

# Summaries

UDC 546.82:546.74:54-19:546.28:66.088:620.193

**Psakhye S.G., Lotkov A.I., Meysner L.L., Kudryashov A.N.,  
Meysner S.N., Abramova P.V., Galanov A.I., Korshunov A.V.**  
**CORROSION RESISTANCE OF NITINOL MODIFIED  
WITH SILICON IN BLOOD PLASMA**

Using the electrochemical methods the authors have studied the corrosion resistance of nitinol which surface is modified with silicon under ion implantation in blood plasma *in vitro*. It is shown that TiNi ion-beam processing results in formation of morphologically and structurally homogeneous thin surface layers. As a result of ultimate composition differentiation in a near surface layer the silicon containing layer (to 30 atom % of Si) is formed at a depth of 30...35 nm; external O-Ti (the ratio is closed to TiO<sub>2</sub>) and subsurface Ni-Si-Ti-O sublayers are formed. It is ascertained that in comparison with the machined samples of TiNi the potentials of TiNi-Si repassivation in saline solution and in blood plasma are close and amount to 0,9 V at average (sat. ch. s. e.) due to decrease of nickel content in surface layer and increase of its structural homogeneity. It is shown that the increase of corrosion resistance of TiNi modified with silicon displays itself in preventing alloy corrosion damage with the formation of pitting, spots and microcracks as well as in decreasing the rate of nickel ions release into solutions up to high positive potentials.

UDC 628.316

**Nazarenko O.B., Zarubina R.F.**  
**APPLICATION OF BADINSK ZEOLITE  
FOR PHOSPHATE REMOVAL FROM WASTE WATERS**

The authors have studied the possibility of water purification from phosphates in dynamic conditions when using natural zeolite of Badinsk deposit as filtering load. The impact of filtration rate of phosphate test solution on the efficiency of water purification has been determined. The article introduces the discussion of mechanism for removing phosphates involving zeolite by the formation of poorly soluble compounds at interaction of calcium cations and phosphate anions.

UDC 661.832.321

**Vakhrushev V.V., Poylov V.Z., Kosvintsev O.K.**  
**REMOVAL OF SODIUM CHLORIDE FROM FLOAT  
CONCENTRATE KCL AT ULTRASONIC TREATMENT**

The authors have studied the process of ultrasonic treatment of a single crystal of calcium chloride float concentrate in saturated salt solutions KCl-H<sub>2</sub>O and KCl-NaCl-H<sub>2</sub>O. Using the electron microscopy method and X-ray analysis it was ascertained that the adsorbed and ingrown blocks of NaCl impurity is removed from the surface of KCl float concentrate crystals at ultrasonic exposure.

UDC 543.544.45

**Vetrova O.V., Burmetyeva M.S., Gavrilenko M.A.**  
**HUMIC ACIDS FIXATION ON THE SURFACE  
OF SILICA-GEL THROUGH THE LAYER  
OF POLYMETHYLENEGUANIDINE**

The authors have proposed the sorbent on the basis of humic acids faced on silica-gel through the interlayer of polyhexamethyleneguanidine and studied its sorption properties in relation to the main organic contaminants of aquatic media. The stability constants of complex formation were calculated and the efficiency of humic acids fixation through the amino-containing polymer was shown.

UDC 544.653.22

**Ustinova E.M., Kolpakova N.A.,  
Pshenichkin A.Ya., Ilyenok S.S.**  
**THE RESEARCH OF THE SURFACE OF GRAPHITE ELECTRODES  
WITH INDIUM AND PLATINUM DEPOSITS**

The authors have studied electrolytic deposits of indium, platinum and indium-platinum alloy by raster electron microscopy. It is shown that indium-platinum alloy on the surface of graphite electrode is represented by indium, platinum and chloride ions. It has been ascertained that platinum is not oxidized on the graphite electrode surface and it cannot be found out by raster electron microscopy. It is shown that maximums observed on current-voltage dependences are conditioned by indium selective electro-oxidation from intermetallic compound with platinum. In this case platinum remains on the graphite electrode surface and may be oxidized at 1 V potential.

UDC [544.3-971.2+542.913-977]:546.41'171

**Avramchik A.N., Chukhlomina L.N.,  
Maksimov Yu.M., Bolgaru K.A.**  
**SELF-PROPAGATING HIGH-TEMPERATURE SYNTHESIS  
OF CALCIUM NITRIDE FROM ELEMENTS**

The authors have carried out the thermodynamic analysis of adiabatic temperatures ( $T_{ad}$ ) and interaction product composition in calcium-nitrogen system depending on nitrogen pressure and the amount of calcium nitride admixture doped into the original mixture. It is shown that  $T_{ad}$  is limited by calcium nitride dissociation. Pressure growth increases the design temperature suppressing dissociation. The dependences of combustion rate and nitrogen fixation by calcium on nitrogen pressure and the original calcium form (chip, granulas) have been studied experimentally. It was ascertained that calcium chip is more active original component than its granulas. The end product is formed in the form of bar at nitrogen pressure not less than 4 MPa at chip burning and 6 MPa at calcium granulas burning

UDC 546.34:546.664 + 66.022.51

**Isupov V.P., Eremina N.V., Bulina N.V.**  
**MECHANICAL ACTIVATION OF LITHIUM CARBONATE**

The authors have studied the change in structural-morphological and dispersed characteristics of lithium carbonate after its mechanical activation in planetary activator AGO-2. It is shown that the activation results in growth of solid body specific surface, decrease of crystal size and change of particle size distribution. The heating of mechanically activated lithium carbonate is attended by the decrease of reflexes width that indicates lithium carbonate crystallization. The data obtained are of great interest for understanding the processes of mechanochemical synthesis of complex lithium-containing oxides.

UDC 66.097

**Karakulov A.G., Sharova E.S., Ivanchina E.D.,  
Svarovsky A.Ya., Kulbov D.A.**  
**MONITORING OF CATALYTIC REFORMING UNIT  
FOR GASOLINES OF ACHINSK OIL REFINERY PLANT  
WHEN USING COMPUTER MODELING SYSTEM**

The authors have investigated the key performance indicators of industrial plant for gasoline catalytic reforming considering raw feed types, catalyst grade and technological features of production in different production cycles. The necessity of continuous monitoring of industrial plants using computer systems is shown. This allows making recommendations for operation modes optimization, thereby improving the efficiency of gasoline production.

UDC 66.028

**Faleev S.A., Zanin I.K., Ivanchina E.D., Sharova E.S., Prodan V.I.**  
**OPTIMIZATION OF HYDROGEN CHLORIDE FEEDING INTO REFORMING REACTORS CONSIDERING COKE ACCUMULATION OVER CATALYST**

The authors have studied in details the action of chloride containing compounds on activity and selectivity of gasoline reforming catalyst. The technique which considers simultaneous influence of various factors on chloride content over the catalyst was proposed. These factors are mole ratio of  $H_2O:HCl$ , coke accumulation, process temperature during raw cycle time.

UDC 546.162'14:544.344.2

**Ivlev S.I., Sobolev V.I., Shagalov V.V., Ostvald R.V., Zherin I.I.**  
**PHASE DIAGRAM OF THE SYSTEM POTASSIUM FLUORIDE-BROMINE TRIFLUORIDE**

The authors have studied experimentally the phase equilibria in the system potassium fluoride-bromine trifluoride in the range of concentrations from 0 to 0,7 of KF mole fractions and have formed the phase diagram corresponding to this part of the system. The dependence of potassium tetrafluorobromate solubility in bromine trifluoride on temperature was determined. The composition and temperature of eutectic in the range of phase diagram with low content of potassium fluoride were defined experimentally. By the results of thermogravimetric analysis of  $KBrF_4$  decomposition the authors have formed the phase diagram of the system  $KF-BrF_3$  in the range of high temperatures.

UDC 543.544.45

**Gavrilenko M.A., Filatova N.A., Burmetyeva M.S.**  
**SENSOR BASED ON NICKEL OXIDE FOR DETERMINING HYDROCARBONS IN THE AIR**

The authors have developed the sensor with semiconductor gas detectors based on nickel oxide for determining the concentration of air pollution components. The electric conductivity of the sensor obtained when varying the production conditions, temperature and the analytes nature was studied. The sensor was tested on model gas mixture and applied for determining hydrocarbons in the environment.

UDC 542.913:54.061

**Sobolev V.I., Radchenko V.B., Ivlev S.I., Ostvald R.V., Filimonov V.D., Zherin I.I.**  
**FLUOROHALOGENATES OF ALKALI AND ALKALI-EARTH METALS IN ORGANIC SYNTHESIS**

For the first time the reactions of interaction between tetrafluorobromates (III) of alkali and alkali-earth metals and arenediazonium tosylates, nitrobenzene and styrene were researched. The extremely high reactivity of tetrafluorobromates (III) of alkali and alkali-earth metals with mentioned organic compounds was found. The products of interaction were identified by a LC-MS method. Various brominated and less fluorinated moieties were found. This result makes promising further investigations of the properties of these compounds as organic synthesis reagents.

UDC 66.095.21.097:665.656.2

**Ibragimov A.A., Rakhimov M.N.**  
**THE IMPACT OF WATER IMPURITIES ON ISOMERIZATION OF N-HEXANE CATALYZED WITH SUPERACID IONIC LIQUID**

The authors have studied water impact on laws of formation of iso-components in isomerization of n-hexane on chloroaluminate ionic liquid. It was ascertained that water at certain concentration intensifies n-hexane isomerization mainly due to side cracking.

UDC 544.452.2

**Root L.O., Konovchuk T.V., Smorygina K.S.**  
**EFFECT OF ADMIXTURES OF SODIUM MOLYBDATE AND TUNGSTATE ON PHASE COMPOSITION OF COMBUSTION PRODUCTS OF ALUMINUM NANOPOWDER IN THE AIR**

The authors have studied the effect of sodium molybdate and tungstate admixtures on combustion products composition in aluminum nanopowder in the air. These salts admixtures increase absolute count of aluminum nitride phase in combustion products of mixtures with aluminum nanopowder only at their low content: 0,1..0,4 wt. %. Aluminum nitride absolute count in combustion products have grown by 36..37 % that may be used in the technique of producing aluminum nitride if the admixtures do not influence greatly on electrophysical properties of the end product or do not decline the mechanical characteristics of consolidated aluminum nitride. It was ascertained that the increase of aluminum nitride yield in combustion products of aluminum nanopowder mixtures with the mentioned admixtures is connected with their catalytic action and decrease of residual aluminum content in end products.

UDC 543.544.45

**Pakhnutova E.A., Slizhov Yu.G.**  
**SYNTHESIS AND PROPERTIES OF CHROMATOGRAPHIC SORBENTS WITH GRAFTED LAYERS OF NICKEL ACETYLACETONATE**

Chelating packing chromatographic sorbents with grafted layers of nickel acetylacetonate were synthesized by series assembly on carrier surface through the silica gel chlorination stage. Their structural and chromatographic characteristics were studied by physicochemical methods. It was shown that the sorbents obtained may be applied in gas chromatography for separating light olefin, aromatic, saturated hydrocarbons as well as alcohols, aldehydes and ketones.

UDC 546.78

**Dyachenko A.N., Dugelny A.P., Kraydenko R.I., Chegrintsev S.N.**  
**TUNGSTEN PRESSURE LEACHING FROM TIN PRODUCTION WASTE BY SODIUM CARBONATE**

The authors have studied tungsten leaching from industrial waste discharge of Novosibirsk tin plant. Sodium carbonate ( $Na_2CO_3$ ) was the leaching agent. The maximum leaching degree was achieved in leaching autoclave at 225 °C, when mixing at 60 rev/min and the ratio T:L=1:5 for 6 hours. The general scheme of obtaining tungsten oxide from tungsten-containing dumps was proposed.

UDC 66.099.2

**Semakina O.K., Igasheva V.P., Shevchenko A.A.**  
**SORBENT OBTAINING BY EXTRUSION TECHNIQUE**

The authors have studied the possibilities of obtaining granulate sorbent from industrial wastes by extrusion technique for purifying used mineral oils. The sediments formed at artesian water aeration were used as wastes. Optimal mode of granulation with different binding liquids: carboxymethylcellulose, polyacrylamide and polyvinyl alcohol was selected. The authors have determined physical and mechanical properties of the granulas obtained before and after their thermal treatment: fractional composition, pore space, crush strength.

UDC 665.71:544.18

**Petrova A.A., Kirgina M.V., Ivanchina E.D., Maylin M.V.**  
**THE DEVELOPMENT OF TECHNIQUE FOR CALCULATING INDIVIDUAL HYDROCARBON OCTANE NUMBER APPLYING QUANTUM CHEMISTRY METHODS**

The article introduces the technique for calculating octane numbers of individual hydrocarbons in series of n-alkanes and 2-methylalkanes based on calculation of molecule dissociation energies using quantum chemistry methods. A set of octane numbers calculated by the developed technique was used for calculating octane numbers of mixing the base components of commercial gasolines.

UDC 66.01; 544.4

**Dolganova I.O., Dolganov I.M., Ivashkina E.N., Ivanchina E.D., Frantsina E.V.**  
**THE ANALYSIS OF OPTIMIZATION WAYS OF «REACTOR-REGENERATOR» SYSTEM OPERATION IN THE PROCESS OF MANUFACTURING LINEAR ALKYL BENZENES**

The carried out investigation on supporting the failure-free operation of «reactor-regenerator» system is the important stage in solving the problem of increasing the efficiency of manufacturing synthetic detergents. The authors have revealed the reasons resulting in operating troubles of HF-catalyst regeneration column. The article describes the failures influence on operation of the reactor of benzene alkylation with higher olefins. The optimization ways of reactor and column co-operation were proposed.

UDC 553.97+547.91

**Serebrennikova O.V., Strelnikova E.B., Preys Yu.I.**  
**THE FEATURES OF LIPID STRUCTURE IN HIGH AND LOWLAND PEATS IN THE SOUTH OF TOMSK REGION**

The authors have studied the lipid structure in the high and lowland peats formed in three bogs in the south of Tomsk region. The authors have determined the features of the molecular composition and distribution of hydrocarbons including n-alkanes, alkenes, mono-, bi-, tri- and tetracyclic aromatic structures, bi-, tri- and pentacyclic terpanes and terpenes as well as oxygen-organic compounds such as fatty acids, their ethers, n- and isoalkanones, tocopheroles, steroids, terpenoids, dibenzo- and benzonaphthophurans. On the strength of all the data obtained the most probable reasons of differences in the set and the number of separate organic compounds in the peats examined are the composition of peat-forming vegetation as well as water and water-mineral nutrition modes of bogs.

UDC 665.658.62

**Krivtsova N.I., Ivanchina E.D., Zanin I.V., Landl Yu.I., Tataurshchikov A.A.**  
**KINETIC LAWS OF TURNING SULFUR-CONTAINING COMPOUNDS AT HYDROREFINING OF OIL DIESEL FRACTION**

The authors have estimated the operating efficiency of two industrial catalysts of diesel fuel hydrorefining: domestic production, manufactured by Novokuybyshevsk plant of catalysts and the catalyst produced by French company Axens. Catalysts relative activity and the change of sulfur residual content in hydrogenation product depending on temperature were calculated. The values of rate constants and activation energy of turning sulfur-containing compounds on two types of catalysts were determined.

UDC 665.775: 665.6.033.28

**Krivtsov E.B., Karpov Yu.O., Golovko A.K.**  
**THE CHANGE IF THE STRUCTURE OF BITUMEN ASPHALTENES AND RESINS MOLECULES IN BAYAN-YORHAT DEPOSIT AT AQUATHERMOLYSIS THE**

The authors have carried out aquathermolysis of bitumen of Bayan-Yorhat deposit (Mongolia) under precritical and supercritical conditions. The article demonstrates the differences of liquid products material composition depending on thermolysis conditions. Structural-group parameters of average molecules of resins and asphaltenes in the original bitumen and the products of its aquathermolysis were calculated. The authors have determined the laws of changing the structures of high-molecular compounds (resins and asphaltenes) of bitumen in the processes.

UDC 666.972.162

**Debelova N.N., Gorlenko N.P., Nekhoroshev V.P., Sarkisov Yu.S., Zavyalova E.N., Zavyalov P.B.**  
**WATER REPELLING AGENT ON THE BASIS OF OXIDIZED ATACTIC POLYPROPYLENE**

The authors have proposed the hydrofobic protection of capillary porous building materials applying the atactic polypropylene.

UDC 541.64:547.759.32

**Lyapkov A.A., Bondaletov V.G., Melnik E.I., Zyabbarova E.B.**  
**INDENE COPOLYMERIZATION WITH DICYCLOPENTADIENE UNDER THE CATALYTIC SYSTEM (C<sub>2</sub>H<sub>5</sub>)<sub>2</sub>AlCl-TiCl<sub>4</sub>**

The authors have studied dicyclopentadiene copolymerization with indene in toluene solution under the catalytic system (C<sub>2</sub>H<sub>5</sub>)<sub>2</sub>AlCl-TiCl<sub>4</sub>. It has been ascertained that in this case the sequence copolymer is formed and dicyclopentadiene is more active monomer in the mixture. The conclusion is made that at dicyclopentadiene indene ratio 0,55:0,45 (it corresponds to azeotropic point on copolymer composition curve) the molecular weights of copolymers as well as heat generation in the system depend extremally on dicyclopentadiene content in copolymer.

UDC 541.183:544.653.2

**Korobochkin V.V., Usoltseva N.V., Balmashnov M.A.**  
**TEXTURE OF CARBONATE PRECURSORS OF COPPER ALUMINUM OXIDE SYSTEM OBTAINED FROM THE PRODUCTS OF NON-EQUILIBRIUM ELECTROCHEMICAL OXIDATION OF COPPER AND ALUMINUM**

The authors have studied the texture of carbonate precursors of copper aluminum oxide system obtained from the products of electrolysis of metallic copper and aluminum under alternating current with density of 0,5...2,5 A/cm<sup>2</sup>. It was ascertained that carbonate precursors obtained at the given current density values possess mainly the mesoporous structure in spite of the dependence of porous structure characteristics on current density. Temperature intervals of decomposition processes of the main carbonates correlate with literature data.

UDC 541.64:66.095.261.4

**Lyapkov A.A., Bondaletov V.G., Melnik E.I., Ogorodnikov V.D.**  
**THE RESEARCH OF DICYCLOPENTADIENE POLYMERIZATION WITH CATALYTIC SYSTEMS BASED ON TiCl<sub>4</sub>**

The authors have studied the laws of dicyclopentadiene polymerization under TiCl<sub>4</sub> and catalytic system AlEt<sub>3</sub>Cl-TiCl<sub>4</sub> in toluene solution. It has been ascertained that heat generation at dicyclopentadiene polymerization under TiCl<sub>4</sub> is determined by thermal effects of polymerization and salvation of catalyst. The method of monomer batching into reactor influences considerably on the reaction under the catalytic system AlEt<sub>3</sub>Cl-TiCl<sub>4</sub>. It is shown that the effective value of the observed rate constant of dicyclopentadiene polymerization as well as heat generation in the system depend extremally on the catalytic complex content. The formed microstructures in polymer chain were found out to be conditioned by addition of a monomer new molecule by one of double bonds. A part of microstructures formed in metathesis depends both on the method of batching monomer into reactor and on component ratio in the catalytic system.

UDC 543.552.054.1

**Slepchenko G.B., Pichugina V.M., Cherempey E.G., Shchukina T.I.**  
**THE CONTROL OVER HEXAVALENT CHROMIUM IN TUMOR CELLS BY THE METHOD OF ADSORPTIVE CATHODIC VOLTAMMETRY**

The authors have selected the conditions for voltammetric determination of hexavalent chromium on graphite electrodes using diphenylcarbazine by the method of adsorptive cathodic voltammetry. The voltammetric procedure for controlling tumor cells for hexavalent chromium content was developed and certified metrologically.

UDC 547.62+54.41

**Nguyen Kh.M., Chaikovskiy V.K.**  
**SYNTHESIS OF N, N-DIIODODERIVATES OF 5,5-DIETHYLBARBITURIC ACID AND THE RESEARCH OF THEIR IODINATING PROPERTIES**

The authors have proposed the technique for synthesizing N,N-diiodo- and N,N-diiododerivates of 5,5-diethylbarbituric acid and studied the properties of N,N-diiodo-5,5-diethylbarbituric acid in aro-

matic compounds iodination. It was shown that new iodinating systems based on N, N-diiodo-5,5-diethylbarbituric acid are efficient at aromatic compounds iodination both with electron-donor and electron-acceptor substituents.

UDC 668.819.5

**Samigulina L.A., Velichko A.V., Pavlovich L.B.**  
**SYNTHESIS OF METAL PHTHALOCYANINES WITH DIFFERENT COMPLEXING AGENTS**

The authors have carried out the researches of the influence of metal-complexing agents salts on synthesis of copper and cobalt phthalocyanines by the method of IR-spectroscopy and derivatographic analysis. The selection of synthesis complexing agents is substantiated. The researches allowed developing the resource saving technological process, proving the use of technogenic waste of phthalic anhydride production as raw material for obtaining molecular nanostructures on the basis of metal phthalocyanines; determining the role of metal-complexing agents salts in the synthesis of cobalt and copper phthalocyanines by the method of IR-spectroscopy and derivatographic analysis.

UDC 66.061.3:669.2/.8

**Alenichev V.M., Umansky A.B., Klyushnikov A.M.**  
**THE DEVELOPMENT OF HEAP LEACHING TECHNIQUE FOR OXIDIZED NICKEL ORES OF URAL DEPOSITS**

The authors have studied the laws of nickel percolation leaching from different types of Ural oxidized ores. The possibility of these ores

processing by heap leaching method with sulfuric acid solutions  $50...100 \text{ kg}\cdot\text{m}^{-3}$  is shown. The authors proposed the flow sheet of processing the obtained product solutions assuming precipitation of nickel hydroxide concentrate from solutions preliminary purified from the impurities by the method of hydrolytic precipitation. It was ascertained that the implementation of this technique allows obtaining the concentrate with nickel content of 26...30 % at nickel recovery from solution to concentrate on the level of 92...98 %.

UDC 66.011

**Belinskaya N.S., Silko G.Yu., Frantsina E.V., Ivashkina E.N., Ivanchina E.D.**  
**THE DEVELOPMENT OF FORMALIZED SCHEME FOR HYDROCARBONS TRANSFORMATION AND KINETIC MODEL OF DIESEL FUELS HYDRODEWAXING**

Based on quantum-chemical calculations thermodynamic probability of chemical reactions at diesel fuels hydrodewaxing is shown and the level of formalization of transformation procedure is proposed. The developed transformation procedure became the base for kinetic model of diesel fuels hydrodewaxing which allows considering the influence of raw material chemical composition on process efficiency.