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Science & Technology
CENTRAL EURASIA: Chemistry

JPRS-UCH-92-006 CONTENTS *7 July 1992*

AEROSOLS

CATALYSIS

COMBUSTION AND EXPLOSIVES

ELECTROCHEMISTRY

ENVIRONMENTAL CHEMISTRY

FERTILIZERS

MATERIALS RESEARCH

POLYMERS AND RUBBER

MISCELLANEOUS

Mathematical Description of Aerosol Particle Settling Process in Regular Moving Bed Packing Layer

927M0077F Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 321, No 1, Nov 91 (manuscript received 10 Sep 91) pp 153-160

[Article by Academician V. V. Kafarov, L. D. Plyatsuk, I. N. Dorokhov, and M. Z. Yeskendirov, Chemical Technological Institute, Kazan; UDC 532.5]

[Abstract] One way to intensify the inertial-diffusion processes forming the basis of so-called "wet" cleaning of gases from aerosols (mists, dusts, smokes, etc.) is to conduct these processes under conditions of intensified turbulence. This may be realized in an apparatus having a regular moving bed packing. Being highly efficient in capturing both fine and large sized aerosols, and possessing self-cleaning properties in the contact elements, as well as being small in size and dependable in use, these units appear to be very promising for wide scale industrial application. In the present work a system of differential and differential-integral equations was derived which makes it possible to describe the agglomeration process of aerosol particles as a function of condensational and coaggulational growth and to compute the efficiency of capturing mists in intensified regular moving bed packing units. Figure 1; references 8: 6 Russian, 2 Western.

Unusual State of Platinum in Alumina-Platina Catalysts, Subjected to High Temperature Oxidation

927M0077C Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 321, No 1, Nov 91 (manuscript received 17 Sep 91) pp 114-119

[Article by S. I. Abasov, V. Yu. Borovkov, F. A. Babayeva, B. A. D. adashev, and Corresponding Member V. B. Kazanskiy, Organic Chemistry Institute imeni N. D. Zelinskiy, Moscow; Petrochemical Processing Institute imeni Yu. G. Mamedaliyev, Baku; UDC 541.128]

[Abstract] Alumina-platina catalysts (APK) containing less than 1 percent by weight Pt are widely used in various industrial chemical processes such as reforming, hydroisomerization, exhaust gas treatment, etc. The efficiency of these catalysts depends greatly on the method of preparation and the pre-activation or regeneration conditions. Basic factors determining catalytic properties of the platinum are its particle size and nature of interaction with the carrier. One may expect that metal-carrier interaction will manifest itself more clearly in low-percentage highly dispersed APK as well as in catalysts subjected to high temperatures where phase transitions of the carrier are possible. Such conditions could arise as a result of local overheating of the APK during regeneration by burning off coke, or the presence of redox reactions on their surfaces. In the present work IR-spectra of adsorbed CO was used to study the effects of high temperature treatment of low-percentage APK on the subsequent capability of carried platinum to be reduced with hydrogen. The results demonstrate that prolonged heating of APK in dry air at 1023 K, i.e. close to the carrier phase transition point, results in a marked modification of the carried platinum in both oxidized and reduced samples. This is manifested in the surface formation of difficult-to-reduce platinum oxides and the formation of other metallic forms on the carrier surface which are not characteristic for conventionally prepared APK. Figures 3; references 15: 9 Russian, 6 Western.

Combining Cyclohexane Dehydrogenation with Pentadiene-1,3 Hydrogenation Over System of Particlate and Monolithic Membrane Catalysts

927M0077E Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 321, No 1, Nov 91 (manuscript received 23 Aug 91) pp 141-145

[Article by N. V. Orekhova, M. M. Yermilova, and Academician V. M. Gryaznov, Petrochemical Synthesis Institute imeni A. V. Topchiyev, Moscow; Friendship of Peoples University imeni Patrice Lumumba; UDC542.97:54.731]

[Abstract] Cyclohexane dehydrogenation is a basic reaction in the catalytic reforming of petroleum products. The equilibrium yield of benzene may be increased by selective elimination of the hydrogen formed during the cyclohexane dehydrogenation over a palladium alloy membrane catalyst or a particulate catalyst placed within the hydrogen exit tube. In either case, increasing the throughput rate of an inert purging gas raises the benzene yield up to a certain point, which varies with the cyclohexane feed rate. If this limiting point is due to the fact that the rate at which hydrogen atoms are split off from the cyclohexane becomes equal to the hydrogen recombination rate at the exiting surface of the membrane, it may be eliminated by replacing the hydrogen recombination stage with the more rapid hydrogen consumption process. For example, during dehydrogenation of cyclohexane on the inner walls of a palladium tube, the hydrogen diffused through the membrane has been used for hydromethylation of toluene or o-xylene, thereby accelerating the rates of all reactions as well as the hydrogen transfer rate as compared to carrying out the reactions individually. In the present work optimum conditions were determined for combining cyclohexane dehydrogenation with pentadiene-1,3 hydrogenation over a two- catalyst system - particulate and monolithic membrane palladium- ruthenium, at 490 K and atmospheric pressure in a counter-current reactor. Figures 2; references 11: 6 Russian, 5 Western.

Effect of Tertiary Amine Structure on Their Catalytic Activity in Reaction of Diphenylphosphinic Acid Hydrazide with Phenyl Isothiocyanate

927M0098A Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 61, No 4, Apr 91 (manuscript received 19 Dec 89) pp 879-886

[Article by N. I. Yanchuk, Ternopolskiy State Pedagogical Institute imeni Ya. A. Galan; UDC 547.234.1+547.241+541.128]

[Abstract] The effect of structure on catalytic activity was studied in twelve aliphatic amines, using the kinetic model reaction of diphenylphosphinic acid hydrazide with phenylisothiocyanate in benzene at 25°C. The rate constants of the uncatalyzed and catalyzed reactions were calculated graphically algebraically exhibited good agreement. The ratios of the catalyzed to uncatalyzed rate constants were 372-1538 for nine of the compounds. Tribenzylamine, N,N- dimethylanaline, and N,N-diethylanaline had no catalytic activity. Amines containing methyl groups had enhanced catalytic activity, due to low screening effect and active interaction with the hydrazide. Steric hindrance caused the low activity of the cyclic amines. With increased substituent size, the screening effect played a more important role than the induction effect, in that all tertiary aliphatic amines tested had decreased catalytic activity. Electron acceptor substituents on the tertiary amines further decreased catalytic activity. The absence of catalytic activity in tribenzylamine and N,N-dialkylaniline can be explained using only the low electron donor ability of the nitrogen atom, without resort to the screening effect of the substituents. The results indicate that coordination interactions play a significant role in the mechanism of the reaction under study. The most probable mechanism

involves rapid association of the hydrazide with the amine, followed by interaction with the carbon atom of the isothiocyanate, aided by hydrogen bonding from the amine, to give a five-membered-ring intermediate in the rate limiting step. The modified Taft equation best describes the results obtained. References 22: 19 Russian, 3 Western.

Features of Crystallization of Basalt-Based Glass in Presence of Silicon Carbide

927M0100B Moscow IZVESTIYA SIBIRSKOGO OTDELNIYA AKADEMII SSSR, SIBIRSKIY ZHURNAL No 4, Jul-Aug 91 (manuscript received 4 Jan 91) pp 110-115

[Article by N. P. Rudenko, G. Yu. Shvedenkov, and V. P. Kuzyutin, Institute of Geology and Geophysics, Siberian Department, USSR Academy of Sciences; Institute of Catalysis, Siberian Department, USSR Academy of Sciences, Novosibirsk; UDC 666.193:548.517:549.214]

[Abstract] A study was conducted on the influence of silicon carbide on the process of sitall formation from mixtures of oxides with compositions close to that of basalt. The products obtained from melt solidification depended on melt temperature, cooling rate, and SiC presence. Slow cooling with SiC produced glass with few, evenly distributed crystalline inclusions. Rapid cooling gave monophasic glass. Glass state was confirmed by microscopy and X-ray analysis. Addition of SiC increased the tendency of the melt to crystallize and inhibited glass formation. The phase composition of the product was also altered by the point of SiC addition, in the starting material or during heating. SiC elevated the melting temperature of the oxide mixtures and increased the tendency of samples to crystallize. In the absence of SiC phase changes began at 1523 K, in its presence at 1723 K. Formation of cordierite and mullite was noted in the samples containing SiC. References 9: 4 Russian, 5 Western.

Chlorination of Ethylene in the Presence of Different Catalytic Systems

927M0108A Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 1, Jan 92 pp 3-4

[Article by V.I. Rozhkov, O.A. Zaydman, E.V. Sonin, M.G. Avetyan, N.F. Krishtal, Yu.A. Treger, V.I. Kharitonov, V.F. Perevalov, and Yu.M. Shestakov; UDC 66.094.403.097:661.715.332]

[Abstract] The authors of the study reported herein compared the effectiveness of six catalysts in the synthesis of dichloroethane by liquid-phase chlorination of ethylene. The six catalysts used were as follows: 1) ferric chloride ($FeCl_3$) with a concentration of Fe^{3+} ions ranging from 0.04 to 0.07%; 2) a complex finely disperse catalyst containing 7.8% $FeCl_3$ that has a softening point of 270°C and that is not soluble in dichloroethane, dioxane, chloroform, or carbon tetrachloride; 3) the catalyst S-393, which is based on mono- and diglycides of oligoethylene glycol esters; 4) a complex of $FeCl_3$ with diglyme; 5) metallized pellets produced by the Oskolsk Metallurgy Combine and containing at least 90% metallic iron, 1.4% carbon, 4.1% silicon dioxide, not more than 0.005% sulfur, not more than 0.015% phosphorus, and with 97% metallization; and 6) a complex metal catalyst that was developed at Nizhegorod Polytechnic Institute and synthesized at the Kaprolaktam Production Association in Dzerzhinsk and that is readily soluble in dichloroethane. The studies were performed in a dichloroethane-filled glass reactor with a 5% excess of ethylene. The studies were performed in accordance with a method described elsewhere. The experiments lasted from 11 to 20 hours. The studies performed indicated that of all the catalysts examined, $FeCl_3$ with small additions of oxygen (air) proved to be the best catalyst from the standpoint of preventing reactions of substitute chlorination in the gaseous phase. The catalyst developed at Nizhegorod Polytechnic Institute was found to result in about a 0.6% reduction in selectivity of the process of direct chlorination of ethylene when the reaction mass boiled. Catalysts 2 and 5 had nearly identically inhibiting effects with respect to the reaction of substitute chlorination of dichloroethane. When $FeCl_3$ was used on a complex finely disperse carrier, however, elevated (to 0.26% in 20 hours) amounts of 1,1,1,2- and 1,1,2,2-tetrachloroethane were found to form. The said compounds were not noted to form when the other two catalytic systems were used. After 10 hours, the S-393 catalyst resulted in the formation of 11.1% 1,1,2-trichloroethane, and as much as 13.5% was formed when a second catalyst was also used. These findings thus confirmed the inadvisability of using the given compounds as inhibitors of the reaction of substitute chlorination during direct chlorination of ethylene. Figures 3; references 6: 5 Russian, 1 Western.

Using a Hydrophobic Catalyst-Based Hydrogen Incendiary To Protect Against Fire and Explosion

927M0108D Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 1, Jan 92 pp 53-55

[Article by A.V. Trunev, S.G. Tsarichenko, Yu.N. Shebeko, and V.D. Keller; UDC 614.841.12]

[Abstract] The technique of catalytic combustion of hydrogen-and-air mixtures with low hydrogen concentrations has received a great deal of attention as a way of reducing the fire and explosion hazard of areas subject to the formation and accumulation of hydrogen. A hydrophobic catalyst for hydrogen combustion that was developed at the Physicochemical Scientific Research Institute [NKFKhI] imeni L.Ya. Karpov has been used as the basis of a device for providing such protection. The device consists of a series of rods made of sintered γ-Al_2O_3 with platinum black niello injected into their pores. The rods are coated from the top with a porous gas- and vapor-permeable film of fluoroplastic-4. They are 5.8 mm in diameter and 63 mm long. The rods have an axial channel 1 mm in diameter. The device consists of an assembly of the said rods in a casing. Studies of the effectiveness of using the hydrophobic incendiary and rod device have been conducted and published elsewhere. The authors of the study reported herein focused their attention on the problems of optimizing the processes of convective flows along the surface of the rods with the hydrophobic incendiary so that the maximum amount of hydrogen involved in the oxidation can enter the reaction zone and thus increase the fire and explosion safety of the areas in which the incendiaries have been placed. Initial hydrogen concentrations not exceeding 3.5% by volume were used during the optimization studies. The experiments were conducted in a reaction vessel 300 mm in diameter and 825 mm high that was equipped with a peephole. For comparison purposes, three rods with hydrogen incendiary were used during the studies, and two series of experiments were performed with each rod. In the first series, the reaction vessel was filled with a hydrogen-and-air mixture containing an initial hydrogen concentration of 2.5-3.5% by volume, and the combustion was allowed to proceed until the hydrogen practically disappeared. In the second series of experiments, the reaction vessel was filled sequentially with different hydrogen-and-air mixtures with initial concentrations of 0.2 to 3.5% by volume, and the effectiveness of hydrogen combustion was determined only at close to the initial concentrations. The dependence of rod surface temperature and hydrogen concentration turned out to be nearly linear. The productivity constant turned out to equal 0.93 $dm^3 \times h^{-1} \times [\% vol]^{-1}$ for all three of the rods and hydrogen incendiaries studied. Placing the rods in a 20-mm-diameter casting was found to result in a 30% higher productivity than that of a single hydrogen incendiary-containing rod without a casing). The use of a multitier rod configuration did not appear to affect productivity; however, a multitier rod configuration did help to reduce superheating of the catalyst, prevent the destruction of the protective fluoroplastic coating, and thus extend the life of the rods used in a given assembly. Even after three hydrogen incendiary-containing rods had been held in a hydrogen-and-air mixture for 40 hours, they still maintained their initial characteristics. The dependence of the hydrogen incendiary-containing rods on volume hydrogen concentration in the concentration range from 0.2 to 3.5% by volume turned out to be close to linear. Figures 4; references 4 (Russian).

Calculating the Lower Temperature Threshold of Flame Propagation of Mixtures of Mutually Soluble Combustible and Incombustible Fluids

927M0109A Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 5, May 91 pp 275-277

[Article by Ye.R. Nazin, I.V. Kaprukhina, and N.G. Smolyakova; UDC 543.874.001.24]

[Abstract] One promising way of reducing the fire hazard of production processes using combustible and highly combustible fluids is to dilute them with phlegmatizers. Phlegamatizing additives reduce the lower threshold flame propagation temperature of combustible fluids to the point where they are actually transformed into incombustible fluids. The currently accepted methods of calculating the lower threshold temperature of flame propagation makes it possible to perform calculations for only a certain class of phlegmatizers. Specifically, the existing computation method can only be used if the temperature dependence of the saturation vapor pressure and the parameter characterizing the phlegmatizing or inhibiting of the incombustible component in the vapor phase are both known. Because these data are lacking for a number of incombustible fluids, the existing method of calculating the lower flame propagation threshold temperature has a limited application area. In an effort to remedy this situation, the authors of the study reported herein have worked to create a method of calculating the lower flame propagation threshold temperature of mixtures of combustible and incombustible fluids that is based on more readily accessible data. A tentative lower flame propagation threshold temperature and a coefficient characterizing the phlegmatizing effect of the incombustible component are used. The proposed method is further based on the assumption that the phlegmatizing effect of an incombustible fluid depends on its "degree of incombustibility," which is determined by the ratio of the combustible and incombustible elements in its molecule and on the ratio of the lower flame propagation threshold of the combustible and incombustible components of the mixture. A combustibility coefficient derived from Oehley's formula is used to characterize the latter ratio. The validity of the proposed method is tested by a comparison of calculated and experimental values of seven mixtures of combustible and halogen-containing hydrocarbons. The mean square error of calculations 1) based on previously published

methods, 2) based on previously published methods but with the phlegmatization coefficient calculated in accordance with the formula derived herein, and 3) based exclusively on the formula derived herein amounted to 14.4, 10.4, and 6.1°C, respectively. A second series of calculations in the case where the incombustible component does not contain hydrocarbon atoms in its molecule is also presented. The mean square error of calculations (averaged over calculations performed for 23 mixtures) amounted to 10°C. Calculating the lower flame propagation threshold temperature by using the proposed method requires knowing only the following: the composition of the mixture, the lower flame propagation threshold of the combustible component, and the boiling point and molecular formula of the incombustible component. Tables 2; references 6: 5 Russian, 1 Western.

Attempts to Detect Electrochemical Cold Fusion by Determination of Excess Tritium

927M0094A Moscow ELEKTROKHIMIYA in Russian Vol 27 No 11, Nov 91 (manuscript received 8 Apr 91) pp 1403-1412

[Article by O. A. Petriy, G. A. Tsirlina, Ye. F. Simonov, V. A. Safonov, Ye. V. Lapshina, Moscow State University imeni M. V. Lomonosov; UDC 541.128.26]

[Abstract] Experimental results obtained from April 89, when the first cold fusion (CF) was announced, were reported. Although they do not support CF phenomena in the systems studied, they could be used in solving the principal questions relating to the setting up, executing and interpreting the experimental results obtained in the attempts to achieve CF. Specifically, results were reported of the determination of excess tritium in solutions based on D_2O following their hydrolysis with hydrogen adsorbing cathodes made of platinum and intermetallic compounds. In their experiments, the authors paid close attention to the composition of the system, especially the quantities of adsorbed hydrogen and oxygen, fine purification of the surface of the electrodes and of the solutions used. Detailed description was provided of the preparation of electrodes and of the solutions used, the collection of gas, determination of the time required for the adsorption-desorption process and other experimental conditions. Principal methodological errors were analyzed along with various methods for identifying synthetic products; the setups for control experiments were noted. Special attention was given to liquid scintillation methodology. Analysis of liquid scintillation and γ- spectroscopic data of more than 100 experiments showed that no CF could have occurred in the systems investigated. However, many side effects were observed which could have given false impressions of the CF. Figures 2, table 1; references 42: 7 Russian, 36 Western (1 by Russian authors).

Interaction of Sulfide Ions With Gold Electrode Surface Based on Data of Electric Reflection and Quantum Chemical Calculations

927M0094B Moscow ELEKTROKHIMIYA in Russian Vol 27 No 11, Nov 91 (manuscript received 19 Nov 90) pp 1461-1469

[Article by G. V. Korshin, A. R. Sayfullin, An. M. Kuznetsov, R. R. Nazmutdinov, Kazan Chemical-Technological Institute imeni S. M. Kirov; UDC 541.13:541.183:543.42:546.59]

[Abstract] Literature data indicate that during adsorption of materials containing $S^{=}$, a strong chemical sorption interaction occurs between the adsorbate and the metal surface. In the present paper experimental results were reported of the adsorption of such sulfide ions on gold electrode investigated by the methods of electric reflection (ER) and quantum chemical calculations (QCC). Heat effects of the adsorption and various chemical parameters were analyzed for several types of adsorbed particles. On the basis of the accumulated observations a conclusion was stated that the layer of adsorbed sulfur on the surface of gold consists of atomic sulfur and not of its charged particles. Possible reasons were proposed for the appearance of a positive sign structure of the ER in the range of energies exceeding 2.5-2.8 eV, however, it was not possible to make an unequivocal conclusion. Additional data should be obtained from adsorption of sulfide ions on copper and silver. Similar behavior could possible be observed for adsorption of tellurium and selenium ions on copper subgroup metals. Figures 4; table 1; references 27: 12 Russian, 15 Western.

Investigation of Thiocyanate Ion on Polycrystalline Gold Electrode

927M0094C Moscow ELEKTROKHIMIYA in Russian Vol 27 No 11, Nov 91 (manuscript received 20 Nov 90) pp 1470-1478

[Article by G. V. Korshin, R. R. Nazmutdinov, A. R. Sayfullin, Kazan Chemical-Technological Institute imeni S. M. Kirov; UDC 541.13:541.183:543.422:546.59]

[Abstract] Results of theoretical and experimental investigation of the adsorption of SCN^- on gold electrode have been reported. The electric reflection method and the determination of differential capacity were used in the experimental portion of the study; theoretical analysis was based on quantum-chemical calculations. It was shown that adsorption of the thiocyanate ion on gold occurred with a planar orientation of the adsorbate and the degree of the charge transfer towards the metals was close to one. Even though, on the basis of thermodynamic calculations, dissociation of SCN^- was possible, which could lead to an adsorption of the cyanide ion and sulfur, in a practical sense this process would be practically insignificant due to the high energy barrier to dissociation. Formation of the trace amounts of sulfide ion were observed resulting probably from hydrolysis. The authors concluded that discrepancies in the obtained results were due to characteristic effects of the free and bound charges on the electric reflection signal. Figures 7, table 1; references 18: 8 Russian (1 by Western author), 10 Western (1 by Russian authors).

Electrolytic Platinum Crystal Nucleation in Chloride Melts

927M0094D Moscow ELEKTROKHIMIYA in Russian Vol 27 No 11, Nov 91 (manuscript received 19 Dec 90) pp 1496-1505

[Article by N. A. Saltykova, O. V. Potnyagin, L. T. Kosikhin, A. N. Baraboshkin, N. O. Yesina, A. P. Korovenkov, Institute of Electrochemistry, Ural Division of USSR Academy of Sciences, Sverdlovsk; UDC 541.135.3:546.92]

[Abstract] Using the galvanostatic method, formation of platinum crystal seeds on glassy carbon micro-electrodes in an eutectic mixture melt consisting of KCl-NaCl-CsCl (24.5-30.0-45.5 mole-% respectively) was investigated at 500-700° C in an atmosphere of helium; an attempt was made to determine exchange currents of the discharge-ionization reaction of platinum in these solutions. It was noted that maximum overcharge of platinum crystal seeds could be as high as 600 mV, especially at high current density. It was noted that with an increased content of hydroxy admixtures in the melt, the glassy carbon surface became activated, resulting in a 250 mV drop of the maximum overcharge. One of the possible reasons for this phenomenon is the independent chemical precipitation of platinum crystals on the glassy carbon support. The exchange currents for discharge-ionization of platinum on growing platinum seeds were calculated. The magnitude of the maximum overcharge of platinum crystals nucleation depends on the state of the glassy carbon support which in turn depends on the composition of the melt. Figures 7, table 1; references 10: 8 Russian, 2 Western (1 by Russian authors).

Cathode Cleavage of P-H Bond. Electrochemical Reduction of Dialkylphosphites

927M0098B Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 61, No 4, Apr 91 (manuscript received 23 Oct 89) pp 889-893

[Article by A. V. Bukhtiarov, V. V. Mikheyev, A. V. Lebedev, and Yu. G. Kudryavtsev, State Scientific Research Institute of the Chemistry and Technology of Hetero-organic Compounds, Moscow; UDC 541.138.3]

[Abstract] Volt-amperometric investigations of the dialkylphosphites $(RO)_2P(O)H$, where R was methyl, ethyl, butyl, or octyl, were conducted in a 0.1M solution of dry tetraethylammonium chloride in acetonitrile under dry nitrogen. The dialkylphosphites did not exhibit electrochemical activity on lead, cadmium, tin, or graphite electrodes, but were electrochemically active on platinum, nickel, iron, and copper. In the latter case they had reproducible reduction waves proportional to their concentration. Reduction was accompanied by intense evolution of hydrogen on the cathode surface. Coulometric measurements indicated that a one electrode reaction was occuring at the cathode, cleavage of the P-H bond with formation of a singly charged dialkylphosphite ion. Identification of the reaction products via cyclic oxidation was not possible, indicating that they oxidize at a more positive potential than the supporting electrolyte. Preparative experiments in a diaphram-free cell demonstrated that the product of the reaction is the metallophosphite $[(RO)_2P(O)]_nM$. The structure of the product was confirmed by elemental analysis, IR spectra, and regeneration of the starting phosphite by oxidative hydrolysis. Figures 1; references 4: Russian.

Cleaning Petroleum-Containing Waste Waters by Ultrafiltration

927M0108B Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 1, Jan 92 pp 13-15

[Article by Ye.V. Kupchinskaya, I.N. Lipunov, Yu.G. Martynova, and G.G. Redkina; UDC 628.543:666.98]

[Abstract] Because of steam-curing of the forms with live steam, the process of manufacturing reinforced concrete products results in waste waters containing 200 to 8,500 mg/l petroleum products. The cleaning equipment currently existing at plants producing reinforced concrete products cannot treat these waste waters adequately and have thus necessitated the development of an effective final treatment method. the authors of the study reported herein studied the feasibility and efficiency of using the method of ultrafiltration for final treatment of the waste waters generated during the manufacture of reinforced concrete products. Research conducted at the UralpromstroyNIIProyekt has established that water containing up to 50-260 mg/l petroleum products may be used in manufacturing concrete of acceptable quality. In view of this fact, the researchers conducting the study reported herein set out to develop a method that would result in water containing no more than 10 mg/l petroleum products. The experiments were performed on continuous- and intermittent-type laboratory units. Membranes with average pore diameters ranging from 20 to 60 nm were used. UAM-600 membranes (which have an average pore diameter of 60 nm) were found to have a high productivity and to result in water with a petroleum product content that did not exceed 10 mg/l throughout the entire range of starting petroleum product contents tested (50 to 500 mg/l). Further studies to determine the optimum conditions for using the said membranes in continuous-type filtration units indicated that they function best when used at pressures of 0.45 to 0.5 MPa and that they are at their peak productivity when used with waters having petroleum product contents of more than 300 mg/l. Acidifying the emulsions used to a pH of 3-4 was found to help reduce the content of petroleum products in the filtrate by a factor of 1.5 and to cause a 5% increase in productivity. A process temperature of 40-45°C was found to be optimal. Studies performed on intermittent-type ultrafiltration units established that even though higher initial concentrations of petroleum products in the waste water resulted in higher amounts of petroleum products in the final filtrate, the final concentration did not exceed 10 mg/l even when an initial concentration of 500 mg/l was tested. The tests provided a basis for hoping that the concentration of petroleum-containing waste waters could be reduced all the way to a concentration of 5 mg/l. Fifteen minutes of rinsing in solutions of artificial detergent at a temperature of 40-45°C was found to be sufficient to clean the membranes. The process described was found to be able to treat waters to a final petroleum content not exceeding 10 mg/l and to do so with a productivity between 70 and 80 l/(m^2 x h). Figures 3; references 10: 6 Russian, 4 Western.

Ecological Problems in Creating an Optimal Thermal Layout for Combined Production of Calcined Soda and Calcium Chloride

927M0109C Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 5, May 91 pp 58-59

[Article by P.M. Kritsula and A.F. Zozulya; UDC 662.99.001.57:661.42]

[Abstract] The generation of the thermal and electric power required for soda production requires the consumption of a great deal of fuel, which results in significant pollution of the air basin of industrial and population centers with significant quantities of nitrogen and sulfur oxides. Natural gas is the main fuel used in the soda sector, and furnace residual fuel oil is used as a backup. The structure of the consumption of natural gas in the combined production of calcined soda and calcium chloride by using the flame method of calcining sodium bicarbonate and a drum-granulator-drier loop is virtually equivalent to the structure of natural gas consumption in the production of calcined soda with vapor calcination alone. At soda enterprises such as the Khimprom Production Association in Slavyansk and the Krymsk Soda Plant 80% percent of the gas used goes to meet the electric and thermal power needs of the heat source itself. At the Soda Production Association in Sterlitamak, flame calcination of sodium bicarbonate with central heat supply from the Bashkirenergo PEO is the primary soda production technique used. Consequently, the thermal and electric power required for the TETs itself amounts to only 38-40% of all the natural gas used by the enterprise. The net emission of NO_x from heat sources into the air basin (calculated for NO_2) amounts to 80% in the cases of the Khimprom and Krymsk Soda Plan and up to 40% in the case of the Soda Production Association in Sterlitamak. The structure of meeting steam requirements of the calcined soda production process at the Karbonat KhNPO [not further identified] is based on a circuit entailing recovery of the heat of the distiller fluid in a distillation department and balanced use of steam with a pressure of 0.25 MPa produced by the distillation department after adiabatic units expanding the condensate of the steam calciners and reducing net emissions of NO_2 by the boiler units by 18%. The ecological situation in the areas surrounding soda-producing enterprises may be further improved by increasing the amount of condensate returned to the process after heat exchange equipment and by cleaning it to a level meeting the indicators established for the steam produced by the given enterprise's heat source. The process flows for regenerating ammonia from the primary distillation filter fluid and distillation of weak fluids should be optimized so that the steam condensate is not fully lost in the filter fluid (thus increasing heat losses with the distiller fluid) but is instead entirely returned to the TETs and used as feedwater for the boiler units. Combining the production of calcined soda and calcium chloride can provide a 100% return of the primary condensate from soda production, which is equivalent to saving 0.2 tons fuel equivalent per ton of soda and 2 m^3 per ton of soda in the primary fuel heat source and live steam, respectively. The resultant increase in the concentration of calcium chloride in the distiller fluid from 12 to 18% will in turn reduce the amount discharged and extend the operating life of the tanks used to accumulate it. Recovering the secondary condensates from the production of calcium chloride as a feedwater for the boiler units of the TETs at the Khimprom plan will reduce fuel consumption at the plant by 4%. Using electrodialysis or reverse osmosis to clean the secondary condensate is not economically feasible and would cost about 1 ruble/m^3 versus 0.3 ruble/m^3 when ion exchange cleaning is used. The All-Union Heat Engineering Institute imeni F.E. Dzerzhinskiy [VTI] has developed a method of homogeneous high-temperature reduction of NO_x by ammonia in an effort to combat the negative effects of nitrogen oxide emissions on the environment, and the Karbonat KhNPO has collaborated with the VTI to produce the engineering documentation needed to construct a prototype commercial unit for high-temperature ammonia cleaning of the stack gases of boiler units used at the Krymsk Soda Plant. It is projected that the efficiency of scrubbing NO_x from the stack gases will reach 70%. Integrated improvement of the thermal layout of the combined production of calcined soda and calcium chloride and the TETs used to furnish power for the production process will not only save significant amounts of fuel and water but will also significantly reduce the discharge of sewage and reduce gross net nitrogen oxide emissions from the TETs from 62 to 19%. References 8 (Russian).

Compactability of Granular Materials (Inorganic Salts and Mineral Fertilizers)

927M0108C Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 1, Jan 92 pp 29-34

[Article by I.M. Kuvshinnikov; UDC 620.192.64:541.12]

[Abstract] The author of this research review has examined the problem of the compactability of granular materials (specifically, inorganic salts and mineral fertilizers). After analyzing a series of experimental and theoretical studies of the problem, he concludes that the compaction of granular materials is the result of and is always linked to the mutual adhesion of particles. Compaction represents the replacement of the weak dispersion interaction of ions with dipole-induced air molecules by stronger ion-ion and ion-dipole bonds of the grains' surfaces. The following conclusions also emerged from the studies reviewed: 1) a freshly prepared crystalline product always has a higher compactability than does a product whose surface has passed through the aging stage; 2) commercial products containing impurities have a higher compactability than do chemically pure substances; 3) compactability should increase exponentially with temperature; and 4) granular materials possessing a high compactability are generally classified as highly absorbent. These findings in turn led the author to conclude that because the mechanism of the compactability of inorganic salts and mineral fertilizers is based on the adhesion of solid particles, the aforesaid laws may be extended to all chemical processes entailing adhesion, i.e., granulation and conditioning of fertilizers, dust trapping and removal, and mixing and dosing powder materials and other products. Second, attempts to increase the productivity of equipment used in the process of producing inorganic salts and mineral fertilizers must involve intensifying the processes of crystallization, drying, cooling, classification, crushing, etc., by using a fluidized bed, large temperature differentials, or strong mechanical actions. Consideration must also be given to the fact that all such engineering decisions will inevitably result in a sharp increase in the concentration of crystalline defects and in a corresponding reduction in product quality. For this reason, any large-scale and expensive measures taken to increase product quality should involve simultaneous actions to reduce the deleterious effects of the said measures on product quality. Research on defects in crystalline structure thus continues to be the most important element of the theoretical foundations of the technology of producing granular materials. Figures 4, table 1; references 18: 16 Russian, 2 Western.

Mechanism of Direct and Phase Conversions of Carbon Black and Charcoal in Diamond Under Impact Compression

927M0077A Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 321, No 1, Nov 91 (manuscript received 12 Aug 91) pp 95-97

[Article by N. I. Borimchuk, V. B. Zelyavskiy, A. V. Kurdyumov, N. F. Ostrovskaya, Academician V. I. Trefilov, and V. V. Yarosh, Problems of Material Science Institute, Kiev; UDC 548.33:539.26]

[Abstract] The mechanism of direct phase transformations occurring at high pressures and in the absence of any catalyst- solvents is governed primarily by the structural perfection of the initial carbon-graphite material. This dependence on initial structural perfection is markedly apparent in the preparation of diamonds by impact compression. Highly crystalline grades of graphite, subjected to impact compression, pass through martensitic transformations sequentially: graphite - lonsdelite - diamond. Low crystalline carbon-graphite materials, such as carbon black and charcoal, having a dispersed turbostratified structure, are unable to transform into diamond via a martensitic mechanism, although under high compression and heating they can transform into diamond structure by diffusion-reconstruction (in this case rapid cooling and special additives are used to prevent reverse transformation). In the present work a diffusion mechanism based on structural studies of the products of impact compression of turbo-stratified carbon-graphite materials (graphite S-1, carbon black PM-15, and charcoal BAU-1) is proposed. The carbon is transformed into cubic diamond and an amorphous phase which has a density in between that of the initial and diamond phases. Depending on the location of the halo in X-ray diffraction patterns, its structure also lies in between the trigonal structure of the graphite layer and the tetrahedral structure of diamond. This makes it possible to propose that the amorphous phase constitutes an intermediate structure in the reconstructed transformation of low crystalline forms of carbon- graphite materials into diamond. Along with diamond formation from an amorphous phase, it is also possible that carbon black structures are also directly transformed into diamond. The "reconstructed" diamond grain has an equi-axial form and has fewer defects in comparison to martensitic diamond-lonsdelite structure. Figures 3; references 4 (Russian).

Structure Formation and Properties of Highly Dispersed Diamonds During Detonation in Various Media of Condensed Carbon- Containing Explosive Materials With a Negative Oxygen Balance

927M0077B Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 321, No 1, Nov 91 (manuscript received 7 Aug 91) pp 99-103

[Article by G. I. Savvakin and Academician V. I. Trefilov, Problems of Material Science Institute, Kiev; UDC 548.3:539.2.26:666.239]

[Abstract] Forming the crystal structure of powders in the detonation waves of condensed explosives is a new scientific trend which allows creation of new structure states for substances with preassigned properties. Especially interesting is the forming by this method of the crystal structure of ultra- dispersed diamonds during detonation of carbon-containing condensed explosives with a negative oxygen balance in connection with the ultra-dispersion and special structural features of the diamond phase. In the present work a study was made of the effects of the conditions of controlled quenching of the products of explosion in various media arranged within the detonation zone of carbon-containing explosive charges, on the structure and properties of ultra-dispersed diamonds, as well as a comparison of diamonds crystallized under different quenching conditions. TNT/hexogen charges were placed in the center of a detonation chamber. Near the charge zone were placed various liquid and gas coolants with densities ranging from 10^{-3} to 1 gram per cm^3. After detonation the powders were separated and their structures studied. Crystal structure was determined by electron and X-ray diffraction. Bulk defect structure was determined by electron-positron annihilation. The experiments revealed a lack of any generalized correlation between the gravimetric content of ultra-dispersed diamonds in the carbon condensate and the mass of the detonating carbon-containing explosive material. Very high values were obtained for several physical chemical characteristics of ultra-dispersed diamonds making it possible to formulate multi-functional composite materials and to significantly broaden the applications and quality of composites. Figure 1; references 11 (Russian).

Coesite Inclusion in Zircon of Diamond-Containing Gneisses of Kokchetav Massif - First Finding of Coesite in Metamorphous Rocks on USSR Territory

927M0077G Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 321, No 1, Nov 91 (manuscript received 18 Sep 91) pp 184-188

[Article by Academician N. V. Sobolev, V. S. Shatskiy, M. A. Vavilov, and S. V. Goryaynov, Minerology and Petrography Institute, Novosibirsk; UDC 549.514.6]

[Abstract] A finding of coesite as an inclusion in pyrope from quartzite of Dora Mayer (Italy) served as a new and independent proof of the manifestation of extremely high pressures during formation of certain metamorphose rocks in the earth's crust. Coesite was also established in eclogites of Norway, North Korea, and in Mn-quartzites of the Italian Alps. Thus, abnormally high pressures during metamorphosis of rocks have been established on a global basis thereby confirming previously proposed possibilities of the presence of pressures exceeding lithostatic during metamorphosis. Even high pressures corresponding not only to quartz-coesite transition, but also to graphite-diamond have been established by locating micro-diamonds and high baric minerals as inclusions in garnets, zircons, and pyroxenic gneisses and garnet-pyroxenic rocks of the Kokchetav Massif in Northern Kazakhstan. In the present work coesite inclusions were detected in zircon grains embedded in epoxy resin, ground to a polish, and examined microscopically. Figures 3; references 14: 5 Russian, 10 Western.

New Manifestation of Microdiamonds in Metamorphous Rock as Proof of Regional Character of Metamorphoses of Ultrahigh Pressures in Kokchetav Massif

927M0077H Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 321, No 1, Nov 91 (manuscript received 23 Sep 91) pp 189-197

[Article by V. S. Shatskiy, Academician N. V. Sobolev, A. A. Zayachkovskiy, Yu. M. Zorin, and M. A. Vavilov, Geological Sciences Institute, Yakutsk; Geology and Geochemistry of Combustible Materials Institute, Lvov; UDC 552.4+549.211]

[Abstract] The first evidences of the presence of sandy microdiamonds, first in southern Ukraine and then in the Kokchetav Massif, were published in 1964-68. Specifically, 250 grains of diamond 0.07-0.2 mm in sandstone from the Obukhov alluvial deposit were isolated by a team at the Simferopol Institute of Mineral Resources in 1967. Following this, data were published on the presence of diamonds in the eclogite weathering crust; still later, geologists were able to establish the presence of microdiamonds in certain rocks of Kumdy-Kol. However, the thermochemical methods used to determine the presence of diamonds prohibited full identification of the petrographic type of rock needed to elucidate the genesis of these diamonds. Newly developed optical methods made it possible to establish that diamonds in various petrographic types of rock exist as inclusions in grains of garnet, zircon, and pyroxenes. This made it possible to identify primary diamond-containing parageneses and to evaluate the conditions of metamorphoses of these rocks. Since manifestation of ultra-high pressures in metamorphoses was fixed only at Kumdy-Kol with the appearance of microdiamonds as well as coesites as inclusions in zircons from diamond-containing rock, this may serve as evidence of local nature of this type of metamorphoses. New data were obtained on the manifestation of ultra-high pressure metamorphoses by studying eclogites in mixed rock of the Lenin section, located 15 km northwest of Kumdy-Kol. Other data and comparison with the Dora Mayer Massif in the Alps suggests incompatibility with the hypothesis on ultra-high pressures in the earth's crust. Figures 2; references 15: 7 Russian, 7 Western.

Composition and Content of Gases in Diamonds of Eclogitic and Ultrabasic Paragenesis from Kimberlite Pipes of Yakutiya

927M0077I Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 321, No 1, Nov 91 (manuscript received 23 Sep 91) pp 194-197

[Article by S. B. Talnikov, Yu. P. Barashkov, and I. M. Svoren; presented by Academician N. V. Sobolel, Geological Sciences Institute, Yakutsk; Geology and Geochemistry of Combustibel Materials, Lvov; UDC 549.211(571.56)]

[Abstract] Recently, much attention has been devoted to the fluid conditions of the crystallization environment of diamonds. Full characterization of the conditions of diamond genesis is not possible without first determining the gaseous composition of the crystallization environment, despite the abundance of information on the composition of solid inclusions. Although varying in composition, gases isolated from diamonds consist mainly of C, H, O and N atoms. Basic volatile components in both foreign and Yakutsk origin diamonds are hydrogen, nitrogen, carbon dioxide, water, carbon monoxide, and methane. Reproducible results on the composition of gases from diamonds of various locations and detected by using various techniques makes it possible to hypothesize that the isolated volatile gases are relics of the fluid composition of the crystallization environment. In the present work diamond crystals were cleaned and calcined in a quartz ampule for 0.5 hour at 350-400° C to release the gases which were then analyzed mass spectrometrically. The results demonstrate that the content of the gases is a function of the presence of solid mineral inclusions. A higher concentration of gases in those portions of the diamonds which contain mineral inclusions is evidently due to the sorption of volatile gases at the diamond-inclusion interface. The concentration of the gaseous phase in diamonds of eclogitic paragenesis is one order higher than the quantity of gases in diamonds of ultrabasic association. References 14: 8 Russian, 6 Western.

Water Transport Across Polymeric Membrane During Electrolysis of Aqueous Solution of Lithium Chloride

927M0080A Moscow ELEKTROKHIMIYA in Russian Vol 27 No 8, Aug 91 (manuscript received 10 Oct 89; in final form 30 Nov 90) pp 969-973

[Article by A.V. Skolunov, 'Khimvolokno' Scientific Industrial Association, Mytishchi; UDC 541.135.5]

[Abstract] Plots of v (mL/m^2 x s) vs. i (kA/m^2) were used to assess water transport across cation exchange membranes Nafion-214 and MF-4SK during electrolysis electrolysis of 7.5-21.3% LiCl at 30 and 80°C, and with current density reaching a maximum of 2 kA/m^2. The data demonstrated that the quantity of water transported was directly proportional to current density and inversely related to [LiCl]. The results indicated that, depending on [LiCl], Li ions are hydrated to various degrees, and account for the fact that the quantity of transported water can be correlated with Li transport. Diminished water transport at 80°C vis-a-vis 30°C is attributable to loss of water of hydration by Li ions at the higher temperature due to thermal dissociation. Consequently, at 80°C fewer of the Li ions crossing the membranes are in the hydrated state. An equation was derived relating rate of water transport across the membranes to current density and temperature, and microscopic studies related pore density and pore size to transport efficiency. Figures 4; tables 2; references 17: 16 Russian, 1 Western.

Mechanisms of Catalytic Discharge of Indium(III) Complexes

927M0080B Moscow ELEKTROKHIMIYA in Russian Vol 27 No 8, Aug 91 (manuscript received 23 Aug 90) pp 991-996

[Article by R.R. Nazmutdinov, M.S. Shapnik and O.I. Malyucheva, Kazan Institute of Chemical Technology imeni S.M. Kirov; UDC 541.13:541.183:543.42:546.59]

[Abstract] Quantum chemical calculations were combined with theoretical considerations of charge transfer in polar solvents for analysis of catalytic discharge of Indium(III) complexes. The results demonstrated that the discharge of the $In(H_2O)_5OH^{2+}$ complex is three orders of magnitude greater than that of the $In(H_2O)_6{}^{3+}$ complex. The difference was attributed to stronger binding and actually 'penetration' of the OH groups among the In atoms in the case of the former complex. Accordingly, incorportation of $In(H_2O)_5OH^{2+}$ into the bilayer leads to reduction of the energy of activation which, in conjunction with favorable electron transport, can account for its greater discharge rate. Figures 2; tables 4; references 9: 8 Russian, 1 Western.

Solid Polymer Electrolyte-Based Photoelectrolyzer for Water Decomposition

927M0080C Moscow ELEKTROKHIMIYA in Russian Vol 27 no 8, Aug 91 (manuscript received 20 Nov 90) pp 1022-1027

[Article by M.D. Krotova, Yu.V. Pleskov and I.V. Pokrovenko, Institute of Electrochemistry imeni A.N. Frumkin, USSR Academy of Sciences, Moscow; UDC 541.14]

[Abstract] Cursory details are presented on the design of an experimental solid electrolyte device for decomposition of water using light energy. The system utilizes a 150-200 µgm thick MF-4 SK membrane, an analogue of Nafion membrane, as the polymeric solid electrolyte component in combination with semiconductor $SrTiO_3$ and TiO_2 electrodes. Testing revealed considerable electrochemical similarities to liquid electrolyte (H_2SO_4) systems, although the photocurrents were some 30-50% lower for the solid electrolyte device. The latter fact indicates that, as constructed, most of the electrode surface is electrochemically active in the solid electrolyte system. The quantum yield on illumination with 313 nm UV light approached 0.8 with the $SrTiO_3$ electode, showing the feasibility of using solar energy for water decomposition and generation of hydrogen fuel. Figures :references 5: 3 Russian, 2 Western.

Acrylamide Polymerization in Concentrated Aqueous Solutions in Presence of Basic Hydrolysis Agents

927M0097A Moscow PLASTICHESKIYE MASSY in Russian No 8 Aug 91 pp 9-11

[Article by T. O. Osmanov, N. V. Kozlova; UDC 678.745.842:66.095.26:546.311]

[Abstract] The kinetics of acrylamide polymerization was investigated in presence of Na_2CO_3 in an attempt to determine the factors affecting the molecular weight of the polymers, and the results were compared with data obtained in presence of NaOH. The lowest reaction rate was observed with the use of the following composition: 4 mole-% NaOH, 15 mole-% Na_2CO_3 and 25 mole-% $NaHCO_3$. On the basis of the experimental data obtained it was concluded that the reaction rate is determined by two competing processes: a slow decomposition of potassium persulfate dominates during the initial stage occuring in strong alkaline medium, which slows down the reaction, and accumulation of nitrile propionamide during the second stage which results in an accelerated polymerization. Using Na_2CO_3 or $NaHCO_3$ instead of NAOH gave a 5 to 8 fold increase in the molecular weight of the product. Thus a high molecular weight partially hydrolyzed polyacrylamide with excellent properties could be obtained using Na_2CO_3 or $NaHCO_3$. Figures 2; tables 2; references 11: 9 Russian (3 by Western authors), 2 Western.

Copolymers of α-Cyano-acrylic Acid Esters With Monomeric Adamanthane Derivatives

927M0097B Moscow PLASTICHESKIYE MASSY in Russian No 8 Aug 91 pp 11-13

[Article by T. I. Guseva, N. G. Sechenya, K. A. Mager, Yu. G. Gololobov; UDC 678-13:546.268.2]

[Abstract] Unsaturated esters of α-cyano-acrylic acid were copolymerized with adamanthane derivatives: allyl ester of 1- adamanthane carboxylic acid, diallyl ester of 1,3-adamanthane dicarboxylic acid, allyl ester of 1-adamanthane-acrylic acid and 1,3-adamanthylenediacetic acid. Under the reaction conditions used, the unsaturated adamanthanes did not polymerize. The α-cyano-acrylic acid-adamanthane copolymers obtained at 150° C are transparent, colorless or slightly yellowish blocks. It was shown that resistance of the copolymers to thermal destruction at 200° C increased with and increased content of the adamanthane fragments up to the level of 0.02 mole-fraction and then remained stable. These copolymers were used effectively in manufacturing heat resistant adhesive compositions. Figures 3, tables 2; references: 10 (Russian).

Properties and Utilization of Polychlorotrifluoroethylene Films and Copolymers of Ethylene With Tetrafluoroethylene and Chlorotrifluoroethylene (A Review)

927M0097C Moscow PLASTICHESKIYE MASSY in Russian No 8 Aug 91 pp 17-20

[Article by V. A. Artemyev, G. A. Belyayeva (Deceased), L. A. Gann; UDC 678.743.4-13-488.01]

[Abstract] The ethylene-tetrafluoroethylene (ETFE) copolymer is a fluoro-plastic with high atmospheric stability, transparency, permeability to UV light, resistance to radiation and other interesting physical, chemical and mechanical properties. It was first produced by DuPont Company in the early 1970's, followed by other companies in Germany, Japan, etc. It is used in production of insulation covers for computer and aviation electronics. ETFE is stable in mineral acids, inorganic bases, and halide solutions. The ETFE films are superior to films made of tatrafluoroethylene or its copolymers with hexafluoropropylene, polyvinyl fluoride and polyvinylidene fluoride. The films are non-flammable and actually self-extinguishing. Because they transmit light in the entire spectrum, they can be used in many construction applications (sky lights, solar battery cell covers, etc.). Other applications range from insulation of marine and aircraft communication wiring to pharmaceutical packaging, preparation of computer memory elements, etc. Tables 2; references 13: 2 Russian (2 by Western authors), 11 Western.

Acceleration of Solidification of Compositions Based on Acetone-Formaldehyde Resins With Mineral Fillers

927M0097D Moscow PLASTICHESKIYE MASSY in Russian No 8 Aug 91 pp 42-43

[Article by A. I. Petrov, M. A. Askarov; UDC 678.632'32'21.046.3.028:547-284.3]

[Abstract] An attempt was made to develop a method of accelerated solidification of compositions based on acetone-formaldehyde resins and mineral fillers, because current methodology is plagued with many problems. This goal was achieved by applying a constant electric potential of 5-50 V/cm for 10-50 min to achieve a preliminary solidification of the composition, followed by thermal treatment at 80+/-° C for 10-12 hrs to allow for the completion of the chemical processes and production of material with optimal properties. This accelerated solidification of the resin is due to the fact that, exposed to a constant electric potential, the mobility of the hydroxyl ion is increased and the resin solidification process is accelerated. Figure 1, table 1; references: 3 (Russian).

Diffusion Model for Protective Action of Additives in Polymer Coatings

927M0097E Moscow PLASTICHESKIYE MASSY in Russian No 8 Aug 91 pp 45-47

[Article by V. S. Markin, G. Ye. Zaikov; UDC 678.026.3.04:66.063.2]

[Abstract] One of the more effective ways of protecting various components from the action of aggressive media is to coat their surface with polymers. A theoretical approach was undertaken to evaluate the effectiveness of various additives to slow down the action of aggressive media on the coating material. One of the simplest models of the action of such protective additive assumes adsorption of the aggressive agent by the polymer followed by a neutralizing reaction between the additive and the aggressive medium. Two possibilities were considered for such a binding: a reversible and an irreversible binding. The calculations performed have indicated that addition of binding additives lowers the diffusion rate of the aggressive medium. In an ideal state, this is not accompanied by any deformation of the cover material. In the real world, diffusion equations have to be solved with proper consideration of the electro-chemical reactions occuring on the polymer-metal interface. Figures 4, table 1; references 6: 4 Russian, 2 Western.

Hardness of Solution-Derived Epoxy Lacquer Coatings

927M0099A Moscow LAKOKRASOCHNYYE MATERIALY I IKH PRIMENENIYE in Russian No 4, Jul-Aug 91 pp 17-18

[Article by A. A. Ivanyuk, A. Yu. Gerasimov, G. K. Rashevskaya, and N. A. Zemlyak, Institute for Colloidal

Chemistry and Water Chemistry imeni A. V. Dumanskiy, Kiev; UDC 678.5:667.637.4:537.622.4]

[Abstract] The effect of the composition of the mixed solvent on the microhardness of solution-derived epoxide lacquer deposited on a magnetic disk was studyed in six multifactorial experiments. Cyclohexanol content was varied from 10% volume to 50%, ethylcellosolve from 42.3% to 50%, and isoforon from 0% to 15.2%. The nonreactive solvent xylene was used at 7.9% in one experiment and 30.1% in another. Lacquer deposition was also conducted in pure cyclohexanol, ethylcellosolve and isoforon. The dependence of microhardness on indentor depth was calculated from the load-deformation diagram. An equation was obtained for microhardness in terms of solvent composition. Solution of this equation indicated that the maximum hardness value with four solvents was outside the composition ranges used. For three solvents, with no xylene, maximum hardness was calculated to occur when cyclohexanol content was 31.9%, ethylcellosolve 35.6%, and isoforon 32.47%. Introduction of small amounts of xylene into a 1:1 mixture of cyclohexanol and ethylcellosolve did not affect lacquer microhardness, but larger amounts caused hardness to fall. Lacquer elasticity was increased with greater amounts of ethylcellosolve. Use of a 1:1 mixture of cyclohexanol:ethylcellosolve is the optimal condition for forming a cross-linked polymer with minimal structural defects and maximal hardness. References 10: Russian.

Reagents for Directed Modification of Biopolymers. V. Synthesis of 1-Amino-3-[4-(N-2-Chloroethyl-N-Methylamino) Phenyl] Propane

927M0100A Moscow IZVESTIYA SIBIRSKOGO OTDELNIYA AKADEMII SSSR, SIBIRSKIY ZHURNAL, No 4, Jul-Aug 91 (manuscript received 25 Jan 91) pp 27-31

[Article by A. A. Gall, T. M. Ivanova, and G. V. Shishkin, Novosibirsk Institute of Bio-organic Chemistry, Siberian Department, USSR Academy of Sciences; UDC 547.571]

[Abstract] In order to obtain a reagent which will increase the effectiveness and selectivity of the interaction of oligonucleotide 5'-phosphamides with nucleic acid, 1-amino-3-[4-N-2-chloroethyl-N- methylamine)phenyl]propane was synthesized. The first step in the reaction scheme was the reaction of 3-(N-methylanilino)propenal with N- 2-chloroethyl-N-methylaniline, using a $POCl_3$ catalyst at 0°C in chloroform. The structure of the product, 3-[4-(N-2-chloroethyl-N-methylamino)phenyl]propenal, was confirmed by PMR. The next step was the reaction of this aldehyde with hydroxylamine. TLC of the product indicated that it contained two components in approximately equal amounts, demonstrated by PMR to be syn- and anti-1-oximino-3-[4- (N-2-chloroethyl-N-methylamino)phenyl]propene. The optimum conditions for the hydrogenation of this oxime to the desired product, palladium black in 2 N HCl in ethanol, were established using a model compound. Reaction of the product with acetaldehyde provided additional confirmation of product structure and evaluation of its propensity for acetylation. References 7: 6 Russian, 1 Western.

Fine Filtration of a Methyl Methacrylate-Based Polymerization Mixture To Improve the Quality of Acrylic Plastic

927M0109B Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 5, May 91 pp 298-301

[Article by V.A. Petrukhina, G.N. Abayev, A.I. Dyachkov, Yu.O. Belopolskiy, N.P. Tukalo, D.K. Chuprov, and V.N. Pronchenko; UDC 66.067.001.5:666.1]

[Abstract] The specifics of the process currently used to produce acrylic plastic are such that improving product quality requires perfecting the stages in which the methyl methacrylate-based polymerization mixture is cleansed of mechanical contaminants. In view of this fact, the authors of the study reported herein examined the feasibility of microfiltration of methyl methacrylate-based polymerization mixtures to increase the yield of high-quality acrylic plastic. Their studies indicated that the amount of acrylic plastic that is defective from a heat resistance standpoint may be reduced by more than an order of magnitude when the purity of the particles of the methyl methacrylate-based polymerization mixture (i.e., their freedom from mechanical contaminants) is increased from 91.3 to 99.9%. They succeeded in achieving the said degree of purity by subjecting the polymerization mixture to microfiltration based on a filtration element with plane filtering partitions. As partitions, the researchers used polymer membranes with pore diameters of 0.2 to 1 µm and filter fabric with a retention between 1.5 and 25 µm. The experiments were conducted with a constant pressure differential on the filter element equal to 0.05 MPa, which corresponded to a constant filtrate productivity. The concentration of particles in the starting mixture and filtrate were determined by using a laser microscope with a resolution of 0.5 µm. The researchers also derived an expression providing a mathematical description of the passage of a polymerization mixture through a nuclear membrane. The mathematical model developed may be used to calculate the useful life of a filter element. Calculations performed by using the newly derived expressions revealed that the useful life of filters of the type described may be increased by reducing the concentration of particles in the starting fluid passing into the filtration element. This in turn may be done by using a preliminary filter (for example, a plate filter with type FPA Petryanov fabric). Figures 6; references 3 (Russian).

Gold-Containing Sulfides and Native Gold of One Ore Deposit in Western Uzbekistan

927M0103A Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA: GEOLOGIYA, GEOGRAFIYA in Russian Issue 4, No 28, Dec 91 (manuscript received 18 Feb 91) pp 77-80

[Article by N.V. Kotov, L.G. Poritskaya, V.V. Gembitskiy, and M.S. Poristkiy; UDC 553.411:549(575.16)]

[Abstract] The authors of the study reported herein analyzed the gold-bearing sulfides and native gold of one of the ore deposits of Western Uzbekistan. Data are presented on the sulfide and native gold contents of 28 mineral samples from the following zones of the deposit: Sarmich-1, Arab, Severnaya, Biran, and zapadnyy uchastok (western segment). Analysis of the specimens has established that arsenopyrite, pyrite, pyrhotite, chalcopyrite, galenite, sphalerite, and selected sulfosalts are the main gold- and silver-bearing minerals of the deposit in question. The content of native gold in the weathering crust samples studied was found to depend on the Au/Ag ratio in the sulfide minerals. The native gold in the deposit was found to be confined mainly to an oxidation zone that was tracked to a depth of several tens of meters. Incorrectly shaped disperse particles with indentations of the surrounding minerals were found to predominate, with individual gold grains having cross sections up to 0.3-0.5 mm. Scanning electron microscopy studies (with a Camscan [England]) revealed the following types of gold grains: grains with a homogeneous smooth surface, coarse grains with traces of silver leaching, and (more rarely) grains with lattice crusts with accretions of high-carat gold. "Beads" of native silver were encountered yet more infrequently. Weathering-resistant quartz, rutile, and sericite, as well as feldspars and carbonates were found to be ingrown in some of the gold grains examined. Yet other gold grains were found to be coated with films of iron and manganese hydroxides or to have grown together with cerargyrite or, more rarely, bromargyrite. Most of the gold found was classified as low or very low carat, with its copper content ranging from 0.01 to 0.06% (by mass). Another noteworthy finding was the high silver content of the galenite accompanying the silver-sulfosalt mineralization. Table 1; references 4 (Russian).

The Epitaxy of Native Gold in Zirconium—An Example of Natural Radiation Activation of Crystalline Surfaces

927M0104A Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 320 No 2, Sep 91 (manuscript received 25 Jun 91) pp 425-427

[Article by R.A. Amosov, A.S. Lobanov, and N.G. Chuvikina, Central Scientific Research Geological Prospecting Institute of Nonferrous and Noble Metals, Moscow; UDC 549.283:548]

[Abstract] The oriented (epitaxial) growth of native gold into other minerals is a criterion of the catalytic effect of the latter on the precipitation of gold from mineral-forming solutions. The selective growth of individual grains of native gold onto sheared surfaces of crystals and the grains of forming minerals has been discovered almost universally during the study of gold ores. Signs of the cocrystallization of native gold and the substrate mineral have been established much less frequently. The authors of the study reported herein have found epitaxial aggregates of native gold with zirconium demonstrating the phenomenon of radiation activation of crystalline surfaces. The study specimens were gathered from the Lower Proterozoic intraformation conglomerates of Northern Karelia that are interlayered with quartz sandstone. The study specimens were obtained by crushing the core samples, using an electromagnet to separate out the heavy washed fraction, and extracting zirconium from the nonmagnetic fraction by hand under binoculars. The aggregates were studied first by optical microscopy, then by scanning electron microscopy, and finally by roentgenography. The zirconium crystals were pink with a short-columnar appearance caused by the predominant development of [100] and [110] prism faces in combination with a [111] dipyramid face. The dipyramid faces were absent in some of the specimens. The crystals measured 0.1 to 0.5 and were generally well nodularized. The native gold formed discrete islands and larger homogeneous films on the zirconium. The islands measured 1 to 5 μm in the plane of the substrate and reached 30 μm in the largest films. The film thickness was estimated at 400 to 500 nm. There were no traces of nodularization in the native gold, which was taken as a confirmation that it was deposited after the zirconium had been buried in sediment. The relatively large continuous films were established to be monocrystalline formations, whereas the individual particles of gold in the island films have a regular orientation and formed a complete texture. One of the most noteworthy findings was that the islands of native gold are confined to holes in the zirconium substrate measuring 0.2 to 0.6 μm across. The said holes were interpreted as being the result of the spontaneous fission of nuclei of radioactive elements (uranium and thorium) included in the structure of the zirconium. To be more precise, they were interpreted as resulting from the natural etching of tracks and the adjacent defect areas of the crystals. The studies performed established the epigenetic growth of native gold onto nodulized zirconium grains in the conglomerates studied. The deposition of gold could have occurred either as a result of metamorphogenic transformation of ancient alluvial deposits or in conjunction with a hydrothermal process. In the specific case studied, the epitaxial growth of native gold onto another mineral was stimulated by the radiation activation of the latter. The study specimens may be looked upon as f-autoradiographs shadowed with gold under natural conditions. Figures 2; references 7 (Russian).

Redox Conditions of the Formation of Diamond-Bearing Cyanite Eclogites (The Udachnaya Tube in Yakutia)

927M0104B Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 320 No 2, Sep 91 (manuscript received 4 Jun 91) pp 440-443

[Article by A.A. Kadik, Ye.V. Zharkova, and Z.V. Spetsius, Geochemistry and Analytical Chemistry imeni V.I. Vernadskiy, USSR Academy of Sciences, Moscow; UDC 550.843]

[Abstract] The mantle eclogites that are encountered in the form of xenolites in kimberlites are a source of continued discussion. For a long time they were viewed as products of the crystallization of the basic magmas in the depths of the upper mantle. A greater knowledge of the redox conditions under which eclogites were formed is essential to increasing understanding of the nature of the said eclogites. In an effort to add to the body of knowledge in the said field, the authors of the study reported herein have studied cyanite diamond-bearing eclogites from the Udachnaya kimberlite tube in Yakutia in order to determine the redox conditions of eclogite formation. The study specimens contained granite, clinopyroxene, and cyanite, as well as small amounts of sanidine and coesite. Working within the framework of the hypothesis of the mantle origin of high-alumina eclogites, the researchers examined both pyroxene and pyroxene-corundum cumulates of the basic magmas, which were subjected to intensive subsolidus decomposition with the formation of cyanite and granite. The researchers hypothesized that if eclogites were formed when the ocean crust sunk into the mantle, they would be transformed analogues of high-alumina basalts or their cumulates with high percentages of plagioclases. The f_{O2} of the study specimens was measured in a high-temperature furnace based on two solid electrochemical cells. The unit was calibrated based on a mixture of the gases CO_2 and H_2 and an Ni-NiO solid-phase buffer, thus providing a precision of measuring f_{O2} of +/-0.2 log units f_{O2}. The thermocouple was calibrated based on the melting point of gold, and the temperature was determined with a precision of +/-2°C. The experiments performed demonstrated that the values of f_{O2} characteristic for cyanites from the high-alumina eclogites of the Udachnaya kimberlite tube at the coordinates log f_{O2} - 10^4/T (K) are subordinate to a linear dependence, namely, $\log f_{O2} = A + B/T(K)$, and lie in the region close to f_{O2} of QFI and IW buffer equilibria or slightly higher. The values of f_{O2} measured for cyanites of eclogites with coesite and sanidine were also found to be extremely low and lie in the region between IW and WM buffer equilibria. Overall, they were close to the values of the volatility of oxygen that were established for diamond-bearing chromopyrope peridotite xenolites of the same kimberlite tube but were significantly below the values of f_{O2} characteristic of products of the crystallization of basalts close to the earth's surface (which are close to QFM buffer equilibria). The studies performed thus demonstrated that the redox conditions of the formation of diamond-bearing cyanite eclogites are such that the said eclogites may not be considered fragments of the ocean's crust sunk into the mantle. At the same time, the match between the redox state of these mantle rocks and that of diamond-bearing peridotites provides a foundation for hypothesizing that they share a common formation caused by the melting and magmatic differentiation of the upper mantle under the continental regions in the Archean strata with oxygen potential values close to IW equilibrium. This hypothesis is confirmed by the presence of an iron-nickel phase in the form of inclusions in diamond crystals as reported elsewhere. Figures 3, table 1.

The Solubility of Graphite and Diamond in NiMn Melt Under High Pressure

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[Article by A.V. Yelyutin, corresponding member, USSR Academy of Sciences, V.P. Polyakov, and R.O. Chernykh, Moscow Steel and Alloys Institute; UDC 549.211:548.5]

[Abstract] The authors of the study reported herein examined the solubility of graphite and diamond in an NiMn melt under the effects of high pressures and temperatures. Specimen NiMn tablets that had been produced for the experiments by melting in a muffle furnace in a protective atmosphere and that were separated from one another and bounded on their ends by disks made of MG OSCh graphite were isolated from a tube heater by means of a container made of sodium chloride. The assembled container was subjected to compression in a high-pressure chamber to a specified pressure level. Next, an alternating electric current was passed through the heater to heat the study assembly to the specified temperature. The pressure and temperature were monitored by using standard methods with a precision of +/-0.1 GPa and +/-3-4 K, respectively. After the specimens were held under isothermal conditions, the chamber was cooled and discharged. The specimens were removed from the high-pressure chamber, subjected to mechanical cleaning to remove the graphite, subjected to a surface cleanliness check, and then analyzed to determine the amount of carbon they absorbed. The specimens' carbon content was determined by the method of coulometric titration on an AN-7529. The data obtained for the two tablets were averaged. The temperature dependence of the specimens' graphite solubility was determined for pressures of 3.0, 3.4, and 3.7 GPa. Estimates were also made of the solubility of diamond in metal melts under conditions of thermodynamic stability. The method used was based on a determination of the amount of carbon contained in the study NiMn tablets after diamond had been synthesized by layer-by-layer filling of the high-pressure chamber's reaction space. After analyzing the results of the studies performed, the authors arrived at three conclusions. First, an increase in pressure in the temperature range

from 1,423 to 1,573 K facilitates an increase in the absolute values of the equilibrium carbon concentration in an NiMn melt saturated with respect to diamond and graphite. Second, pressure increases also lead to a significant decrease in the temperature dependences of the solubilities of both carbon phases in a NiMn molten alloy. Third, an increase in pressure has a stronger effect on the solubility of graphite in an NiMn melt than on the solubility of diamond in the same melt. The study findings were in good agreement with published reports and with the practice of catalytic diamond synthesis. Figures 4; references 10: 8 Russian, 2 Western.

Characteristic Features of Progressive Ore Formation in the Nyavlenga Gold and Silver Deposit

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[Article by A.V. Volkov, L.N. Shishakova, and A.G. Demin, North-Eastern Affiliate, Central Scientific Research Geological Prospecting Institute of Nonferrous and Noble Metals, Magadan; UDC 553.068.7:553.261]

[Abstract] The Nyavlenga gold and silver deposit is a dome structure complicating the central portion of the Nyavlenga volcanic-tectonic depression in Northern Prikhotye. Within the confines of the dome structure, granites constitute the layers closest to the surface. The deposit's ore bodies are localized in propylitized andesites and andesite tuffs. The dome structure is characterized by small extrusive-cover bodies of fluid and spherolite liparites and liparite-dacites. The most important ore-controlling structure within the confines of the dome is the Central Fault and discontinuities that in turn give the deposit a pronounced block structure. The main ore bodies are platelike vein-metasomatic zones with a complex structure and up to 20 m thick that make cracks in the discontinuity perpendicular to the Central Fault. The ore bodies are intersected by Paleogenic basalt dikes. The ore deposits thus date to the Upper Cretaceous-Paleogene period. The rock intervening between the ores have experienced intensive metasomatic changes that have significantly leveled their primary petrographic features. The formation and characteristics of the metasomatites of the Nyavlenga deposit may be grouped into five stages: 1) a period of pre-ore formation stage that included the formation of greenstone, propylites, and secondary quartzites; 2) an ore formation stage during which volcano-induced ore formation and tectonomagmatic changes resulted in the formation of apopropylites and hornfels; 3) a stage when fluids resulted in the formation of greisenoids, skarn-like rock, and beresite; and 4) a post-ore formation stage that resulted in zeolitized and carbonatized rock. The formation of mineral ores is, from the standpoint of acid-base and temperature characteristics, in conformity with metasomatic processes. The mineral profile of the ore of the Nyavlenga deposit and the textural and structural characteristics of the mineral parageneses may be grouped into three stages: preproductive, an initial productive stage, and a second productive stage. The first stage encompassed the formation of quartz rock; the second entailed the formation of quartz containing gold; and the third included the formation of rock containing silver, copper, and molybdenum. In the Nyavlenga gold and silver deposit, the formation of ore bodies did not occur in the traditional manner of a hydrothermal process involving a decrease in temperatures from the earl to later stages. Instead, it occurred in a progressive mode involving further increases in the temperatures of mineral formation. Tables 2; references 6: 5 Russian, 1 Western.

Mineralogic Features of Alkaline-Ultrabasic Lamprophyres and Kimberlites of the Kola Province

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[Article by S.K. Kimakov, E.A. Bagdasarov, and L.I. Lukyanova, All-Union Scientific Research Institute of Geology imeni A.P. Karpinskiy, Saint Petersburg; UDC 549:552.232.4(470.21)]

[Abstract] The Kola Province is a classic example of the development of alkaline-ultrabasic complexes associated with deposits of apatite, nepheline, mica, iron-titanium, and rare earth metal ores. The lamprophyres and kimberlites of the Kola Province have been known since the 1950's and have been examined in a number of publications. The alkaline-ultrabasic lamprophyres of the Kola Province are dense, dark-colored cryptocrystalline porphyraceous rock containing disseminated deposits of olivine, titanium-augite, phlogopite, melilite, and (more rarely) nepheline. From a petrochemical standpoint, these lamprophyres are distinguished by their high titanium content, high iron content, and high alkalinity. The also contain elevated amounts of Nb, Sr, V, Rb, and the rare earth elements. Among the more noteworthy of the explosive volcanic rock of the Kola Peninsula is the rock that has been discovered on the Tersk shore in the form of tubes. They contain melitites, limburgites, augitites, and carbonatites. The genetic and geochemical uniqueness of the alkaline-ultrabasic rock of the Kola Province, as well as the occurrence of processes of automatasomatism in them, have both been dictated by the presence of unique accessory minerals in the said rock. Included among these minerals are gold, silver, copper, and sulfides (galenite, sphalerite, chalcocite, gersdorffite, and argentite). Gold was first discovered in 1986 in the picrite porphyrites of the Kandalaksha graben and Pechenga area. It was found in the form of individual incorrectly shaped grains in paragenesis with quartz and arsenopyrite. A new find was discovered in the Kovdor area. The initial sample weighed 2 kg and consisted of three grains 0.25 to 0.5 mm in size in paragenesis with ilmenite, jadeite, olivine, albite, and biotite. Microprobe analyses have demonstrated the presence of a slight impurity in the gold in the form of silver (up to 5.5% [mass]) and zinc (0.1%). On the basis of the studies performed, the authors concluded that the alkaline-ultrabasic lamprophyres and

conditions of the Kola Province studied are deep mantle formations. The lamprophyres were formed under conditions corresponding to spinel-pyrope and grospidit [transliteration] facies at the depth of hyperbasic rock. The kimberlites were formed in deeper foci of the mantle corresponding to conditions of coesite and diamond facies at the depth of hyperbasic rock. Figures 3, tables 2; references 14: 9 Russian, 5 Western.

Gold and Quarternary Volcanic Rock of the Kurile Island Arc

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[Article by A.Yu. Antonov, O.N. Volynets, G.P. Koroleva, S.Ye. Chernigova, and A.A. Khlebnikova, Geochemistry Institute, Siberian Department, USSR Academy of Sciences, Irkutsk, and Volcanology Institute, Far Eastern Department, USSR Academy of Sciences, Petropavlovsk-Kamchatskiy; UDC 550.42]

[Abstract] The authors of the study reported herein conducted the first systematic examination of the distribution of gold in Quarternary volcanic rock from the various volcanic zones of the south and central parts of the Kurile Island arc. A total of 205 samples from 29 volcanic rocks, including 19 underwater volcanoes, were examined. The examination established that the distribution of gold in the volcanic rock of the area is primarily dependent on the saturation of the parent magmas with volatiles (such as sulfur and chlorine). The distribution of gold in the said rock is also (albeit to a lesser extent) directly correlated with the alkalinity and melanocrativity of the rock as well. Differences in the distribution of gold in the volcanic rock sampled from different zones of the Kurile Island arc were linked to differences in the alkalinity of the parent magmas as well as to differences in the tectonic activity of the individual zones that were in turn responsible for differences in the intensity of gold efflux from the melts together with volatiles. The frontal zone of the Kurile Island arc was found to have had the longest and highest tectonic activity as well as the lavas with the lowest alkalinity. For this reason, the frontal zone may be considered to be the area of the arc most conducive to the formation of gold manifestations and deposits. The highest average content of gold found in a section of the frontal zone of the Kurile Island arc was 16.0 mg/t versus 5.50 mg/t in the intermediate zone and 12.60 mg/t in the rear zone. Figures 2, tables 3; references 17: 15 Russian, 2 Western.

Flowthrough-Injection Systems for Spectrophotometric Determination of Palladium, Gold, and Silver

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[Article by L.K. Shpigun and R.F. Guryeva, Geochemistry and Analytical Chemistry Institute imeni V.I. Vernadskiy, USSR Academy of Sciences, Moscow; UDC 543.422.002.5:546.57:546.59:546.9]

[Abstract] Interest in developing automated methods of determining noble metals in nonferrous metallurgy and in other sectors as well has increased significantly in the past few years. In view of this fact, the authors of the study reported herein studied the conditions of the nonferrous reactions of palladium, gold, and silver with selected azo compounds. They then proceeded to develop a flowthrough-injection system for individual determination of the specified metals in acidic aqueous solutions. A FIAStar 5020 flowthrough-injection analyzer with a 5023 spectrophotometric detector of Swedish production was used in the studies. The flowthrough-injection analyzer circuit was monitored based on a Chemifold II flow distribution device produced by the same firm. The inner diameter of all of the system's components (including the mixing [reaction] spirals) was 0.5 mm. The two study reagents, i.e., sulfochlorophenolazorhodanine and sulfonitrophenol M, were synthesized in accordance with a method described elsewhere. Starting 0.1% solutions of the reagents were prepared by dissolving an exact weighted portion of reagent in water. More diluted (0.01 to 0.001%) solutions were then obtained by further diluting the starting solutions with water. During the studies, the researchers used 1×10^{-2} M starting solutions of each of the three metals, as well as series of comparison solutions of each metal. To find the optimal conditions for spectrophotometric determination of palladium, gold, and silver in the specified flowthrough-injection system, the authors calculated the dependences of the height of the recorded signal (H) on the carrier flow rate (v_1), reagent flow rate (v_2), volume of sample added (V_0), and length of the mixing (reaction) spiral (L). The following conditions were determined to be optimal for spectrophotometric determination of palladium in the flowthrough-injection system studied: $v_1 = v_2 = 0.4$ ml/min; $V_0 = 300$ µl; L = 60 cm; carrier = 0.3 M H_3PO_4; reagent = 0.05% solution of sulfonitrophenol M; and spiral temperature = 70°C. Under the said conditions, palladium in concentrations ranging from 0.1 to 2.0 mg/l could be detected at a rate of 30 determinations per hour. The optimal conditions for spectrophotometric determination of silver were found to be as follows: $V_0 = 200\ \lambda$; L = 30 cm; $v_1 = 2.8$ ml/min; and $v_2 = 1.2$ ml/min. When these parameters were used, silver could be determined in concentrations of 0.3 to 4.5 mg/l at a rate of 180 determinations per hour. The following parameters were found to be optimal for determining gold: $V_0 = 200\text{-}300$ µl; $v_1 = 1.2$ ml/min; $v_2 = 0.8$ ml/min; and L = 60 cm. Given the said parameters, gold could be determined in concentrations of 2 to 19 mg/l with a system capacity of 90 determinations per hour. Figures 5, tables 2; references 5: 2 Russian, 3 Western.

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