cdot 3CaO\cdot 75SiO_2$ were studied. Iron was added to some of the glasses while oxidative or reductive synthesis conditions were created by bubbling the glass melt with oxygen or ammonia. Gamma radiation at room temperature was used to make dye centers in the glasses. The effect of low-energy optic radiation on radiation dye centers in sodium silicate glasses was studied. Measurements showed that reduction of dye center absorption throughout the spectrum studied occurs due to optic radiation of all wavelengths being used. Detailed measurements of absorption spectra in time were made to obtain additional information about the anisotropy of dye center absorption. Spectra are presented of the parallel and perpendicular components of absorption that correspond to radiation time. Glasses with electron acceptors and donors added to them were studied to ascertain which dye centers were responsible for the perpendicular growth of the absorption component at 2.8 eV, and it was determined that the dye centers already present in the glass were responsible for the increase in absorption at 2.8 eV. Linearly polarized radiation at 2.8 and 3.7 eV increases absorption of radiation with polarization that is orthogonal to that of the activating radiation. Stimulating the hole centers with light causes depolarization of the holes. The delocalized holes are seized in the anisotropic state and participate in recombination with electron centers. Figures 3, references 15: 14 Russian, 1 Western.

UDC 553.637+666.01+543.42

## Studying Niobium Borate Glasses by Vibrational Spectroscopy

*907M0035C Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 15 No 4, Jul-Aug 89 (manuscript received 13 Nov 86) pp 533-38*

[Article by Ye. V. Kolobkova, Leningrad Technological Institute imeni Lensovet]

[Abstract] BaO-$B_2O_3$-$Nb_2O_5$ glass systems were studied. Glasses of various series based on barium di- and metaborate were used to measure vibrating spectra. It was shown that niobate tetrahedrons probably form in the glass network since the high-frequency band that appears coincides with the vibration of the $\nu_1$ group $(NbO_4)^{3-}$ in $YNbO_4$, and the high-frequency bands in the glass spectrum are similar to bands of the valence oscillating groups $(NbO_4)^{3-}$ in $LaNbO_4$. The vibration of heavily distorted niobate octahedrons makes the most substantial contribution to the intensity of the band at 690 $cm^{-1}$. The reduction in the vibrating frequency of $\nu1NbO_4$ with an increasing concentration of $Nb_2O_5$ possibly indicates some reduction in the interaction of borate and niobate structural units in the glass network that is caused by the transition of barium ions from a borate component into a niobate component and by the formation of a number of Nb-$O^-$ bonds. The effect of adding niobium oxide to the borate component of the glass network was thoroughly discussed. It is believed that a reduction in band intensity occurs following the addition of niobium oxide in a process of dissociating the ring groups. At small concentrations of $Nb_2O_5$, niobium is tetrahedral in BaO-$B_2O_3$-$Nb_2O_5$ glasses, and niobate tetrahedrons and borate structural groups form a uniformly mixed network. Niobate octahedrons arise with an increase in $Nb_2O_5$ concentrations. The change in the vibrating frequencies of $NbO_6$ groups shows distortion in the glass caused by articulation of the edges among themselves. Adding niobium oxide to barium borate glasses reduces the content of tetravalent boron and increases that of trivalent boron. Figures 3, references 13: 5 Russian, 8 Western.

UDC 541.15:542.08

## Studying Short-Lived Defects in Quartz Glass by Using Pulse Sources

*907M0035D Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 15 No 4, Jul-Aug 89 (manuscript received 29 Jan 86) pp 539-43*

[Article by V. I. Zolotarevskiy, D. M. Zorin, S. G. Titov, A. V. Vannikov, G. M. Zimina, V. F. Solinov, and V. V. Panteleyeva, Electrochemistry Institute imeni A. N. Frumkin, USSR Academy of Sciences, Moscow]

[Abstract] Studying short-lived radiation defects in glass matrices requires developing devices combining pulse sources for ionization with respective (spectral, electron paramagnetic resonance, nuclear magnetic resonance, electrometric, etc.) recording instruments. Optical changes in the glass matrices were studied by using spectral measurements of the wavelengths from 220-1700 nm. Cylindrical quartz glass samples 10 mm in diameter and 30 mm long were used. The absorption spectra of short-lived defects formed by accelerated electrons in quartz glass were studied. A device for studying short-lived radiation-induced defects by speed spectrophotometry was developed. Dissociation of complex spectra was performed. Bands with maximums at 550 and 800 were identified as belonging to local electrons stabilized in traps at varying depths. Figures 2, references 14: 12 Russian, 2 Western.

UDC 666.113.711'27'18

## Magnetic Susceptibility of Borophosphate Glasses Containing Cobalt and Manganese Ions

*907M0035F Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 15 No 4, Jul-Aug 89 (manuscript received 24 Dec 87) pp 565-71*

[Article by A. A. Arkhipov, Yu. M. Vulfson, L. A. Laukmanis, and A. Ye. Petrov, Physics Institute, LaSSR Academy of Sciences, Riga]

[Abstract] Borophosphate glasses containing cobalt and manganese ions were studied. These two ions were selected because cobalt normally has a $2^+$ valency, while that of manganese varies, which makes it possible to check the valent state of 3d ions. The magnetic value measured was the specific magnetic susceptibility of X, which was measured in a vibration magnetometer at 77-300 K in fields up to 15 kE. CuO, MnO, ammonium phosphate, and boric acid were the substances used to produce the CoO(MnO)-$B_2O_3$-$P_2O_5$ glasses, and synthesis was conducted in corundum crucibles at a maximum temperature of 1,350°C. The melt was quickly cooled, and the experimental dependencies of X(T) were analyzed within the framework of approximating the molecular field. The behavior of cobalt ions in glasses indicates that they are both tetrahedral and octahedral. As the CoO content increases, more $Co_2^+$ ions enter the glass-forming structure, thus increasing the chemical stability of the glass. Data indicate that clustering in manganese glasses is much stronger than in cobalt glasses, beginning with the very lowest concentration of manganese ions. Glasses made of CoO(MnO)-$B_2O_3$-$P_2O_5$ between 77-300 K are paramagnetic with exchange interaction between manganese and cobalt ions that are anti-ferromagnetic. Cobalt ions may be modifiers or become part of the glass-forming structure. In MnO-$B_2O_3$-$P_2O_5$ glass systems, a strong exchange interaction is observed among manganese ions due to the formation of clusters consisting of 3-5 ions. Figures 4, references 19: 14 Russian; 5 Western.

UDC 666.11.01

## Alkaline Borophosphate Glass as New Base for Ion-Exchange Alteration in Refraction Index

*907M0035G Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 15 No 4, Jul-Aug 89 (manuscript received 12 Sep 88) pp 616-19*

[Article by V. Ya. Livshits, Ye. A. Marchuk, N. K. Mokin, M. G. Potalitsyn, and O. S. Shavelev, Leningrad Paper-and-Pulp Industry Technological Institute]

[Abstract] Gradient glasses were produced based on an $R_2O$-$B_2O_3$-$P_2O_5$ system with ion exchange from melts of salts and diffusion of sodium and lithium cations into a homogenous glass. The ion exchange properties of glasses in solutions at room temperature as well as in melts of lithium, sodium, and potassium at the melting point of glass are determined by the structural position and energy state of alkaline cations in glass. Formation of a continuous borophosphate lattice and lack of trivalent boron and boroxol rings are typical for a $30R_2O \cdot 10B_2O_3 \cdot 30P_2O_5$ glass structure. A homogenous glass of $15Li_2O \cdot 15Na_2O \cdot 40B_2O_3 \cdot 30P_2O_5$ was synthesized to make a gradient glass and perform ion exchange. The alkaline borophosphate glass with low Tg value has a higher diffusion value because of its lower viscosity than alkaline aluminoborosilicate glasses at the same temperature. Figure 1, references 9 (Russian).

UDC 535.349:161.6

## Thermoluminescence of Irradiated Phosphate Glasses Activated by Rare Earth Activators

*907M0089A Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 15 No 5, Oct-Nov 89 (manuscript received 15 Mar 88) pp 666-674*

[Article by S. A. Postelnikov, All-Union Geological Information Systems Scientific Research Institute]

[Abstract] Experiments were conducted to study the thermoluminescence spectra, the form of the thermoluminescence curves, and optical and electron paramagnetic resonance spectra of irradiated glasses activated by the rare earth activators terbium and samarium. $La(PO_3)_3$ glasses were synthesized with an activator concentration up to 5 molecular percent. The terbium in the phosphate glasses is a good hole trap that prevents the formation of $PO_4$2- centers and reduces the intensity of electron paramagnetic resonance signals from hole centers of $PO_4$2- as well as $PO_3$2- electrons. The glasses with samarium were the only ones in which the $Mn^{2+}$ ions were not lighted, probably because $Sm^{3+}$ is an electron trap, whereas the other activators used in glasses are hole traps. The phototransport of holes with $Tb^{3+}$ centers was revealed when stimulated in their absorption bands. The thermoluminescence of $Mn^{2+}$ depends slightly on some postradiation processes in the glass and may only be connected to the immediate surroundings of this ion. The thermoluminescence of $Tb^{3+}$ is electron recombination luminescence where radicals play the role of electron centers. The thermoluminescence of $Sm^{3+}$ occurs in the hole recombination process where $PO_4$2- centers are the hole "suppliers." The thermoluminescence of $Tb^{3+}$ has two maximums at 120° and 230°C in the phosphate glasses and is caused by an electron recombination process in the $Tb^{3+}$ centers. The thermoluminescence of $Sm^{3+}$ has its maximum at 230-250°C and is hole recombination luminescence that occurs in the thermal destruction of $PO_4$2- centers. At low concentrations of samarium, there is a low-temperature maximum at 120°C in the thermoluminescence curve that is associated with the resonance transmission of electron recombination energy from the $PO_4$2- centers to $Sm^{3+}$ ions. Figures 5, references 18 (Russian).

UDC 666.11.01

## Mechanics of Cutting Glass Slivers

*907M0089B Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 15 No 5, Oct-Nov 89 (manuscript received 15 Sep 1986) pp 739-743*

[Article by B. I. Pokrass, A. V. Boyko, L. N. Karpenko, and S. E. Umanskiy, All-Union Research and Design Construction Institute on Automating Factories for the Construction Material Industry, Institute of Strength Problems of the UkSSR Academy of Sciences, Kiev]

[Abstract] In order to improve the process of cutting glass slivers it is necessary to have a clear concept of its mechanism and the effect of factors such as size and distribution of technological stresses on the effectiveness of the process. The cutting process is determined by the interaction of cracks in the slivers and the field of technological stresses. The types of cracks that appear when cutting glass and the stresses involved were discussed. The effect of various factors on the coefficients of stress intensities and the effect of the movement of cracks on the distribution of residual stresses in the glass-cutting process were revealed, and the nature of the effect of technological stresses on the quality of cutting was established. Figures 4, references 5: 3 Russian, 2 Western.

UDC 666.112.7

## Optical Constants and Density of Potassium Borosilicate Glasses

*907M0089C Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 15 No 5, Oct-Nov 89 (manuscript received 25 April 88) pp 758-760*

[Article by V. V. Akimov, All-Union Research Institute of Light Sources imeni A. N. Lodygin, Saransk]

[Abstract] The refractive index, average dispersion, and density of 83 potassium borosilicate glasses with a constant ratio of components were studied. The mixture for cooling the glasses was composed of raw materials used for making optical glasses. All the glasses were annealed

at 552°C for 3 hours. The optical constants were calculated at room temperature on a refractometer for the refractive index, average dispersion, and density. The diffuse extremums on the curves indicate some thermal dissociation of the tertiary compound. Tables 1, references 7 (Russian).

UDC 539.213

## Reaction of Components and Critical Rates for Cooling Melts of $As_2S_3$-$P_2S_5$ System

*907M0089D Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 15 No 5, Oct-Nov 89 (manuscript received 26 April 88) pp 761-763*

[Article by A. S. Tveryanovich, Ye. Yu. Turkina, and M. S. Gutenev, Leningrad State University]

[Abstract] The phase diagram of a melt of the system $As_2S_3$-$P_2S_5$ was studied, and the concentration dependence of the glass-forming ability was also determined. The samples were synthesized from elements of semiconducting purity by vacuum smelting in quartz ampules. The absolute value of the critical cooling rate of the $As_2S_3P_2S_8$ classifies it as a good glass former. It was also demonstrated that $As_2S_3P_2S_8$ is a congruently melting compound that is relatively resistant to dissociating in the melt. Figures 2, tables 1, references 9: 4 Russian, 5 Western.

UDC 546.34'185:54-161.6

## Relative Strength of P-O Bonds in Glass-Forming Lithium Polyphosphates by Using Raman Spectroscopy Data

*907M0089E Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 15 No 5, Oct-Nov 89 (manuscript received 12 May 88) pp 764-766*

[Article by V. A. Sinyayev and L. V. Levchenko, Institute of Chemical Sciences, KaSSR Academy of Sciences, Alma-Ata]

[Abstract] The relative strength of P-O bonds in lithium polyphosphate molecules was assessed by using lithium polyphosphate glasses with varying relative contents of oxides of lithium and phosphorus. Adding diphosphate to a middle $PO_4$ group causes the formation of triphosphate, which weakens the P-O bonds in the outer $PO_4$ tetrahedron. A similar action for triphosphate results in tetraphosphate and further weakening of P-O bonds in $PO_4$ groups. Differences in the strength of P-O bonds in polyphosphate molecules may be expressed in the deformation of $PO_4$ tetrahedrons from which these molecules are built. Because strong bonds are shorter, it is expected that the oxygen atoms of the middle $PO_4$ groups would be closer to phosphorus atoms than the other two and that the outer $PO_4$ tetrahedra of polyphosphate molecules would be larger than the middle ones. Figures 2, references 12: 7 Russian, 5 Western.

UDC 539.213.2:535.211

## Kinetics of Restoring Transparency of Quartz Glass After Laser Pulse

*907M0089F Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 15 No 5, Oct-Nov 89 (manuscript received 31 May 88) pp 766-769*

[Article by N. Ye. Kask, G. M. Fedorov, and D. B. Chopornyak, Nuclear Physics Scientific Research Institute, Moscow State University]

[Abstract] The absorption of quartz glass at temperatures up to 3,800 K was studied. At room temperature, quartz glass has a low absorption coefficient in the wavelength of a neodymium laser; therefore, a foil was pressed against the sample to heat the glass to high temperatures and ignite an optic discharge. Expansion of the absorption band is due to electron-phonon interaction as well as to dynamic effects in liquid that cause the nonequivalence of the angles of the silico-oxygenous disordered grid. Adding alkaline metals to the glass weakens the silico-oxygenous framework and decreases the activation energy for forming point absorption centers on alkaline-silicate glass. Results show that in silicate glass melts there is a phase transition caused by the interaction of point centers. Effective intercenter interaction decreases the interatomic potential and causes thermodynamic instability of the medium, thereby increasing the concentration of absorption centers. Figures 2, table 1, references 9: 7 Russian, 2 Western.

UDC 546.289:666.11.01

## Electrical Conductivity of Chalcogenide Glasses Containing Lead

*907M0089G Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 15 No 5, Oct-Nov 89 (manuscript received 25 July 88) pp 783-786*

[Article by A. V. Albegova and Z. U. Borisova, Leningrad State University]

[Abstract] The electrical conductivity of chalcogenide glasses containing lead was studied. The maximum amount of lead that can be added to a glass system is 23 percent (it is added to the Ge-Se system). $PbAs_2Se_4$ is a compound that is not very stable thermally, that melts incongruently, and that is found at 375- 475°C. Keeping the melts at 400-450°C for 4 hours helps the glass arsenic selenides react with lead, thus increasing the content of lead in the As-Se glass systems. In proportion to the increase of PbSe in $As_2Se_3$, its density steadily increases in a linear manner, while the temperature remains unchanged. The parameters of the electrical conductivity of $As_2Se_3$-PbSe glass sections changes less steadily. A dramatic increase in conductivity is noted with an increase in the PbSe content, whereas the activation energy decreases. The electrical conductivity of the Ge-Se- Pb glass systems was researched by using three sections: $GeSe_{1.5}$-PbSe, $GeSe_2$-PbSe, and $GeSe_3$-Pb. The

$GeSe_{1.5}$-PbSe and $GeSe_2$-PbSe glasses were homogenous up to a 500-fold increase. $GeSe_3Pb_x$ glass with a low lead content had a liquation, microheterogenous structure. Glass was produced only from the $GeSe_2$-PbSe section melts that had a lead content in excess of 18 atomic percent, while melts with a lesser content were either partially or completely crystallized. A sharp increase in the conductivity and activation energy for electrical conductivity when 5-7 atomic percent lead is added to $GeSe_{1.5}$ in the Ge-Se-Pb system was noted, but adding up to 20% more lead had practically no additional effect. For $GeSe_3Pb_x$, the peak of the electrical conductivity activation energy is found in glasses containing 20-22 atomic percent lead. The effect of lead on the electrical conductivity of Ge-Se glass systems substantially differs from that of lead and other metals on the electrical conductivity of chalcogenide glasses. An increase in the copper content of vitreous melts increases conductivity and decreases the activation energy. Adding lead to vitreous Ge-Se glasses increases the conductivity. When the lead content reaches its maximum, the electrical conductivity activation energy remains unchanged or increases. Figures 2, tables 2, references 7: 5 Russian, 2 Western.

UDC 537.622.3+541.183.56

## EPR Study of $SbF_5$ Intercalation Into Highly Oriented Pyrolytic Graphite

*907M0109E Moscow KHIMICHESKAYA FIZIKA in Russian Vol 8 No 12, Dec 89 (manuscript received 24 Nov 88 pp 1680-1683*

[Article by A. M. Ziatdinov, A. K. Tsvetnikov, N. M. Mishchenko, and V. Yu. Glushchenko, Institute of Chemistry, USSR Academy of Sciences, Vladivostok]

[Abstract] Under specific reaction conditions it is possible to introduce (intercalate) various foreign atoms and molecules into the interlayer space of graphite in the area of the van der Waals' forces. This results in the formation of a new product, namely, an intercalated graphite compound (IGC) consisting of alternating hexagonal layers of graphite and layers of "guest" atoms or molecules. In the present work EPR methodology was used to observe discrete acts of the insertion of $SbF_5$ molecules into a film of highly oriented pyrolytic graphite (HOPG). On the basis of the changes observed over time, two mechanisms of the insertion of $SbF_5$ molecules into HOPG could be postulated: a slow diffusion through the face of the crystal parallel to the c axis along the entire sample and relatively rapid discrete acts of the formation of individual intercalate layers. It has been hypothesized that the latter are initiated by electrostatic interactions resulting from the presence of adsorbed intercalate layers on exposed facets containing $SbF_5$- ions that generate a rapidly quenched charge density wave. Figures 2; references 8: 1 Russian, 7 Western.

UDC 537.5

## Front Spread of Thermooxidative Destruction of Polymer Stimulated by low Current Surface Charge

*907M0109F Moscow KHIMICHESKAYA FIZIKA in Russian Vol 8 No 12, Dec 89 (manuscript received 22 Dec 88 pp 1684-1690*

[Article by N. V. Yevtukhin, A. V. Savelyev, A. D. Margolin, and V. M. Shmelev, Institute of Chemical Physics imeni N. N. Semenov, USSR Academy of Sciences, Moscow]

[Abstract] Experimental and theoretical results were reported of the studies of the distribution patterns of thermooxidative destruction (carbonization) fronts on the surface of polymers that occurred under the influence of low-current surface charges. Such patterns, which are characterized by the formation of carbon channels, may occur on soiled or wet surfaces of electroinsulating materials in relatively weak electric fields. Both regular and dendritic (tree-shaped) front structures of the carbonization spread were observed. The range of the front spread was analyzed with consideration of additional Joule heat generation in the reaction zone. Figures 6; references 7: 2 Russian (1 by Western authors), 5 Western.

UDC 541.123:546.26

## Calculations of Thermodynamic States Behind a Shock Wave and During Isoenthropic Spread of Heterogeneous Mixtures

*907M0109G Moscow KHIMICHESKAYA FIZIKA in Russian Vol 8 No 12, Dec 89 (manuscript received 16 Jan 89 pp 1691-1701*

[Article by G. A. Adadurov, S. A. Gubin, V. V. Odintsov, and S. S. Sergeyev, Moscow Physics Engineering Institute]

[Abstract] Thermodynamic modeling results have been reported of the behavior of heterogeneous mixtures of liquefied gasses (He, $H_2$, $N_2$, and $O_2$) with graphite in thermal (identical phase temperatures), mechanical (identical phase rates), and possibly chemical equilibrium in a shock wave and in the ensuing discharge. This review-type article covered four subtopics: the methodology of thermodynamic calculation of the states behind the falling shock wave and during isoentropic spread, calculation results of the shock wave parameters in heterogeneous mixtures of carbon condensed with cryogenic mixtures, calculation results of the isoentropic discharge of the shock- compressed heterogeneous mixtures, and the effect of chemical reactions of the heterogeneous mixture components on the parameters of shock waves and isoentropic discharge of the products. The following conclusions were drawn: the temperature of a shock-compressed heterogeneous mixture increases with increased intensity of the wave and the quantity of cryogenic liquid. The highest temperatures are reached for mixtures of light liquefied gasses. The temperature of the initiation of graphitization increases with an increase in shock wave pressure and the share of liquefied gasses

in the mixture. The final product temperature increases with the growth of the intensity of the shock wave but decreases with increased quantity of cryogenic liquid in the mixture. Due to the chemical reactivity of the components, the temperature of the ternary mixture nitrogen-oxygen-carbon increases behind the shock wave, but the temperatures of the final products behave randomly. Figures 7; references 18: 9 Russian (1 by Western author), 9 Western.

UDC 541.127:542.943.7:547.592.2

## Determination of Interionic Distances in Cobalt-Containing Polymer Catalysts by Spin Label Method

*907M0109H Moscow KHIMICHESKAYA FIZIKA in Russian Vol 8 No 12, Dec 89 (manuscript received 28 Jun 88 pp 1715-1720*

[Article by A. V. Nikitin, S. A. Maslov, and V. L. Rubaylo, Institute of Chemical Physics imeni N. N. Semenov, USSR Academy of Sciences, Moscow]

[Abstract] Cobalt-containing polymers are excellent catalysts for liquid-phase oxidation of unsaturated compounds. The goal of this work was to determine the distance between $Co^{2+}$ ions in several catalysts and to correlate this parameter with their activity. The Co-Co distance was determined by the EPR method by using a spin label. It was shown that the catalytic activity of the polymers studied in the liquid-phase oxidation of cyclohexene increased with an increase in the separation between the $Co^{2+}$ ions (within the range of 13-27 A). Furthermore, in the oxidation of cyclohexene, the active centers were only the $Co^{2+}$ ions on the surface of the heterogenic polymer catalyst. Figures 3; references: 7 (Russian, 1 by Western author).

UDC 541.14;541.124.13

## Secondary Chemical Reactions in Multiphoton Dissociation of Chlorodifluoromethane Molecules

*907M0058E Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 23 No 5, Sep-Oct 89 (manuscript received 13 Nov 87) pp 456-60*

[Article by A. M. Velichko, A. A. Nadeykin, and A. I. Nikitin, Institute of Power Generation Problems of Chemical Physics, USSR Academy of Sciences]

[Abstract] The chemical reactions that are involved in the industrial use of chlorodifluoromethane for laser separation of isotopes and that accompany the multiphoton dissociation of this compound are presented and discussed in detail. References 12: 1 Russian, 11 Western.

UDC 541.144.8:547.963.32

## Measuring Quantum Yield of Biquantum Photoreaction of Cleaving of N-Glycoside Bond in Thymidine Following Nanosecond of Laser Ultraviolet Radiation

*907M0058F Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 23 No 5, Sep-Oct 89 (1 Dec 87) pp 461-63*

[Article by D. N. Nikogosyan, Spectroscopy Institute, USSR Academy of Sciences]

[Abstract] Measuring the quantum yield of the cleaving of a nucleic base following a nanosecond of ultraviolet radiation of thymidine in an aqueous solution is reported. The assaying method used is based on the fact that the ultraviolet spectra of thymidine and its respective base thymine differ greatly in an alkaline aqueous solution, which makes it possible to measure the quantum yield of the cleaving of the N-glycoside bond. It was demonstrated that cleavage of the N-glycoside bond with ultraviolet photolysis is approximately as effective as using gamma- radiolysis. Figure 1, references 8: 3 Russian, 5 Western.

UDC 542.91:541.49:547.1'118

## New Cyclopendant Organophosphoric Complexion—1,4,7,10-Tetraoxide (B-Dioxyphosphorylethyl)-1,4,7,10-Tetraazacyclododecane

*907M0022D Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 9, Sep 89 (manuscript received 19 Jul 88) pp 2112-2116*

[Article by Yu. M. Polikarpov, F. I. Bel'skiy, S. A. Pisareva, and M. I. Kabachnuk, Heteroorganic Compounds Institute imeni A. N. Nesmeyanov, USSR Academy of Sciences, Moscow]

[Abstract] The synthesis of 1,4,7,10-tetraoxide-(B- dioxyphosphorylethyl)-1,4,7,10-tetraazacyclododecane (V), which contains cyclene and dioxyphosphorylethyl groups as pendant groups, was described. Comparison of the $pK_\alpha$ of complexions with dioxyphosphorylmethyl and dioxyphosphorylethyl groups shows that the latter are weaker acids. The complex-forming properties of the complexion (V) were studied by potentiometric titration in water. Many complexes are insoluble in water, and equilibrium is established slowly. The effectiveness and selectiveness of the complex formation of all the cyclopendant complexions studied were compared. Complexions with dioxyphosphorylethyl pendant groups are less effective than their analogs with dioxyphosphorylmethyl groups, but more selective in complex formation. The most suitable coordination of a cation to which a ligand (IV) or (V) is attached plays the main role in the coordination of complexions (IV) and (V) with dioxyphosphorylethyl pendant groups. Figures 2, tables 3, references 16: 10 Russian, 6 Western.

UDC 547.241

## Phosphorus-Containing Heterocycles. Synthesis of 3-Substituted Derivatives of 3-Oxo-2H,4H-1,5,3-Benzodioxaphosphepine

*907M0036B Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 59 No 9 Sep 89 (Manuscript received 18 Jan 88), pp 1985-1990*

[Article by A. N. Bovin and Ye. N. Tsvetkov, Institute of Physiologically Active Substances, USSR Academy of Sciences, Chernogolovka]

[Abstract] The authors previously demonstrated that the products of the hydrolysis or alcoholysis of 2-(α-chloroalkyl)-2-oxo-1,3,2-benzodioxaphosphols are easily cyclized to form 2-oxy- and 2-alkoxy-2-oxo-3R-1,4,2-benzodioxaphosphorines. This article takes a similar approach to the synthesis of derivatives of 3-oxo-2H,4H-1,5,3-benzodioxaphosphepine—a 7-membered heterocycle that has, for practical purposes, never been studied before. The condensation of pyrocatechin with bis(chloromethyl)-phosphine acid chloride in the presence of triethylamine is used to synthesize 2-oxo-2-chloromethyl-1,4,2-benzodioxaphosphorine. Splitting of 2-oxo-2-chloromethyl-1,4,2-benzodioxaphosphorine by various nucleophilic reagents such as water and RMgBr with subsequent intramolecular alkylation-cyclization in an alkaline medium produces 3-substituted derivatives of 3-oxo-2H,4H-1,5,3-benzodioxaphosphopine. References 3: 1 Russian, 2 Western.

UDC 547.241

## Structure of Molecular Associate in Reaction of Trialkylphosphites With Chloral Hydrates

*907M0036D Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 59 No 9 Sep 89 (Manuscript received 1 Feb 88), pp 1995-1999*

[Article by V. I. Krutikov, A. V. Naydenov, T. V. Palagina, and A. N. Lavrentyev, Leningrad Institute of Technology imeni Lensovet]

[Abstract] Previous works have demonstrated the importance of studies of phophorous and phosphonous acid esters with chloral hydrate and have demonstrated that the reaction of P(III) acid esters with chloral hydrate involves the participation of a molecular associate. This article discusses experimental data obtained in previous studies and explains possible regrouping of the associate formed between phosphites and chloral hydrate that leads to the synthesis of various products. The intermediate associate is formed due to the hydrogen bonds that cause the development of various adducts leading to the formation of phosphonates and phosphates. Figure 1; References 7: 6 Russian, 1 Western.

UDC 547.341

## Esters of 5-O-Diethyoxyphosphoryl-2-Hexendioic Acid

*907M0036E Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 59 No 9 Sep 89 (Manuscript received 9 Dec 88), pp 2124-2125*

[Article by I. N. Burangulova, Yu. G. Trishin, I. V. Konovalova, L. A. Burnayeva, V. N. Chistokletov, and A. N. Pudovik, Leningrad Institute of Technology of Pulp and Paper Industry]

[Abstract] The reaction of α,β-acetylene phosphonites with pyruvic acid esters in boiling benzene leads to products of "double" cycloattachment—substituted 1-phosphabicyclo[3.2.0]hept-4-enes. The authors found that under similar conditions α,β-ethylene phosphonites form acyclic compounds. Reaction of diethylalkinylphosphonites with methylpyruvate yields dimethyl esters of 5-O-diethoxyphosphoryl-2-dimethyl-3-R-2-hexendioic acid as a mixture of E- and Z-isomers. Reference 1: Russian.

UDC 547.26'118

## Reaction of Dichlorothiophosphites With Oxygen

*907M0036F Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 59 No 9 Sep 89 (Manuscript received 20 Sep 88), pp 2125-2126*

[Article by A. R. Burilov, A. A. Barulin, M. A. Pudovik, and A. N. Pudovik, Institute of Organic and Physical Chemistry imeni A. Ye. Arbuzov, Kazan Affilitate, USSR Academy of Sciences]

[Abstract] When oxygen is passed through dichlorothiophosphites cooled to -40°C, an exothermic reaction occurs that results in the formation of a mixture of products and phosphorus oxychloride. IR and NMR spectra were recorded and are reported. References 3: 1 Russian, 2 Western.

UDC 541.124:542.91:547.963.32

## Nature of Reaction of Interaction of Di- and Polynucleotides With Certain Pesticides

*907M0022B Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 9, Sep 89 (manuscript received 28 Jun 88) pp 1984-1989*

[Article by E. A. Saratovskikh, M. V. Lichina, B. L. Psikha, and R. I. Gvozdev, Chemical Physics Institute imeni N. N. Semenov, USSR Academy of Sciences, Chernogolovka]

[Abstract] Data are presented from a study of complex formations of pesticides such as Sencor, Roundup, kusagard, tachigaren, Tilt, and others with di- and polynucleotides such as E-NADN, E-RNA and E-DNA. NADN and commercial preparations of RNA and DNA from the spleens of cattle were used to synthesize E-NADN, E-RNA, and E-DNA. Their fluorescence spectra were recorded by using the Aminco-Bowman spectrophotometer, and the results were mathematically processed. Pesticide solutions were added to an SSC buffer containing DNA to determine the melting point of the DNA, and dialysis of the DNA preparations was also conducted. Complex formation of pesticides with E-NADN, E-RNA, and E-DNA was assessed by the dimming of the fluorescence of di- and polynucleotides modified by the pesticides. Dimming of the fluorescence in E-modified compounds is observed with increasing pesticide concentrations, with the dimming resulting in the formation of a covalent bond with an adenine or cytosine fragment. Sencor had the highest complex-formation constant with E- NADN, while tilt had the lowest. The complex-formation values of pesticides was generally higher with E-NADN than with E-ATP. Reduction of the complex-formation constant for E-NADN in comparison with ATP indicates that the nicotinamide portion of E-NADN creates steric hindrances to complex formation. Similar laws are also observed with bidentate complexes of the herbicide Lantrol. Some bidentate complexes of Lantrol form stronger compounds with di- and polynucleotides than does Lantrol itself. It was observed that the stronger the interaction of the pesticide with adenine or the higher the constant of complex formation, the stronger the nativity of the double-helix molecule, which divides into two complementary polynucleotide chains. Thermal denaturation of DNA was conducted to explain the effect of pesticides on the secondary structure of the nucleic acids, and the data suggest that some compounds also form a complex with nucleic acids, which in turn suggests interaction with the ends of the double polymer molecule. Tachigaren and Tilt have low K values and cannot completely upset the double-helical nature of DNA. The rest of the pesticides are hyperchromic and reduce the melting points of compounds on account of the redistribution of energy in chemical bonds of the DNA chain. The structure of DNA in solution is affected by non-dissociated herbicidal metal compounds whose properties differ from the original herbicide. It is possible that the changes in structure that lie at the base of the pesticide mechanisms being used are mutagenic and carcinogenic. Figures 3, tables 2, references 13: 9 Russian, 4 Western.

UDC 547.241

## Thiophosphorylated 3(5)-Amino-4-Cyano(Ethoxycarbonyl)Pyrazoles

*907M0036C Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 59 No 9 Sep 89 (Manuscript received 12 Jan 88), pp 1990-1995*

[Article by L. V. Razvodovskaya, Ye. B. Putsykina, M. V. Yerikova, N. A. Kiseleva, A. F. Vasilev, A. F. Grapov, and N. N. Melnikov, All-Union Scientific Research Institute of Chemical Means of Plant Protection, Moscow]

[Abstract] Continuing work on the investigation of the stereodynamic processes in a number of phosporylated aminoheterocycles, a study is made of thiophosphorylated 3(5)-amino-4-cyano- and -4-(ethoxycarbonyl)pyrazoles. Thiophosphorylation of these pyrazoles produces primarily 3-amino-1-thiophosphoryl pyrazoles, while cyclization of β-(2,2-dicyanovinyl)- and β-(2-cyano-2-ethoxycarbonylvinyl)hydrazidothiophosphates or thiophosphonates yields 5-amino-1-thiophosphoryl pyrazoles. It is found that many thiophosporylated 3(5)-amino-4-cyano(ethoxycarbonyl)pyrazoles have 1,2-phosphorotropic tautomerism, catalyzed by thiophosphoryl pyrazolium salts. References 4: 4 Russian, 1 Western.

UDC 678.675'126.033.029.72:539

## Change in Structure and Properties of Filled PA-6 Polyamide Upon Long-Term Storage in Various Climate Zones

*907M0016E Moscow PLASTICHESKIYE MASSY in Russian No 8, Aug 89 pp 23-26*

[Article by V. I. Surovtsev, T. N. Bezuglaya, A. V. Samoryadov, L. M. Dyakova, L. A. Goncharenko.]

[Abstract] A study was made of the influence of individual components of glass-filled PA-6 polyamide on the molecular mobility and crystallization kinetics of the polymer from the melt, as well as the mechanism of physical aging of the material upon long- term storage in various climate zones. After aging in temperate and continential climate zones, development of the crystalline structure continues (probably as a result of recrystallization of the polymer in disordered areas). This indicates that magnification of the compositions, which increases their molecular mobility, should result in production of a more stable crytalline structure. Modification can be performed by introducing plasticizing additives. Figures 3, References 5: 2 Russian, 3 Western.

UDC 678-13:547.339.221:547.538.141:678.744.335

## Surface Heat-Shock Working of Polymer Products

*907M0016G Moscow PLASTICHESKIYE MASSY in Russian No 8, Aug 89 pp 38-39*

[Article by A. A. Shturman, T. A. Nazarovo, L. S. Fedotova]

[Abstract] Heat-shock working of polymer products is performed by brief immersion in a liquid at a temperature close to the melting point of amorphous thermoplastics and 100-160 °C above the glass point of the polymer. This article studies the influence of heat-shock working conditions on polymer product quality. Tests were performed on 80x10x4 mm bars of ABS-2020 plastic produced by injection molding by immersion at 200 °C in polymethylsiloxane for 10-30 s followed by cooling in air. The density, impact toughness of notched specimens, bending strength, and microhardness were determined by standard methods. Significant improvements in all characteristics were observed. A combined treatment consisting of normal heat treatment followed by surface heat-shock working was found still more effective in improving mechanical properties. Optimum treatment was 30-120 s at 230-240 °C and yielded an increase in impact toughness of 114%, a bending strength of 65-98%, and microhardness of 58-61%. The treatment caused surface microscopic cracks to disappear, decreased surface roughness, and increased surface layer density. It also caused compressive stresses to develop.

UDC 678.743.22-462:63

## Polyvinylchloride Materials for Pipes and Shaped Articles

*907M0032A Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 89 pp 8-11*

[Article by N. N. Tikhonov, M. S. Akutin, S. S. Tikhonova, V. V. Osipchik, F. Deak, and S. R. Braginskiy]

[Abstract] The feasibility of regulating the supermolecular structure of polyvinylchloride to produce materials with improved properties based on it for making pipes and shaped articles was researched. The supermolecular globular structure of PVC is retained during processing, which allows its properties to be regulated by adding small quantities of compounds that are insoluble or only slightly soluble in PVC. PVC was mixed with small amounts of modifiers (oligodimethylsiloxane and oligobutadiene) at 373-383 K. Test models were made by using the Waltz press method. By infrared spectrometry and selective extraction, it was determined that the silicone and butadiene oligomers used as modifiers do not form any chemical bonds, but a heterogenous mixture of components does form. The phase structure was researched by using dynamic mechanical analysis and electron microscopy, and it was demonstrated that the modifiers are in the matrix of the polymer in the form of spherical inclusions. Thermomechanical analysis and dielectric spectroscopy showed that when alloyed additives are added to the polymer, the mobility of the structural elements of the polymer increases, thus providing faster and more complete relaxation of processes in the polymer. Infrared spectroscopy and positron annihilation were used to study structural changes in PVC following the addition of alloyed oligomers. Positron annihilation also showed that structural transformation of PVC modified by oligomers occurs. Conformational transformations that occur indicate the increased order of the polymer structure and density of packing PVC macromolecules. Acoustic research showed that the speed of longitudinal and transverse ultrasound waves changes. The impact strength improves in modified PVC. The high viscosity of polymer melts limits increasing the processing of PVC materials by extrusion. Modifying polymers with microadditives of oligomers sharply increases the creep of its melts by reducing the shift deformation in the stream, reducing external resistance to the creep process, and increasing the speed of melt slippage relative to the surface of the forming channel. Adding structural modifiers to PVC increases the induction period for the dehydrochlorination of PVC. Adding structural modifiers to PVC reduces the number of defects in the supermolecular structure and forms an ordered polymer system that is more resistant to mechanical stresses. Figures 3, references 10: Russian 8, Western 2.

UDC 678.742.21.046-462:622.5

## Drainage Pipes Made of Filled Low-Pressure Polyethylene

*907M0032B Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 89 pp 12-15*

[Article by Ye. D. Lebedeva, N. B. Enikolopova, M. S. Akutin, and N. G. Paverman]

[Abstract] Filling low-pressure polyethylene with inexpensive fillers will help solve ecological problems and create the conditions for implementing low-waste technology. Multitonnage wastes from aluminum production and calcareous flour are used in making the composite materials for drainage pipes. Adding fillers to low-pressure polyethylene generally increases the residual stresses in products. An effective means of regulating the structure and properties of polyolefins, including filled polyolefins, consists of modifying them with small amounts of substances that do not mix with the main polymer. Difficulties in processing the filled materials include the increasing viscosity of the melt, increasing processing temperature, and increasing stress on the moving parts of the equipment, which results in increased wear on equipment parts. High melting speed and homogenization of the polymer melt occur when products are produced from powdered components. The effects of various factors on the longevity of polymer drainage pipes were studied. It was shown that acceleration of relaxation processes in the polymer melt results in the production of low-stress products with fewer defects in structure. Reduction of the anisotropy coefficient of low-pressure polyethylene filled with additives shows that models homogenous in their cross-section are produced. The materials developed for making drainage pipes are improvements over existing materials, and the equipment for making them saves energy. Figures 2, tables 2, references 2 (Russian).

UDC 678.5-462

## Hoses Made From Polymers

*907M0032C Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 89 pp 15-16*

[Article by I. V. Gvozdev]

[Abstract] Hoses made from polymers are being used in agricultural, automotive, and aviation engineering; in petroleum production; in fire-fighting equipment; and in other fields. In comparison with rubber hoses, plastic hoses do not require as much material, and they require less capital investment coupled with higher productivity. Research has been conducted on over 50 types of hoses. High-pressure hoses are being used to produce numerous products. Development of assembly lines for making hoses is being organized. Table 1.

UDC 678.766:678.743.4-488.001.73

## Modified Polyimide-Fluoroplastic Film

*907M0032D Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 89 pp 16-17*

[Article by N. G. Markov, T. K. Ryashentseva, Ye. A. Chepeleva, Ye. A. Orskaya, V. F. Blinov, and E. P. Dontsov]

[Abstract] Polyimide-fluoroplastic film is being widely used as an electrical insulator due to its high physicomechanical and electrical indices and chemical resistance. The development of modern branches of industry has also dictated the need for creating new electrical insulating materials with a fluoroplastic casing greater than 10 µm thick. This was found to be possible by using mixtures of F-4MD grade B and F-4DU suspensions as the fluoroplastic casing. The polyimide film was covered by dipping it and then drying for 20 minutes, after which it was placed in a heat chamber for 15 minutes. Particle size plays an important role in adhesion strength. The mixture should contain at least 50 percent F-4DU and no more than 15-25 percent of F-4MD. Mixtures of F-4DU and F-4MD may be used to modify polyimide fluoroplastic films so as to increase their operating temperature in making fluoroplastic casings based on a polyimide film. References 2.

UDC 678.742.2-488:622

## Polyethylene Film for Making Waterproof Casings

*907M0032E Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 89 pp 17-18*

[Article by A. Yu. Panshin, T. G. Itskova, and S. G. Barkalaya]

[Abstract] One of the main problems in mining is conducting explosions in water wells, and there is only one waterproof explosive that is industrially manufactured. Placing the explosive in a waterproof casing has been suggested, and there are two methods of doing this. Tests showed that using the waterproof casing simplifies the manufacture and loading of the explosive. High-pressure polyethylene is used to make the film. Making the waterproof casings requires developing special equipment to make the polyethylene film into a bag. Table 1.

UDC 678.743.22:539.23.004.3:667.777

## New Polyvinylchloride Materials for Packaging Foods

*907M0032F Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 89 pp 22-25*

[Article by N. N. Tikhonov, M. S. Akutin, V. N. Egorov, A. V. Morkovin, and V. A. Onishchuk]

[Abstract] New packaging materials like fine and superfine elastic films made of plasticized polyvinylchloride (PVC) that are better than those currently produced need to be developed for the food industry. The properties of film materials based on PVC grade C-70 that contain the plasticizer dioctylphthalate were researched. Calcium and zinc stearates, soybean oil, and pentaerythritol were used to increase PVC stability. The ingredients were mixed for 15 minutes and then granulated, pressed, and extruded. The positron annihilation method was used to study the change of the free volume of plasticized PVC. An x-ray diffractometer was used to analyze the structure of the models. The polymer is physically modified by adding small amounts of compounds that are thermodynamically incompatible and do not react chemically with PVC. The effect of a modifier on the rheological properties of plasticized PVC is determined by its content and temperature. Strengthening modified PVC by using structural changes in the polymer results in forming a more homogenous polymer structure that is resistant to external stresses. Comparative analysis of data showed that by increasing the amount of plasticizer, the maximum possible number of extractions of PVC materials and mobility of the structural elements of the polymer increase, the strength of intermolecular bonds drops, and the ability of the polymer to deform increases. Low deformation strength indices of plasticized PVC materials do not permit the numerous extractions necessary for making fine and superfine strong films to be performed. Adding modifiers to the films increases their strength by 1.5 times. Data show that an increase in the viscosity of the polymer melts longitudinally and amplifications of intermolecular interactions in materials make the polymer stronger. Figures 3, tables 2, references 3 (Russian).

UDC 678.742.2:54-143

## Optimal Composition of High-Pressure Polyethylene Plus Low-Pressure Polyethylene and Conditions of Mixing of Their Melts

*907M0032G Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 89 pp 57-59*

[Article by N. V. Shevalenko, E. V. Lebedev, K. I. and Kolesnik]

[Abstract] The optimal composition of high-pressure polyethylene and low-pressure polyethylene and conditions for mixing their melts were studied by using high-pressure polyethylene grade 15303-003 and low-pressure polyethylene grade 276-73 and varying their ratios widely. The polymers were mixed in an extruder at various temperatures and mixing speeds. With increasing temperature and rate of shift, the effect of the mixture composition on the position of curves of the flow is reduced. The relationship n of mixtures to the temperature is manifested at a low shift rate. It is most substantial when there is a low content of one of the components of the mixture, which causes a substantial change in the structure of the melt. There is an average range of component mixtures that is optimal for producing high-quality products due to the proximity of the rheological properties of the melts being mixed. This proximity results in a high degree of homogenization of the mixture. Figures 2, references 6: 5 Russian, 1 Western.

UDC 677.862.517.1

## Anti-Static Electricity Treatment of Fibers With Surfactants

*907M0065K Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 9, Sep 89 pp 659-662*

[Article by V. A. Volkov and T. Ye. Balanova]

[Abstract] The effect of surfactants on the resistance of fibers to static electricity was studied. Two types of preparations were used, i.e., those adsorbed by the fiber and those that modify the chemical structure of the fiber, after which the fiber takes on the useful properties. The anti-static electricity action of a number of surfactants and various methods of applying the anti-static agent were researched. Cation-active surfactants were the best external anti-static electricity agents due to their blocking of electronegative groups, and those that penetrated deep into the fiber lasted longest. Increasing the drying temperature also improved the anti-static electricity effect of surfactants. In order to produce long-term anti-static protection, conditions need to be created for forming a surface adsorption layer and diffusing molecules of the anti-static agent into the fiber. Figure 1, tables 2, references 5 (Russian).

UDC 678.046:678.01:537.52

## Mechanical and Rheological Properties of Composites Containing Fillers Treated in Gaseous Discharge

*907M0066E Kiev UKRAINSKIY KHIMICHESKIY ZHURNAL in Russian Vol 55 No 10, Oct 89 pp 1086-1089*

[Article by V. V. Davidenko, Ye. P. Mamunya, and Ye. V. Lebedev, Chemistry of High-Molecular Compounds Institute, UkSSR Academy of Sciences, Kiev]

[Abstract] The effect of treatment in gaseous discharge on the properties of composites with glass and shale fillers was compared by using the results and observations from various studies. Despite the difference in the chemical composition of the surface of the fillers used, the dispersion component of the surface energy was the same for both fillers. The shale particles were highly anisodiametric, as were the glass particles, although to a lesser degree. The fillers were treated in gaseous discharge by two methods—with water and in monomer pairs. Adding nontreated glass to polystyrene reduces impact resistance. Adding shale improves it, however, which is why shale is considered an active filler. Treating

fillers in gaseous discharge is an effective method of improving the mechanical characteristics of composites. The chemical nature of the surface affects the processes of activating the surface. Activation of inert and active fillers improves the impact resistance of composites, while processing in monomer pairs improves the impact resistance of composites filled with glass only. Table 1, references 13: 10 Russian, 3 Western.

UDC 532.12:678.686.3.01

### Isothermic Relaxation of Viscosity of Epoxydian Oligomers

*907M0066F Kiev UKRAINSKIY KHIMICHESKIY ZHURNAL in Russian Vol 55 No 10, Oct 89 (manuscript received 8 Apr 88) pp 1093-1095*

[Article by I. G. Gerasimov, L. G. Nechitaylo, A. Ye. Batog, and Yu. S. Zaytsev, Ukrainian Plastics Scientific Research Institute]

[Abstract] The effect of time-temperature prehistory on the viscosity of industrial low-molecular weight epoxydian oligomers was assessed. An increase in viscosity is accompanied by a reduction in the content of epoxide groups and may be tied to polymerization due to the interaction of epoxide and hydroxyl groups. Heating the epoxydian oligomers causes an interaction of epoxide and hydroxyl groups, oxidation of glycidyl groups, loss of volatile impurities, crystallization, or other structural rearrangement to achieve uniform liquid consistency for that temperature. The noticeable loss of mass of the epoxydian oligomers is due to structural relaxation of the oligomers. For the oligomers studied, an increase in viscosity was typical at room temperature in deformation conditions (which is probably due to mechanical conditions when the viscosity was being measured), and the specimen being researched was in a narrow, V-shaped clearance. Mechanical relaxation may be an additional reason for the increasing viscosity following isothermic heating of the epoxydian oligomers. Figure 1, references 6 (Russian).

UDC 678.742.2-046.01:66.085.33

### Effect of Gamma Irradiation on Properties of Composite Construction Materials Made of Polyethylene and Perlite

*907M0077A Moscow PLASTICHESKIYE MASSY in Russian No 10, Oct 89 pp 27-30*

[Article by L. N. Nikitin, V. V. Mordvinov, A. T. Bolgov, N. N. Matveyev, and A. V. Demidov]

[Abstract] The thermal and chemical stability of low-pressure polyethylene increases following gamma irradiation. Polymers with improved dielectric and physicochemical properties can also be produced. The effect of radiation treatment on the structural, physical, and physicochemical properties of construction materials made of low-pressure polyethylene and perlite was studied. A composite material was made by mixing particles of perlite with low-pressure polyethylene synthesized on its surface in a 12.3 percent ratio and then compared with another material made by mechanically mixing these ingredients. The filler content was 30 percent, and the perlite particles were 20-850 μm. Samples were cast under pressure in the form of disks and placed in glass ampules for electron paramagnetic resonance study. Mass spectrometry thermal analysis was used to study the thermal stability of the composite material in a range of 298-850 K. Infrared spectra were recorded by using a double diffraction prism spectrophotometer. Films 10-100 μm thick were pressed from the composite materials. The radiation chemical yields of radicals in the systems studied were calculated on the basis of experimental data. The radiation and chemical processes in the composite material proceed independently of one another and have no noticeable effect. Perlite protects low-pressure polyethylene from radiation and chemical destruction, probably by transferring the perturbation energy from low-pressure polyethylene to the filler. Composite material II, which had 25-30 percent more volatile products than did composite material I, was less stable than composite material I when heated. An analysis of changes in the structural, thermophysical, and viscoelastic properties of low-pressure polyethylene and composite materials based on it under the effect of ionizing radiation showed that materials based on a mixture of low-pressure polyethylene and perlite are more stable when irradiated. Figures 3, tables 2, references 10: 9 Russian, 1 Western.

UDC 678.742.23.539:535-31

### Effect of Ultraviolet Irradiation on High-Pressure Polyethylene Structure

*907M0077B Moscow PLASTICHESKIYE MASSY No 10, Oct 89 pp 30- 32*

[Article by V. M. Aslanyan, V. I. Vardanyan, and S. S. Felekyan]

[Abstract] A high-pressure polyethylene film 200 μm thick was put under ultraviolet light in air. The samples were placed 30 cm from the radiation lamp at a temperature of 40°C for up to 300 hours. A special device with a heater and temperature regulator was used for x-ray crystallography analysis. Due to external factors, changes occur in the macromolecules of the polymer that make new crystalline regions in the polymer possible. Most changes occur in the amorphic phase of the polymer rather than in crystalline regions. The low-temperature endothermic peak in the thermograms and the increase in the number of crystals in high-pressure polyethylene during ultraviolet irradiation is due to the formation of new crystalline regions in the polymer. Ultraviolet irradiation has practically no effect on the structure of crystal regions in the polymer. Figure 1, tables 2, references 7: 2 Russian, 5 Western.

UDC 678.746.222.01:539:37

## Effect of Molecular Mass Distribution of Polystyrene Matrix and Parameters of Rubber Phase on Viscoelastic Properties of Impact-Resistant Polystyrene Melts

*907M0077C Moscow PLASTICHESKIYE MASSY No 10, Oct 89 pp 32- 35*

[Article by Yu. V. Nikitin, N. M. Yefremova, T. G. Shlyakhova, K. A. Vylegzhanina, N. G. Podosenova, and V. A. Zinchenko]

[Abstract] A study examined the effect of the molecular mass distribution of the polystyrene matrix and the parameters of the rubber phase on the viscoelastic properties of impact-resistant polystyrene melts. The method used to manufacture the melts was not considered. Forty batches of impact-resistant polystyrene were produced by using the free radical mechanism of polymerization, but the production systems using different grades of butadiene rubber were varied. The molecular mass distribution matrices were assessed by using gel-penetrating chromotography with three styrogel columns in toluene at 302 K. The amount of rubber in the final product was determined by using a technique based on treating it with bromous iodide in carbon tetrachloride and then titrating the excess bromous iodide with potassium thiosulfate. The structure of the rubber phase was studied on an electron microscope by using ultrathin sections. The viscous-flow properties of the impact-resistant polystyrene batches were evaluated according to the melt flow index, and the superelastic properties of melts were assessed by the degree of distension of the extrudate. In order to establish the quantitative dependence of the melt flow index and distension of the extrudate on the molecular mass distribution of the polystyrene matrix and the parameters of the rubber phase for each of the rheological properties, several linear equations of regression were used. The particles of the rubber phase with the polystyrene macromolecules on them that are dispersed in the polystyrene matrix form strong points. The number of meshing points between the macromolecules of adjoining spatial points increases as the number of rubber phase particles in the agglomerate increases. This in turn results in a decrease of the fraction of meshing points that form between macromolecules of the spatial points and the macromolecules of the polystyrene matrix. In the end, the highly elastic properties of the impact-resistant polystyrene increase, and the viscosity of the polymer melt decreases. The melt flow depends on the ability of its individual structural elements to transform into a forced, highly elastic condition and on losses in friction that occur during transformation. Losses in friction between structural elements of the melt affect the melt flow most at a rate and shift tension like conditions in calculating the melt flow index of impact-resistant polystyrene. Using the equations presented permits the parameters of these equations to be purposefully changed to produce a polymer with given viscoelastic properties. Figures 2, references 11: 9 Russian, 2 Western.

UDC 678.742:661.723-16:537

## Dielectric Properties of Polyethylene With Fluorinated Alkoxyl Groups

*907M0077D Moscow PLASTICHESKIYE MASSY in Russian No 10, Oct 89 pp 35-37*

[Article by V. K. Matveyev, A. A. Machula, and A. T. Podkhalyuzin]

[Abstract] The effect of the structure of fluorinated alkoxyl groups adjoined to a polyethylene polymer chain on its dielectric properties was studied. Modified polyethylene containing differing amounts of alkoxyl groups were studied. Radiation-chemical alkylation of high-pressure polyethylene by using perfluoropropylvinyl ether and perfluoro-3-methoxylpropylvinyl ether were used to make the polymer. The polyethylene films were studied directly after the alkylation reaction and additional irradiation with gamma rays. The tangents of the angles of dielectric losses and dielectric permeability of the films were measured at 200-500 Hz and -90 to 150°C. After additional irradiation in air, the dielectric properties of the alkylated polyethylene samples change substantially. The development of a new region of relaxation in a number of fluorine-containing polyethylene samples is apparently explained by the formation of unstable products of radiolysis in the crystalline phase of the polymer or its defective sections. Alkylated polyethylenes differ greatly from the original polyethylene in their dielectric properties and can be considered polar polymers. But after irradiation, unstable products of radiolysis are formed and cause the appearance of a new maximum of loss typical of pure polyethylene. Figures 2, references 3 (Russian).

UDC 678.743.4-416.01:534

## Acoustic Properties of Fluoroplastic Films in Cold Stretching

*907M0077E Moscow PLASTICHESKIYE MASSY in Russian No 10, Oct 89 pp 40-42*

[Article by V. A. Glukhov, V. V. Kochervinskiy, and Yu. V. Zelenev]

[Abstract] Structural changes in industrial-use film made of F-4 (Teflon) fluoroplastic during elastic loading were studied by using the ultrasound and spectroscopic methods. The speed of sound was measured at 200 kHz. Strips 1.5 mm wide were cut from the industrial film at varying angles to the axis of stretching. An analysis of the dependence of the sound speed in cold stretching on the angle of the direction of original orientation showed that at 0° there is a substantial increase in sound speed with deformation. At larger angles, the sound speed at low relative deformations is noticeably decreased. The dependence of the sound speed in samples on the temperature at varying relative deformations was also studied. The speed of sound increases significantly at low temperatures, and this indicates an increase in the intensity of intermolecular interaction in the amorphic phase of the vitrified polymer. The multiplet temperature transitions in the vitrifying region are tied to levels of the supramolecular structure typical for the amorphic phase of the crystalline polymer. In using fluoroplastic films to make electric converters, possible structural changes occurring in them during elastic deformation should be considered. Figures 2, references 5 (Russian).

UDC 678.6-488:539.4:536.6

## Mechanical and Thermal Properties of Protective Polymer Films at Low Temperatures

*907M0077F Moscow PLASTICHESKIYE MASSY in Russian No 10, Oct 89 pp 42-44*

[Article by E. S. Batyushev, B. P. Zhilkin, V. V. Zhitkov, R. I. Nikulina, and A. A. Polyakov]

[Abstract] Films produced by Nitto (Japan) and Kendall (United States) that were 0-5 mm thick and that had a bonding layer (such films are used for protecting pipes from corrosion) were studied. In order to determine the embrittlement temperature, coating samples consisting of three layers of film were applied to steel disks and then placed on foam rubber in a freezing chamber. Thirty seconds after reaching the next temperature, a 980-g steel die with a flat strike surface 30 mm in diameter was thrown against the sample from a 100 mm height, and the presence of cracks was visually determined. The maximum dynamic stress was on the outer layer of the film. The damping effect of the first layer reduced the impact load on the lower layers and required more cooling before cracks appeared. The specific energy for destroying the polymer film was calculated. A cleaning machine smashes and ruptures the coating, so the breaking stress of the film that is tensed needs to be known. At room temperature, the film has properties of a typical material that is very plastic. The relative extension of the film is greater than 300 percent, so most of the samples could not be destroyed. Thermophysical properties were calculated by using a calorimeter placed in a thermostat with liquid nitrogen and a stirrer, and the curve for cooling the sample was recorded. Results of calculating the embrittlement temperature show that the same structural transition exists in the upper point of the excessive bend due to a new embrittlement condition whose position shifts according to temperature. Figures 2, references 4 (Russian).

UDC 678.664.066.01:678.744.4

## Modifying Properties of Polyester To Increase Elasticity of Polyurethand Coatings

*907M0077G Moscow PLASTICHESKIYE MASSY in Russian No 10, Oct 89 pp 44-47*

[Article by I. I. Kozhokina, T. Z. Tikhonova, A. G. Okuneva, I. A. Vakhtina, N. N. Zhegalova]

[Abstract] Aromatic isocyanate-surizon ATT-2 was used to synthesize aliphatic polyesters with a reduced functionality and rate of crystallization, which made the production of highly elastic polyurethane coatings possible. Aliphatic polyesters with an average functionality of 5.9 are modified with complex polyesters with a linear structure and molecular mass of 3,000-3,500. The effect of the content and nature of the modifier and effects of its addition on the physicochemical properties, molecular mass distribution, and distribution by types of functionality of the polyester were studied. Titanium tetrabutylate, sebacic acid, industrial trimethylolpropane, hexanediol, polydiethyleneglycoladipinate, and polyethylene- butyleneglycoladipinate were the catalysts used to synthesize the polyesters. The molecular mass distribution and distribution by types of functionality were analyzed using gel-penetrating and thin layer chromatography. Temperature transitions were studied by differential calorimetry, and the average functionality was calculated using the hydroxyl groups and molecular mass of the polymer. Polyurethane films were produced by combining polyesters and surizon ATT-2 or by mixing surizon ATT-2 and biurepolyisocyante. Film quality was assessed by its elasticity and hardness. The effect of the conditions of adding a modifier to the reaction mixture on the properties of the polymer being produced was studied, and it was shown that adding a modifier causes a more defective supramolecular structure to form. Thin layer chromatography analysis showed that the polyester samples are homogenous products that do not contain diol fractions. The functionality of the polymer and the content of polyfunctional high-molecular weight fractions in it affect the width of the molecular mass distribution most. Figures 3, tables 2, references 5 (Russian).

UDC 546.799.3

## Simple Acetates of Neptunium (V)

*907M0057A Leningrad RADIOKHIMIYA in Russian Vol 31 No 4, Jul- Aug 89 (manuscript received 8 Sep 88) pp 33-37*

[Article by A. A. Bessonov, M. S. Grigoryev, T. V. Afonasyeva, and N. N. Krot]

[Abstract] The synthesis and some properties of neptunium (V) acetates were discussed. The purpose of this research was to study changes in the structure and properties of simple actinoid (V) carboxylates by using formates and acetates. A comparison of powdered x-ray photograph deposits obtained in various conditions and data from chemical analysis showed that the same composition of $NpO_2Ac{\cdot}H_2O$ is obtained from the solutions regardless of the crystallization temperature and original neptunium (V) concentration. There were attempts to produce monocrystals of $NpO_2Ac{\cdot}H_2O$ and $NpO_2Ac$ in hydrothermal conditions. Cation-cation interaction of $NpO^{2+}$ is very important in the $NpO_2Ac{\cdot}H_2O$ structure. The acetate ions are stronger ligands than $HCOO^-$. Attempts were also made to synthesize double acetates of neptunium (V) like $KNpO_2Ac_2{\cdot}xH_2O$. Figure 1, tables 4, references 8: 7 Russian; 1 Western.

UDC 541.183:546.42:549.67

## Ion Exchange Properties of Zeolite K-G With Respect to Strontium and Cesium

*907M0057B Leningrad RADIOKHIMIYA in Russian Vol 31 No 4, Jul- Aug 89 (manuscript received 9 Sep 88) pp 111-116*

[Article by N. R. Andreeva, M. A. Shubaeva]

[Abstract] The sorbtion properties of low-silicon content chabasite (zeolite) with respect to $Sr^{2+}$, $Cs^+$, $Ca^{2+}$ and $Na^+$ ions were studied to determine the feasibility of using K-G to purify complex salt solutions of $Ca^{2+}$ and $Na^+$ of Sr and Cs radioisotopes. Saturation of zeolite with the cations researched depends on the equilibrium concentration of the cations in solution. Zeolite selectivity changes in proportion to the degree of saturation. Zeolite was much more selective toward $Sr^{2+}$ ions and less selective of $Cs^+$ ions. Zeolite K-G is considered to be a promising sorbent for separating the radionuclide $^{90}Sr$ from solutions containing sodium, calcium, and cesium salts. Figures 4, tables 2, references 14: 6 Russian, 8 Western.

UDC 547.857.7:546.11.3:541.127

## Catalytic Protium-Tritium Isotope Exchange Between Adenine-Series Dinucleoside Polyphosphates and Gaseous Hydrogen

*907M0057C Leningrad RADIOKHIMIYA in Russian Vol 31 No 4, Jul- Aug 89 (manuscript received 25 Jun 88) pp 132-134*

[Article by G. P. Akulov, N. A. Patokina]

[Abstract] The feasibility of introducing labeled tritium into adenine fragments of dinucloside polyphosphates I and II in catalytic isotope exchange reactions of these compounds with gaseous tritium was studied. Adenine series nucleotides labeled with tritium were used in synthesizing the compounds. The molar activity of I was much greater than that of II, probably due to the difference in ion exchange rates caused by the structures of these compounds. Table 1, references 5: 2 Russian, 3 Western.

UDC 542.61:543:43:546.791

## Extraction-Photometric Assaying for Uranium Using Hexabutyltriamide

*907M0057D Leningrad RADIOKHIMIYA in Russian Vol 31 No 4, Jul- Aug 89 (manuscript received 8 Nov 88) pp 135-139*

[Article by V. V. Yakshin, O. M. Vilkova, and L. T. Makarova]

[Abstract] The influence of the three-dimensional and electron structures of R radicals on extraction properties and resistance of phosphoric acid amides was studied. Phosphoric acid hexabutyltriamide is the most promising extractant of uranium in the development of extraction-photometric methods of assaying for uranium in solutions. Phosphoric acid hexabutyltriamide is also promising because of the lack of absorption in visible and ultraviolet spectra, and this ensures that spectrophotometric assays using arsenazo III are reliable. A hexane extract-isopropyl alcohol-nitrate solution of arsenazo III 10:13:2 in volume was used for assaying the uranium directly in the extract. Maximum absorption was observed at 0.01-0.05 mol/l of $HNO_3$, with a 0.002 percent concentration of arsenazo III in the aqueous organic solution. Maximum uranium extraction was observed in uranil nitrate solutions with a concentration of 0.5 mol/l $HNO_3$. The selectivity of extraction-photometric assaying for uranium in the presence of ions that affect it was studied. Thorium disturbs the assaying of uranium and arsenazo III. Figure 1, table 1, references 5; 3 Russian, 2 Western.

UDC 535.37:(546.661+546.799.6)

## Luminescence of Thenoyltrifluoroacetone Complexes of Europium and Curium in Aqueous Solutions of Surfactants

*907M0057E Leningrad RADIOKHIMIYA in Russian Vol 31 No 4, Jul- Aug 89 (manuscript received 22 Apr 88; after revision 5 Apr 89) pp 139-145*

[Article by V. M. Aleksandruk, A. S. Babaev, T. A. Demyanova, and A. V. Stepanov]

[Abstract] The luminescent properties of curium and europium in aqueous solutions of their complexes with thenoyltrifluoroacetone and of triple complexes with phosphine oxides in suspensions with surfactants were

studied, and the resultant data were presented. Gadolinium was used to make the suspensions due to the high luminescent intensity of europium observed in its presence. The surfactants used, Triton X-100 and OP-7, had an identical effect on the luminescence of curium and europium solutions, but with OP-7 the luminescent had a lesser intensity. A substantial difference in the intensity and damping times of luminescence for various phosphine oxides with and without the presence of surfactants was noted. Microcrystals of triple complexes of europium, thenoyltrifluoroacetone, and 1,10- phenanthroline do not form in the presence of surfactants at curium and europium concentrations of 1 and 12 ng/ml, which is possibly tied to the formation of two forms of curium complexes. The luminescent method of assaying for curium by using its triple complex in aqueous solutions of surfactants guarantees maximum discovery, similar to that of the radiometric method. Figures 3, table 1, references 8: 3 Russian; 5 Western.

UDC 546.799.4+621.039.524.4+539.173.12

## Using the Ion-Exchange Resin Bead Technique in Assaying for Plutonium in Refined Nuclear Fuel

*907M0057F Leningrad RADIOKHIMIYA in Russian Vol 31 No 4, Jul- Aug 89 (manuscript received 30 Dec 87; after revision 16 Feb 89) pp 145-152*

[Article by V. M. Andreev-Savelyev, B. N. Belyaev, Ye. A. Gromova, A. V. Lovtsyus, T. P. Makarova, A. V. Stepanov, and B. I. Tarler]

[Abstract] Results of the development of the resin bead technique and its use with mass spectrometer equipment and domestically produced VP-1-AP resin are presented. Optimal conditions were determined for simultaneous sorption of uranium and plutonium in an anion-exchange resin in approximately equal quantities, for refining control methods for the quantities being absorbed, for finding a reliable method of fixing the beads, for finding optimal temperature intervals for the separate ionization of uranium and plutonium, and for determining the effect of the discrimination factor in ionization for resin models. Simultaneous mass spectrometry analysis of uranium and plutonium using single beads of resin containing nanogram quantities of these elements produces results practically identical to those obtained when using the traditional method. Figures 4, tables 6, references 6: 1 Russian; 5 Western.

UDC 542.61:546.26

## Leaching Carbon 14 Fixed in Calcium, Strontium, and Barium Carbonates in Portland Cement Matrix

*907M0057G Leningrad RADIOKHIMIYA in Russian Vol 31 No 4, Jul- Aug 89 (manuscript received 26 Jul 88) pp 165-171*

[Article by N. N. Kalinin, A. N. Elizarova, and A. G. Tutov]

[Abstract] Original data were obtained on the properties of compounds produced by adding finely dispersed calcium, barium, and strontium carbonates to a Portland cement matrix. The optimal ratio of ingredients for providing maximum resistance to leaching and the most preferable carbonate form to be added to the Portland cement matrix were determined. Calcium carbonate was the most saturated with fixed carbon and most resistant to leaching. The most optimal ratio of cement and calcium carbonate was 1:1. Figures 4, tables 3, references 9: 4 Russian; 5 Western.

UDC 539.122.04:537.314

## Effect of Ionizing Radiation on Transport of Charge Carriers

*907M0058A Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 23 No 5, Sep-Oct 89 (manuscript received 25 Aug 87) pp 423-26*

[Article by A. G. Tyurin, T. S. Zhuravleva, and A. V. Vannikov, Electrochemistry Institute imeni A. N. Frumkin, USSR Academy of Sciences]

[Abstract] Irreversible changes caused by gamma radiation in the transport of electric charges in polymers were studied. Polyepoxide amine adduct, poly-N-epoxypropyl carbazol, and triphenylamine in polycarbonate were studied. These polymers were used in electrophotography, and the transit time method was used for measuring the drift mobility of cavities in these materials. The polycarbonate- triphenylamine system was the most resistant to radiation. Possible reasons for irreversible changes in the transport characteristics of polymers following gamma radiation were presented, and it was demonstrated that adding triphenylamine can substantially affect the radiation resistance of a system. Figures 3, references 15: 7 Russian, 8 Western.

UDC 678.743.721.139.019.86

## Effect of Defects in the Physical Structure of Polytetrafluoroethylene on Radiation Changes of Its Dielectric Properties

*907M0058B Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 23 No 5, Sep-Oct 89 (manuscript received 10 Dec 87) pp 427-29*

[Article by V. K. Matveev, N. A. Smirnova, and V. K. Milinchuk, Physical Chemical Scientific Research Institute imeni L. Ya.Karpov]

[Abstract] The effects of defects in the physical structure of polytetrafluoroethylene (Teflon) on changes of its dielectrical characteristics following radiation were studied. The reversible radiation changes of the tangent of the angle of dielectrical losses and dielectrical permeability of two types of Teflon using two different thicknesses each were researched. From the standpoint of physical and mechanical properties, both types of films were practically the same; however, they were distinctly different with respect to their electrical strength. Differences in the characteristics of the films following radiation may be due to the difference in the number of defects as well as the structure of the defects themselves in the films being researched. Differences in the tangent following radiation are observed even for films that differ only with respect to thickness. In addition, it was established that peroxide radicals responsible for altering the tangent during radiation are formed in the structural defects. Figures 2, references 7: 5 Russian, 2 Western.

UDC 678.742.2:678.029.44:542.943.6

## Salient Features of Cross-Linking Copolymer of Ethylene and Vinyl Acetate

*907M0058C Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 23 No 5, Sep-Oct 89 pp 469-70*

[Article by P. V. Zamotayev, Z. O. Streltsova, V. P. Gordienko, and A. A. Kachan, Petrochemistry Department, Physical and Organic Chemistry and Coal Chemistry Insitute, UkSSR Academy of Sciences]

[Abstract] The effectiveness of cross-linking a copolymer of ethylene and vinyl acetate initiated by ionizing radiation and ultraviolet light was compared. Radiation cross-linking of the ethylene-vinyl acetate copolymer was more effective than photochemical cross-linking due to the high level of photodestruction. It is mainly radicals that form at the tertiary carbon atoms of the vinyl acetate group that dominate in processes at low absorption doses and concentrations of the photoinitiator. Figure 1, references 8: 7 Russian, 1 Western.

UDC 514.15

## Radiation Defects in Gamma Radiation of Zirconium Dioxide

*907M0058d Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 23 No 5, Sep-Oct 89 (manuscript received 9 Nov 88) pp 472-73*

[Article by Kh. B. Gezalov, A. A. Garibov, R. D. Kasumov, N. P. Tairov, and N. I. Musaev, Radiation Research Sector, AzSSR Academy of Sciences]

[Abstract] The processes of the formation and nature of radiation defects in gamma-irradiated zirconium dioxide were studied by using electron paramagnetic resonance spectroscopy. The electron paramagnetic resonance spectra of the gamma-irradiated models at 77K are two superimposed lines. One line burns out faster with a temperature increase, while the other becomes saturated with an increase in the power of the microwave field. Both electron paramagnetic resonance signals disappear with an increase to room temperature, and it is believed that the two signals relate specifically to the cavities and electrons. The radiation and chemical yields of the cavity and electron centers drop with an increase in the rate of the dose. Experimental results show that the probability of destroying paramagnetic radiation defects in recombinant processes increases with an increase in the dose rate. Figure 1, reference 1 (Russian).

UDC 630*863.5:663.14.039.3

## Effect of Cultivation Temperature on Protein Content in Candida Scotti Yeast

*907M0002A Moscow GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST in Russian No 6, Sep 89 pp 8-9*

[Article by L. S. Koltsova, T. N. Semushina, N. I. Monokhova, and T. O. Smirnova, Hydrolysis of Plant Material SRI (A-U), Leningrad]

[Abstract] Most producers of feed protein have established a working cultivation temperature of 30-40°C for operational and research purposes. However, a 37-39°C temperature range is known to result in less protein in the biomass when cultivated on various waste products such as sulfite liquor, petroleum hydrocarbons, glycerine, etc. An analogous effect at higher temperatures was observed with yeast grown on plant hydrolysates, where a short-term temperature rise of 2-3°C above optimal leads to a drop in crude protein content from 50-48 percent to 40-36 percent. Despite the pressing need for feed protein, there is virtually nothing in the literature regarding heat-tolerant $mp^+$ (protein mutant) strains of yeasts, which are capable of being cultivated at 40-42°C. The present work discusses a study of the effects of temperature on protein content and composition in Candida scotti yeast cultivated on synthetic and hydrolysate media. The existence of the following three distinct temperature regions is shown: a low-temperature zone (suboptimal) at 22-32°C, where there is a tendency toward increased protein content in the biomass with rising temperature; a basic optimal "plateau" of 34-40°C, where there is essentially no change in protein content; and a superoptimal range of 42-46°C, which marks the beginning of a superoptimal temperature where there is a tendency for the protein content to decrease upon a further temperature rise. Figure 1; references 6 (Russian).

UDC 630*863:541.452-145.11

## Effect of Percolation Rate on Effectiveness of Percolation Hydrolysis

*907M0002B Moscow GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST in Russian No 6, Sep 89 pp 9-10*

[Article by V. I. Kamenny]

[Abstract] Increasing the percolation rate was shown to be an effective way of intensifying hydrolysis by batch percolation. Hydrolysis of plant material is an involved physicochemical process ranging in complexity from rapid to slow hydrolyzing polysaccharides. A study of monosaccharide yield as a function of the specific percolation rate at temperatures ranging from 140 to 180°C shows that the first percolation stage should be conducted in such a manner that the monosaccharides entering solution at 140-155°C are removed at maximum possible speed. These conditions will provide maximum monosaccharide yield and optimum utilization of the equipment. Figures 2; references 9 (Russian).

UDC 630*86.004.5:658.53

## Work Norms Developed for Repair and Maintenance Personnel at Wood Chemistry Enterprises

*907M0002C Moscow GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST in Russian No 6, Sep 89 p 11*

[Article by I. S. Khazak, Wood Chemistry SRI (Central)]

[Abstract] The Central Scientific Research Institute of Wood Chemistry developed size norms for the repair and maintenance work forces at wood chemistry enterprises. The norms were developed in stages: organizational-methodological, assembly of primary materials, technical and economical analysis at work sites, analysis of input data, and certification. Certain shortcomings in labor organization were revealed at the Syava, Neyvo-Rudyanka, and Dmitriyevka wood chemical plants and at the Medvezhyegorsk Rosin Extraction Plant, where efficiency in conducting scheduled repair of equipment was only 65 percent. This was partially due to careless management of labor, low level of maintenance and supervision, and poor organization of labor. The new forms were forwarded to wood chemical enterprises for checking under production conditions, and the final variant, after approbation, was submitted for approval at the Ministry of the Wood Industry.

UDC 630*863.4:543.42

## Use of Atomic Absorbtion Spectrometry for Bertran Microdetermination of Sugars

*907M0002D Moscow GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST in Russian No 6, Sep 89 pp 11-12*

[Article by Z. A. Sergeyeva and I. G. Beym]

[Abstract] Several existing methods for determining the sugar content are based on their capability of reducing copper (II) to copper (I) oxide, which is then determined quantitatively either by titration with a colored indicator (the Bertran method and its modifications) or by photometry of a colored solution. However, these methods entail system errors when used to analyze colored solutions such as hydrolysates or sulfite liquors. In the present work a study was made of the possibility of using the Bertman method in conjunction with spectrophotometry, where the quantity of copper is determined by atomic absorption (AA), a method widely used in laboratories for the microdetermination of copper. The copper (I) precipitate, obtained by reaction of a reducing sugar with Fehling's solution, is separated in a centrifuge, washed, and analyzed by atomic absorption in an AASIN (GDR) spectrophotometer at the 327.5-nm band. Figure 1; references 6: 5 Russian, 1 Western.

541.123.1(047.1)

## Liquid-Vapor Phase Equilibrium in Methylethyl Ketone-Formic Acid Mixture

*907M0002E Moscow GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST in Russian No 6 Sep 89, p 15*

[Article by S. Ye. Teltevskaya, A. L. Bomshteyn, and V. A. Gotlib, Central Wood Chemistry SRI]

[Abstract] To improve current technology on the derivation of formic and acetic acids from wood, information is required on the physicochemical properties of separation systems, especially liquid-liquid and liquid-vapor phase equilibria. The aforementioned acids may be selectively extracted from aqueous solutions with methylethyl ketone, a stable and readily available solvent. However, since liquid-vapor phase equilibrium data for methylethyl ketone are not found in the current literature, a study was made in the present work by using the Sventoslavskiy method, described elsewhere. Experimental data and formulas are presented for calculating vapor phase composition. The methylethyl ketone-formic acid system is characterized by a strongly negative deviation from ideal behavior that results from the strong association of formic acid in the liquid and vapor phases. The methylethyl ketone-formic acid phase diagram indicates that extraction of pure formic acid from this mixture requires a highly efficient column and a high energy outlay. References 4 (Russian).

UDC 630*867.1.002/.2

## Energy-Saving Technology for Recovering Liquid Products of Wood Pyrolysis

*907M0002F Moscow GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST in Russian No 6, Sep 89 pp 16-18*

[Article by M. A. Shaburov, I. I. Pilipenko, and A. N. Trofimov, Central Wood Chemistry SRI; and A. S. Zhikharev, A. V. Kostomakhin, V. V. Kazakov, Mikhm, and M. I. Mikheyev, Ashinskiy Forest Chemical Plant]

[Abstract] The products of wood pyrolysis include charcoal, liquid products (water, $C_1$-$C_4$ acids, alcohols, esters, resins), and gases that are not condensed under normal conditions. These retort gases comprise a multiphase system containing vapors, gases, resin droplets, and fine particles of charcoal and wood bark. The vapor-gas mix is usually cooled to condense and separate the liquid components by employing surface heat exchangers or scrubbers. The liquid condensate contains chiefly water and as much as 15 percent dissolved resins, which makes the recovery of acids, alcohols, and other useful products from this condensate an energy-consuming multistage process. Separation of the components directly in the liquid condensation stage has been proposed. In the present work a study was made of the recovery of wood resins directly from the vapor- gas mix by using inertial separation. This process is based on the tendency of moving solid and liquid particles to maintain their direction and velocity. Any external force acting on a particle, such as gravity, electrostatic or aerodynamic forces, or sonic pressure, causes a change in the particle's velocity and direction. Separation is then based on the vector differences between the gas and other particles. The results show that this makes it possible to recover 90-95 percent of wood resins and to simplify the wood condensate refining technology by excluding the distillation stage. Figures 2; references 3 (Russian).

UDC 634.0.861.14

## Influence of Sulfate Deciduous Bleached Cellulose Components on Stability of Brightness

*907M0017A Riga KHIMIYA DREVESINY in Russian No 4, Jul-Aug 89 (Manuscript received 17 Feb 88) pp 22-26*

[Article by A. N. Zakazov, V. I. Kondratyev, and T. M. Rykova, Siberian Scientific Research Institute of Cellulose and Cardboard]

[Abstract] An estimate is made of the contribution of resinous substances, pentosanes, and carbonyl groups to the change in the optical characteristics of cellulose during artificial thermal aging. Studies were performed on specimens of bleached cellulose made from deciduous trees. An equation is derived to calculate the contribution of these substances to the yellowing of the cellulose. Resinous substances have the greatest influence (45-65 percent). A correlation is found between the changes in optical characteristics and the stability index calculated from thermogravimetric analysis. Figures 3; References: 7 Russian.

UDC 676.2.017.042+676.2.017.6

## Relationship of Deformation and Sorption Properties of Cellulose Materials in Stress-Stain State

*907M0017B Riga KHIMIYA DREVESINY in Russian No 4, Jul-Aug 89 (Manuscript received 18 Mar 88) pp 27-33*

[Article by E. L. Akim, O. A. Yerokhna, V. A. Romanov, and T. N. Romanova, Leningrad Technological Institute of the Cellulose and Paper Industry]

[Abstract] Previous studies demonstrated that by increasing the time of application of a mechanical load to a certain critical value sufficient for cooperative regrouping of structural elements in paper, a forced high elasticity can be achieved at an equilibrium moisture content of the paper corresponding to the normal relative humidity of the air. This article studies the sorption properties of paper in the stress-strained state. Studies were performed on paper made of 100 percent sulfite bleached cellulose, 90 g/m$^{10}$ at a tensile stress of 54 MPa, a deformation of 2 percent, and a thickness 0.1 mm. A quantitative correlation is observed. The change in equilibrium moisture content in mechanically stressed paper begins at the moment of the initial forced elastic transition and does not disappear when the stress is relieved. There are differences in the kinetics of the variation in moisture content of unstressed, stressed, and stressed and then relieved paper. Figures 5; References: 10 Russian.

UDC 547.341

## Reaction of Dialkylalkynylphosphonites With Nitrile and Benzoylformic Acid Esters

*907M0036A Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 59 No 9 Sep 89 (Manuscript received 16 Feb 88), pp 1979-1984*

[Article by R. N. Burangulova, Yu. G. Trishin, I. V. Konovalova, L. A. Burnayeva, V. N. Chistokletov, and A. N. Pudovik, Leningrad Institute of Technology of the Pulp and Paper Industry]

[Abstract] A study is made of the reaction of dialkyl esters of alkynylphosphous acids with nitrile and benzoylformic acid esters. It is found that the reaction of dimethyl- and diethylalkynylphosphonites with benzoylformic acid nitrile in ether at -10 to 0°C results exclusively in the formation of 2,2-dialkoxy-2-alkynyl-4,5-diphenyl-4,5-dicyano-1,3,2-dioxaphospholanes. References 4: Russian.

## Energy of Vacuum?

*907M0061A Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian No 239, 19 Oct 89 p 4*

[Interview with A. Chernetskiy, doctor of Technical Sciences, by M. Dmitruk: "The Energy of a Vacuum?"]

[Text] **An international symposium dedicated to problems of psychotronics concluded in Moscow yesterday. For several decades this science developed underground in the USSR and was legalized only last year. Abroad, however, basic research has long been done in this field. It is not surprising, for after all psychotronics gives hope of a way out of the ecological and moral crisis to which civilization has come.**

**A. Chernetskiy, doctor of Technical Sciences, has spoken in his reports on the perspectives that are being opened up here by some of the studies of Soviet scientists. His speeches aroused great interest at the symposium. After all, it was a question of how to convert science and technology from the spoilers to the saviors of life on earth.**

**The traditional sources of energy provide increasingly less for the needs of developing civilization and increasingly harm the environment. This contradiction is exacerbated with each year that passes and has already reached such an acute state that it has threatened the very survival of mankind.**

**Many scientists are now leaning toward the opinion that studies in the sphere of thermonuclear synthesis are unpromising. This is a very insidious source of energy, mastery of which is fraught with tremendous risk. The chief efforts in creating thermonuclear units are directed toward struggling with unstable plasmas. Really, though, it is impossible to bridle them—this would contradict the very nature of the phenomenon.**

**Is it not better, then, to take the direct path to the goal—to make use of the very instability of plasma?**

**Dmitruk:** Excuse me, Aleksandr Vasilyevich, but at this point I should present you to the readers. You are recognized as one of the leading specialists in this field. The author of a university textbook on the theory of plasma and the first monograph in the world dedicated to equipment-facilitated diagnosis of plasma. The author of 20 inventions and 200 scientific publications. For many years you headed the Department of Physics of the Moscow Institute of the National Economy imeni G.V. Plekhanov, and directed the Commission on Scientific-Technical Problems of Bioenergetics of the VSNTO [All-Union Council of Scientific-Technical Societies] on public principles. Now you are director of the Scientific-Engineering Center for Plasma Equipment of the MINKh [Moscow Institute of the National Economy of the RSFSR Ministry of Higher and Secondary Specialized Education]. Who, if not you, should judge its future.

**Chernetskiy:** I am continuing my idea: the instabilities of plasma, with which we have so far struggled, will make it possible to extract energy... from a physical vacuum. I remind you: this is what scientists called the "empty" space between atoms and elementary particles. In reality a tremendous number of particles and anti-particles are continuously coming into being in it. These pairs live an incomprehensibly short period—$8.10^{-21}$ seconds, and then are annihilated, or as the physicists say, "collapse", at the same time emitting light quantums, which in turn are also annihilated. This phenomenon was called zero-point oscillation of a vacuum, and the particles which simultaneously exist and do not exist—virtual particles. Since they move, though, there is energy. So many of these pairs are given off that their total energy reserve seems miraculous. The American physicists Feinberg and Wheeler estimated that the volume of an ordinary electric light bulb contains an energy potential sufficient... to make all the oceans of the world boil over.

**Dmitruk:** This seems more terrible than a thermonuclear reaction. Do your attempts to utilize the energy of a vacuum not threaten global catastrophe?

**Chernetskiy:** On the contrary—this energy is ecologically pure. In our laboratory not long ago there were devices already in operation to transform it into electrical energy. Yuriy Aleksandrovich Galkin and I obtained this effect together for the first time over 15 years ago, while studying a special form of electric arc—a self-oscillating discharge.

Just imagine: in an electrical circuit, several electric bulbs are switched on in series. Under ordinary conditions they scarcely glow. You have only to open the electrodes of the discharger, however, and an arc is struck between them with a dry crackle and the bulbs ignite blindingly. Some unknown force accelerates the movement of the electrons—it amplifies the current.

After making hundreds of experiments, we came to the conclusion: with a self-oscillating discharge, the acceleration gives to the electrons... virtual particles. When the critical density of the discharge current is reached, the field created by it provides so-called degree of magnetization of the plasma electrons. They give a specific direction to the chaotically moving virtual particles—those rush toward the axis of the self-oscillating discharge and, in turn, attract the electrons. Here they obtain additional energy.

We worked out operating mock-ups. One of them was subjected to an expert examination by V. Lisin and V. Yakovlev, associates of the All-Union Electrical Engineering Institute. They carefully studied the phenomenon and drew up a protocol. It confirms that more than a quadruple increase in energy takes place in the electric circuit.

Just think what this means! In two or three years, with intelligent organization of the work, we could present our plasma amplifiers to electric power plants and increase their power several-fold. This is resource conservation and environmental protection. There will be no major difficulties in making the transfer to powerful and ecologically pure sources of cheap electric energy. This is not simply an alternative—it is our salvation!

**Dmitruk:** So, according to your idea, with zero-point oscillations of a vacuum, no total "collapse" or annihilation takes place, and of the virtual particles—part of their energy is removed by the oscillator.

**Chernetskiy:** Not only that. When the concept of "ether" was abandoned, a whole series, it would appear, of simple physical phenomena were impossible to explain. For example, how can an electromagnetic wave be distributed in a total vacuum? After all, in order for it to be continuous, so-called displacement currents are necessary. But what is displaced in a space in which there is nothing—not even electrical charges? What currents can there be in a complete vacuum? If you adopt the concept of virtual particles, everything goes into its place—it is precisely they that ensure the displacement currents.

**Dmitruk:** But scientists of past centuries used the theory of ether to explain these puzzling phenomena, which many people in our country still doubt. I have in mind the phenomena which in the West are studied by parapsychology—clairvoyance and telepathy, telekinesis and levitation, prediction of the future and insight into the past—this list can go on forever. I suspect that all miracles have a scientific explanation?

**Chernetskiy:** I an not alone in my opinion. For example, according to the theory of V. Dokuchayev, a pulsating electric field may arise in the surrounding space in the form of a so-called wave with a longitudinal component. It is capable of creating negative conductivity of the environment, that is, of being replenished by the energy from it, and through this, of not dying away. For example, calculations have shown that a wave with a longitudinal component can go around our planet many times. This theoretical sample gives the key to puzzling out the phenomena of parapsychology.

According to our concept, waves with a longitudinal component are emanated by means of energy centers and channels in human and other living beings, known in Eastern medicine. These waves are retained in the surrounding space, replenished by the energy of the environment. This means that at any point in space there is information on each inhabitant of our planet. The aggregate of their waves creates a unified information-energy field around the earth—what Vernadskiy called the noosphere.

People with heightened perceptibility are apparently sensitive and can tune in certain wave lengths and read the information from the noosphere. They receive it in the form of visual images, tactile sensations, etc. Incidentally, experiments with clairvoyance have long been carried out in our commission on scientific-techical problems of bioenergetics.

The most interesting results were shown by a group made up of three clairvoyants: Viktor Ivanovich Balashov, a Central Television Station announcer, Svetlana Markovna Chernetskaya, a mathematician, and Inga Ivanovna Panchenko, a candidate in Pedagogical Sciences. Anatoliy Fedorovich Krivtsov, candidate in Technical Sciences, made a statistical processing of the results. It showed that the trustworthiness of the results obtained was from 60 to 97 percent.

From a photograph of a nine-month-old child, Chernetskaya accurately determined that he was now 21 years old, described the appearance of his fiancee, where she lives, and what she likes to do. It turned out that the girl likes to sew, and Svetlana Markovna told in detail about the room where the sewing machine stands.

Viktor Ivanovich Balashov once mentally presented the diagram of a complicated sound device and accurately showed where the defect in it was. Really, many specialists had tried long and unsuccessfully to find it.... There are many such examples—we have conducted hundreds of experiments.

**Dmitruk:** You gave several reports at a symposium dedicated to psychotronics, which deals with technical model study of man's phenomenal abilities. You have probably made studies into this field as well?

**Chernetskiy:** First we satisfied ourselves that man's field could affect the most varied living and nonliving structures. Then we began to make a model study of the bioenergetic processes through technical means—for example, with the aid of an oscillator with a self-oscillating charge. After all, according to our idea, the emissions from this oscillator and man have a common nature: they give off waves with a longitudinal component, which are replenished by the energy of the physical vacuum.

For example, extrasensory charges were carried by the hands to another instrument—a fully shielded quartz oscillator—and influenced it mentally. Usually it has very high stability and operates on a strictly determined frequency. But here, despite the shield, the frequency suddenly changed by a whole order, then by another, and then by a third.... It was clear that the wave with the longitudinal component was penetrating the screen and changing the structure of the elements of the quartz oscillator.

An oscillator with a self-oscillating charge has also caused similar changes in frequency. Just like the hands of an extrasensory person, it gives many other effects. For example, it changes the resistance of the resistors by over 10 percent. Even the seemingly absolutely stable speed of radioactive beta-fallout changes by 5 percent!

Using our oscillator in agriculture may be extraordinarily effective. It seems improbable, but we succeeded in doubling the growth rate of wheat and pea seeds and increasing the storage period for vegetables by a factor of five-six.

**Dmitruk:** Right now there is a great deal of controversy concerning the "aura" which extrasensory persons seemingly see around people and other living beings. Can it be recorded by instruments? What physical meaning does it have?

**Chernetskiy:** These "envelopes" also form around inanimate objects—for example, the oscillator of a self-oscillating discharge. We have measured them around people, plants and instruments with electrometric sensors. Their electric fields had a periodic structure, and they seemed to pulsate. This periodicity is characteristic of neither a static field nor a traveling wave. This phenomenon, however, may fully explain our concept: living organisms and an oscillator emit electromagnetic waves with a longitudinal component. For example, with the pulsation of charges in the main energy channel of a person, located along the spine, a field arises in the surrounding space, with the directivity periodically changing on the basis of the distance to the source.

It is interesting that the structure of the "envelopes" around the oscillator is retained when it is de-energized. This can be explained by the fact that the wave emitted is replenished by the energy of the physical vacuum. The most surprising thing, however, proved to be something else: it is possible to create mentally the image of a person or oscillator in any spot, for example, in the corner of a room, and the instruments record the "envelope" of this phantom. If this image is then mentally washed away, the "envelopes" disappear—the instruments will show nothing. This attests to the fact that a person's brain is capable of emitting waves with a longitudinal component—they give the physical vacuum a specific structure or destroy it.

**Dmitruk:** These results seem simply staggering—after all, they confirm the idea, known from ancient times, of the materiality of all ideas. As the ancient Greeks said, thoughts hover in the air. And now you have succeeded in recording them with instruments. Really, though, this radically changes the traditional scientific concepts of human consciousness. Is it turning out that hallucinations, apparitions, souls and even gods—all these products of the human brain—are material?

**Chernetskiy:** Our studies make it possible to find answers to the eternal questions of philosophy—of life, death and immortality. The main thing right now, though, is not the theories. There is an urgent need to save our earth, which is seriously ill because of the foolish activity of people. We must as quickly as possible set about the practical realization of vacuum energy and deliver the planet from the threat of ruin resulting from unrestrained exploitation of traditional energy sources.

The main thing, however, is to overcome the moral crisis into which the incorrect attitudes of the subjugators of nature have brought us. After all, we have subjugated... ourselves. The more profoundly man can get to know his potentials, the more strongly his conscience tortures him for the evil committed on our great planet—the greater will be the thirst to save nature and that means, mankind as well.

22161
35

NTIS
ATTN: PROCESS 103
5285 PORT ROYAL RD
SPRINGFIELD, VA 22161

Foreign Broadcast Information Service (FBIS) and Joint Publications Research Service (JPRS) publications contain political, economic, military, and sociological news, commentary, and other information, as well as scientific and technical data and reports. All information has been obtained from foreign radio and television broadcasts, news agency transmissions, newspapers, books, and periodicals. Items generally are processed from the first or best available source; it should not be inferred that they have been disseminated only in the medium, in the language, or to the area indicated. Items from foreign language sources are translated; those from English-language sources are transcribed, with personal and place names rendered in accordance with FBIS transliteration style.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by FBIS/JPRS. Processing indicators such as [Text] or [Excerpts] in the first line of each item indicate how the information was processed from the original. Unfamiliar names rendered phonetically are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear from the original source but have been supplied as appropriate to the context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by the source. Passages in boldface or italics are as published.

## SUBSCRIPTION/PROCUREMENT INFORMATION

The FBIS DAILY REPORT contains current news and information and is published Monday through Friday in eight volumes: China, East Europe, Soviet Union, East Asia, Near East & South Asia, Sub-Saharan Africa, Latin America, and West Europe. Supplements to the DAILY REPORTs may also be available periodically and will be distributed to regular DAILY REPORT subscribers. JPRS publications, which include approximately 50 regional, worldwide, and topical reports, generally contain less time-sensitive information and are published periodically.

Current DAILY REPORTs and JPRS publications are listed in *Government Reports Announcements* issued semimonthly by the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161 and the *Monthly Catalog of U.S. Government Publications* issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

The public may subscribe to either hardcover or microfiche versions of the DAILY REPORTs and JPRS publications through NTIS at the above address or by calling (703) 487-4630. Subscription rates will be provided by NTIS upon request. Subscriptions are available outside the United States from NTIS or appointed foreign dealers. New subscribers should expect a 30-day delay in receipt of the first issue.

U.S. Government offices may obtain subscriptions to the DAILY REPORTs or JPRS publications (hardcover or microfiche) at no charge through their sponsoring organizations. For additional information or assistance, call FBIS, (202) 338-6735,or write to P.O. Box 2604, Washington, D.C. 20013. Department of Defense consumers are required to submit requests through appropriate command validation channels to DIA, RTS-2C, Washington, D.C. 20301. (Telephone: (202) 373-3771, Autovon: 243-3771.)

Back issues or single copies of the DAILY REPORTs and JPRS publications are not available. Both the DAILY REPORTs and the JPRS publications are on file for public reference at the Library of Congress and at many Federal Depository Libraries. Reference copies may also be seen at many public and university libraries throughout the United States.