# International Conference on Actual Problems of Chemical Engineering

# APCE - 2020

Baku (Azerbaijan), December 24-25, 2020

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# BOOK OF ABSTRACTS

# Scientific Programme

| | Thursday, December 24, 2020 | Friday, December 25, 2020 |
|---|---|---|
| 09.00-09.30 | OPENING CEREMONY | PLENARY LECTURES |
| 09.30-11.30 | PLENARY LECTURES | |
| 11.30-12.00 | COFFEE BREAK | COFFEE BREAK |
| 12.00-15.00 | ORAL PRESENTATIONS | POSTERS PRESENTATIONS |
| 15.00-16.00 | LUNCH BREAK | LUNCH BREAK |
| 16.00- 17.00 | EXCURSİON<br>VİSİT TO THE ALLEY OF MARTYRS | POSTERS PRESENTATIONS |
| 17.00-18.30 | ORAL PRESENTATIONS | CLOSING CEREMONY<br>EXCURSION “İCHERY SHEHER” |

# Actual Problems of Chemical Engineering

International Conference dedicated
to 100th Anniversary of Azerbaijan State
Oil and Industry University.

# PREFACE

The International Conference on Actual Problems of Chemical Engineering is a meeting aimed at enabling the academic and industrial communities to share scientific progress in the field of Chemical Engineering.

Chemical Engineering area represents a worldwide community of thousands of active researchers engaging in the process of converting raw materials or chemicals into more useful or valuable forms.

In addition to producing useful materials modern chemical engineering is also focusing on pioneering valuable new materials and techniques such as nanotechnology, fuel cells and biomedical engineering. Chemical Engineering is a branch of engineering that uses principles of Chemistry, Physics, Mathematics to efficiently use, produce, design, transport and transform energy and materials.

We are, therefore, pleased to welcome more than 200 participants to the APCE-2020 dedicated to 100th Anniversary of Azerbaijan State Oil and Industry University.

We hope all participants will have an interesting and rewarding scientific meeting and a pleasant stay in the capital of Azerbaijan – Baku.

**Organizing Committee**

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**APCE 2020**

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**Baku, Azerbaijan December 24-25 2020**

International Conference on Actual Problems of Chemical Engineering
December 24-25 2020
Baku Azerbaijan
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## CALL FOR PARTICIPANTS

**The international Scientific Conference on**
**"Actual Problems Of Chemical Engineering"- APCE 2020 will be held**
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## PLENARY LECTURERS

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## Important dates and registration

- Deadline for papers September, 15, 2020
- Deadline for notifications October, 15, 2020
- Deadline for registration November, 30, 2020

## PUBLICATION OPPORTUNITIES

**All the accepted papers will be published in the Conference Proceedings.**

# CONTENT

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# KEYNOTE LECTURES

KL-01

# THE ACTUAL DIRECTION RESEARCHES IN ENERGY AND RESOURCE EFFECTIVE CHEMICAL PROCESSES AND SUPPLY CHAINS ENGINEERING

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Science–based engineering, industrial implementation and digitalized management of energy-efficient and environmentally safe chemical process (CP) and supply chains (SC) chemical and petrochemical enterprises are an important factor in the successful implementation of the economic, social and environmental goals of sustainable development proclaimed in 2000 by the UNO General Assembly [1-3].

Scientific-based solutions to various engineering problems of energy-resource-efficient environmentally safe CP and SC are based on research in the following main topical areas: methods for intensifying and ensuring energy resource efficiency of CPS [3÷4]; methods for computer-aided synthesis of optimal CP [3] using modern nature-inspired algorithms (genetic, ant colonies, swarm of bees, swarm of particles, Firefly behavior, etc.) [6], decision-making procedures based on metaheuristics [7,8] and learner artificial neural networks [1,8]; methods for optimizing CP and automated operation management of energy-saving CP and SC; methods for engineering logistics systems for managing "green" SC of products [1÷3].

The report describes: the main methods to ensure energy conservation in CP; principles of computer-aided synthesis of optimal energy-efficient CP; methods of engineering of energy-saving CP for waste disposal and treatment [1÷3].

The principles, main directions and methods of intensification of energy-resource-saving CP are generalized and systematized [3].

The essence of the principles of micro-level intensification of energy-saving chemical unit operations and CP is described. The main factors and methods for intensifying chemical catalytic reactors are summarized, methods for intensifying heat exchangers and rectification of multicomponent mixtures processes are systematized and developed, as well as methods for combining unit operations and chemical processes.

Examples of solving practical problems of engineering energy-resource efficient CP [6÷8] are presented: the use of swarm intelligence to optimize technological systems for pulp and paper production;

the use of the particle swarm optimization algorithm for engineering the optimal design of a plate distillation column;

application of genetic algorithms for engineering biopolymer production; application of molecular engineering of electrically conductive polymers using artificial intelligence networks.

[1]. Meshalkin V.P. Energy–saving technology performance and efficiency indexes //Chem. Eng. Transactions. 2009, T. 18, p. 953–958.

[2]. Process intensification/Edited by Frerich Johannes Keil/https: ://www. degruyter. com /view/j/revce.2018.34.issue–2/revce–2017–0085/revce–2017–0085

[3]. European roadmap of process intensification /Createve Energie/ https://traxxys.com/wp–content/uploads/2017/05/2.2.8.1_Technology_Report_Reactive_Distillation_Schoenmakers.pdf

[4]. Xin-She Yang. Nature-Inspired Optimization Algorithms, Elsevier Insights, 270p.

[5]. Applications of Metaheuristics in Process Engineering/ J. Valadi, P. Siarry Ed., Springer, 450p.

KL-02

# TECHNOLOGICAL PATHWAYS TO “GREEN” HYDROGEN PRODUCTION

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Hydrogen is considered the ultimate fuel of the future due to its socio-economic, environmental, and health benefits. Currently, hydrogen is produced by a variety of chemical processes using  different feedstocks, however, not all industrially manufactured hydrogen is the same from an environmental viewpoint. Therefore, a “color” code is currently used as a way to distinguish the types of technologies used to produce hydrogen. There exists black, gray, blue and green color-coded variations of hydrogen, depending on the carbon footprint of the manufacturing processes. In particular, black and gray hydrogen are produced by coal gasification and natural gas (NG) reforming, respectively. Blue $H_2$ is produced by steam-methane reforming process combined with $CO_2$ capture and storage (CCS). By contrast, green $H_2$ is produced from water using carbon-free renewable sources, such as solar, wind energy, etc.

Solar-driven hydrogen production by splitting water is considered the most attractive technology. There are three main approaches to using solar energy to split water to hydrogen and oxygen:

- Electrochemical (e.g., via PV-electrolysis)
- Photochemical (e.g., photoelectrochemical, photocatalytic, photobiological) (see Fig. 1)
- Thermochemical (e.g., thermal and hybrid water-splitting cycles).

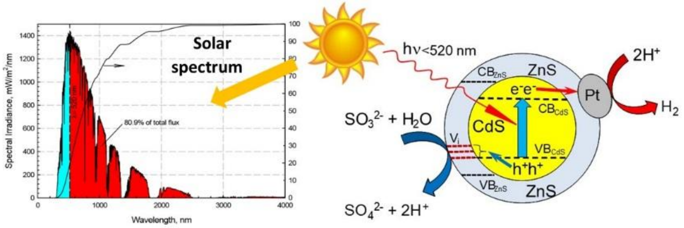

Figure 1. Schematic diagram of the solar-driven photocatalytic production of green hydrogen using core-shell Pt/CdS/ZnS photocatalyst.

Each of these approaches has its advantages and challenges. Among the above options, PV-electrolysis is the most technically mature technology, and it often serves as a benchmark for evaluating other solar hydrogen production systems. The overall solar-to-hydrogen energy conversion efficiency of state-of-the-art PV-electrolysis systems is estimated at 15-20%. Photoelectrochemical, photocatalytic and photobiological systems allow the direct conversion of solar energy into chemical energy of hydrogen, however, the solar-to-$H_2$ energy conversion efficiencies of these systems are still in low single digits. Solar-powered hybrid photo-thermochemical cycles can potentially reach overall efficiency of 35-40%, far exceeding that of PV-electrolysis, however, they are in early stages of development [1]. The latest scientific and technological developments in the area of green hydrogen production are summarized and critically analized in this paper.

[1]. E. Vagia, N. Muradov, A. Kalyva, A. Srinivasa, K. Kakosimos, *Intern. J. Hydrogen Energy*, 2017, 42 20608.

KL-03

# OBTAINING PETROCHEMICAL PRODUCTS FROM RAW MATERIALS OF ALTER-NATIVE OIL

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The development of processes for obtaining petrochemical products from raw materials, alternative oil (gas resources and products of processing plant raw materials) is an important strategic task. The use of renewable raw materials allows not only to expand the raw material base of the petrochemical industry, but also to reduce the negative impact on the environment by maintaining the balance of produced and consumed carbon dioxide. An example of a promising raw material for the production of petrochemical products is isobutanol, produced by fermentation of renewable raw materials. Professor F. Arnold received the No-Belev Prize in Chemistry in 2018 for developing the foundations of biotechnology for the production of isobutanol from biomass. The process is implemented on an industrial scale and allows you to obtain raw materials for the production of monomers and fuels.An important alternative to oil is natural gas. Qualified processing of natural gas (methane) into intermediate petrochemical products (synthesis gas, ethylene) allows creating environmentally friendly petrochemical processes. Hydrogen, a component of synthesis gas, is a promising fuel for alternative energy. Production of synthesis gas by carbon dioxide conversion of methane makes it possible not only to obtain hydrogen-containing gas, but also to utilize greenhouse gases.The implementation of the processes of processing plant and gas raw materials into petrochemical products requires the creation of highly efficient catalytic materials. Obtaining petrochemical products using catalytic processes and based on renewable raw materials complies with the principles of "green" chemistry. We have developed new catalysts and processes for the production of aromatic hydrocarbons and C2-C4 olefins from triglycerides of fatty acids and butyl alcohols, products of processing plant raw materials, or from associated petroleum gas. Also, new active, selective and stable catalysts for the production of synthesis gas by oxygen and carbon dioxide conversion of methane and the production of ethylene by oxidative condensation of methane have been created.

KL-04

# CHEMICAL DESIGN OF MAGNETIC TOPOLOGICAL INSULATORS

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Novel layered van der Waals compounds containing 3*d* transition metal are intriguing materials owing to the quantized states arising from magnetoelectric effects such as the quantum anomalous Hall effect (QAHE) [1, 2]. Magnetization leads to many exotic features especially in the charge transport properties of Topological Insulators (TI's), which expands the application of TI's to other domains such as magnetic tunnel junctions, memory discs, lasers and etc. Development of the magnetic TI's will also open the windows for the study of high-temperature QAHE, Fractional Chern Insulators, Topological magnetoelectric effect, Weyl semimetal, etc [1]. Recently, a considerable number of patents were registered on methods for employing TI's in industries demonstrating a shift from lab to market. Despite all progress, the main obstacle on the path to industrialization of TI's is the difficulty in preparation of high-quality crystals, working in applicable temperatures in the absence of a strong external magnetic field. Therefore, the main aim of our recent researches are dealing with these obstacles by introducing a stable topological insulator crystalline structure with intrinsic magnetic properties and elevated temperature functionality.

Feasibility of realization of magnetic TI's and accompanying exotic phenomena are greatly dependent upon chemical design of the novel magnetic layered materials. The later requires in the first place the detailed knowledge of the phase diagrams of the corresponding chemical systems [3]. The phase diagram maps phase relationships among all the existing phases and provides information about their formation natures, stability temperature ranges, phase transformations, and primary crystallization areas, i.e. information that is crucial and vitally important for proper materials design. The displayed information in the phase diagrams is valuable for choosing starting compositions and development of the techniques for direct synthesis of the alloys and their crystals growing from melts by direct crystallization [3].

We explore the phase relationships in the Mn-Bi-Te ternary system along the MnTe-$Bi_2Te_3$ section in order to look for new mixed-layered phases in this system. We study peculiarities of the formation, liquidus surface, stability temperature range, and homogeneity area within the MnTe-$Bi_2Te_3$ phase diagram, as these data are crucial for growing large single crystals of the ternary compounds both from the stoichiometric and non-stoichiometric melts. As a result, we have synthesized single crystals not only of $MnBi_2Te_4$, but also of the six new members of the $(MnTe)\cdot n(Bi_2Te_3)$ homologous series, namely $MnBi_4Te_7$, $MnBi_6Te_{10}$, $MnBi_8Te_{13}$, $MnBi_{10}Te_{16}$, $MnBi_{12}Te_{19}$ and $MnBi_{14}Te_{19}$ which are were not previously described in the literature so far. As a continuation of this work, an investigation of the Mn-Sb-Te and Cr-Sb(Bi)-Te systems are also underway.

[1]. M. Otrokov et al. *Nature*, Vol. 567 (2019) 416-422
[2]. Z. S. Aliev et al. *J. Alloys Compd*. 789 (2019) 443-45
[3] M. B. Babanly et al. *Russ. J. Inorg. Chem.* 62(13) (2017) 1703–1729

KL-05

# INTENSIFICATION OF NATURAL HYDROCARBON AND CARBOHYDRATE RAW MATERIALS OF PETROCHEMICALS AND FUELS

Teptereva G.A.[1], Chetvertneva I .A.[2]. Karimov E.K.[1], Babaev E.R.[3], Kolchina G.Y.[1], Karimov O.K.[1], Movsumzade E.M.[1]
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The development of the petrochemical industry dates back to the beginning of the twentieth century, when the need arose for the development and production of various products for petrochemistry. The main component of petrochemical production is hydrocarbon raw materials, which are based on oil, gas, shale and coal [1].

After several decades, declining oil raw materials began to be replenished with gas, shale and coal hydrocarbon raw materials. Gas hydrocarbon raw materials, developed in the second half of the twentieth century, in the 60-80s [1.2], were considered especially promising.

At the beginning of the 21st century, we can talk about the production of petrochemicals, which we would not want to call alternative, but they are becoming increasingly important - these are products of green chemistry: biomass, natural polysaccharides, gums, mucus, etc.

These products are already beginning to be used quite intensively in almost all industries and agriculture, as well as medicine, pharmaceuticals and the food industry. The first part of the report deals with hydrocarbon feedstock and its transformations, namely oil refining, petroleum field gas, natural gas [3].

The next part of the report is devoted to raw materials of non-hydrocarbon origin, namely raw materials of natural origin. The use of non-hydrocarbon raw materials results in promising monomers, polymers, reagents and compounds with practical properties for the needs of oilfield chemistry.

Using the possibilities of "green" chemistry, including wood processing products, I would like to note that promising modern composites for drilling and oil production are reagent systems based on the by-product of lignosulfonate (LST) wood processing, cellulose, starch and other natural polysaccharides [4-6]. They are produced and used in many industries in Russia, as well as in Azerbaijan.

[1]. Movsum-zade E. M. Events and facts of Russian oil: the birth of the oil business in the Russian Empire/E. M. Movsum-zade. - St. Petersburg: Nedra, 2008. - 151 p.

[2]. Movsumzade E.M. "Formation of gas processing in Bashkortostan" E.M. Movsumzade, A.M. Syrkin, N.S. Teplov. Moscow. "TsNIITEneftekhim" 1998.- 105s.

[3]. Mathematical methods in oil and gas chemistry [Text] = Mathematical methods in oil and gas chemistry/N. C. Movsum-zade, E. M. Zade. - Moscow: Chemistry, 2012. - 234 p.: il., porter, Table; 20 cm.; ISBN 978-5-98109-098-1

[4]. Karimov O.Kh., Teptereva G.A., Ismakov R.A. Chetverneva I.A. Wood products as an alternative to petroleum hydrocarbons Oil and gas chemistry, No. 3-4, S. 35-40.

[5]. Patent of the Russian Federation No. 2709043 Method of producing lignosulfonate reagent for treatment of drilling mud/Tepterev G.A., Akchurin H.I., Konesev G.V., Nebit A.N., Zhestovsky M.P.

[6]. Teptereva, G.A. Preparation of drilling reagents by modification of neutral-sulfite liquors with phosphone compounds/G.A. Teptereva, G.V. Konesev, R.A. Ismakov, E.A. Kantor, D. Dikhtyar//Izvestia Tomsk Polytechnic University. Georesource Engineering. - 2017.- T.328, No. 9.- S. 94-101.

KL-06

# CATALYSIS AND CARBON NANOSTRUCTURES DURING SYNTHESIS OF DENSE BORIDE CERAMICS

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Boride ceramics have exceptionally high engineering properties and are used in the most demanding applications at Ultra High Temperatures (UHT) at above 2000 $^{0}$C [1]. Synthesis of the dense, pore-less, UHT ceramics requires temperatures in excess of 1900 $^{0}$C with externally applied pressure [2]. Complex processing routes such as Sparc Plasma Sintering (SPS) are used with variable susses get the very best ceramic properties [3]. Utilisation of sintering enthalpies, catalysts and carbon nanostructures allow to get dense composite boride ceramics at moderately relaxed sintering conditions. Foremove, introduction of secondary phases and catalytic ions permit to improve oxidation resistance, crack resistance and thermal conductivity.

We report on utilising reaction

$$2ZrC + B_4C + 2.5Si + 0.2CNC \rightarrow 2ZrB_2 + 2.5SiC + 0.1C + 0.2CNT$$

where CNT stands for Carbon Nano Tubes. The reaction has been used to create fully dense ceramic at 1830 $^{0}$C, 30MPa for 3 min. The stages of the reaction and green body densification are quite complex. We discuss how use of some nanodispersed catalysts allow to shift sintering parameters to less stringent conditions by catalysis in solid and liquid intermittent phases. CNT presence significantly improves ceramics mechanical properties but makes green body densification slightly more challenging.

For the first time in the world it is shown that light excess of carbon in the system shifts thermodynamical balance of the intermittent reactions and allows the CNTs to survive sintering conditions at 1830 $^{0}$C.

The presence of CNTs in the fully densified ceramics allows to increase the ceramic crack resistance more than 1.5 times and does not affect ceramic oxidation behaviour at temperatures above 2000 $^{0}$C.

[1]. W. G. Fahrenholtz and G. E. Hilmas, "Ultra-high temperature ceramics: Materials for extreme environments," Scripta Materialia, pp. 94-99, 2017.

[2]. M. S. Asl and M. G. Kakroudi, "A Processing–Microstructure Correlation in ZrB2–SiC Composites Hot-pressed under a Load of 10 MPa," Universal Journal of Materials Science, vol. 3, no. 1, pp. 14-21, 2015.

[3]. I. Akin, M. Hotta, F. C. Sahin, O. Yucel, G. Goller and T. Goto, "Microstructure and densification of ZrB2–SiC composites prepared by spark plasma sintering," Journal of the European Ceramic Society, no. 29, p. 2379–2385, 2009.

KL-07

# ETHANOL-BASED BIOINDUSTRIES ENABLE EVOLUTION OF KNOWLEDGE-BASED BIOECONOMIES TO SUSTAINABLE MODELS

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At the onset of the third decade in the 21st century, all the societies are at a crucial stage of development. While moving towards a more sustainable model for the industry, becoming a globally competitive knowledge-based economy is an inevitable decision on the future success of an economy and society. To achieve this, every State needs a “technology platform” for the “sustainable production of chemicals” in which INDUSTRIAL BIOTECHNOLOGY takes place as one of the three pillars also considering society and the environment. Industry, academia, interest groups and government jointly need to develop a “strategic research agenda (SRA)” that will be followed by a more detailed “action plan”.

Industrial Biotechnology is a cornerstone of the knowledge-based bio-economy. The overall goal of Industrial Biotechnology is to develop new bio-based technologies to convert renewable materials into chemicals, materials, and bioenergy. To this end, in this presentation, the focus will be on the novel discoveries based on the conversion of ethanol to biomolecules which impact on the green-clean production of biomolecules, including the biopharmaceutical proteins with high yields and productivities. As ethanol is produced from the molasses, but can also be produced from ethylene over a well-known gas-solid/catalytic hydration reaction, green-clean production of biomolecules from ethanol bridges the knowledge-based bioeconomy with the sustainable models for industry based on natural resources like petrochemical industries. Overall, the novel green-clean production platforms open up new avenues for research and production of novel and also conventional biomolecules from ethanol in yeast.

KL-08

# CARBON NANOTUBES IN THE OXIDATION ENVIRONMENT OF LIQUID HYDROCARBONS AND POLYMERS

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Carbon nanostructures (CNS) are attractive subject and means for the fundamental and application natural sciences. These compounds discovery and development are one of the magnificent achievements of last decades in the chemistry.

This report stepwise highlights the milestones:

- short history of discovering fullerene and carbon nanotubes (CNTs)
- variety of carbon nanocompounds and their nanodimension spectrum, type of chemical bonds, fascinating electronic properties and entailed chemical potential. The higher electron affinity of CNS (fullerenes and CNTs) realizing intense addition of free radicals and active intervention into the chain reactions of oxidation, polymerization, degradation etc. are postulated. Potential capacity of CNTs is also goodly applicable for radical reactions which are in the intensive focus of our consideration [1]
- a wide range of methods has been invented and applied to produce CNTs in the lab and large scale, functionalize, use and implement them into devices and materials, for catalysis science, and energy research. Billions of dollars all over the world funded by the governments, institutions and foundations have been spent for these challenged activities. Chemical Vapor Deposition (CVD) is most recognized and accepted method for artificial synthesis of CNTs both in the laboratory and industrial scales. The laboratory setup for CNTs synthesis from the petroleum gases of Azerbaijan just constructed and put into operation at the Institute Catalysis & Inorganic Chemistry is announced in this report for the first time
- model oxidation experiments with fullerene and CNTs are described. Resulted output of these tests are:

1) fullerenes C60 and C70, as well as pristine CNTs are good and exclusive scavengers of carbon-centered radicals, 2) rate constants of the radicals addition is extremely high, so that these nanocompounds can be considered as primary antioxidants operating on the stage the R• radicals capture, 3) the nanocompounds are most effective in the mediums having diffusion restriction for oxygen penetrating, e.g. in polymer materials, solid lubricants, viscous oils, 4) additionally the CNTs display the amazing capacity in the redox system being active scavenger of Reactive Oxygen Species (ROS)

- the CVD synthesis of single, double and multi-walled (MW) CNTs is conducted in the presence of catalyst- precursors which usually are organometallic compounds. Therefore as-prepared CNTs contain as a rule metallic inclusions. As the case study the synthesis of multi-walled CNTs from the gas sources over ferrocene catalyst has been considered. The CNTs containing metallic residues display accelerating influence on the oxidation processes. This phenomenon has been explained in the terms of the accelerated radical decomposition of hydroperoxides leading to the ramification of oxidation chains. The examples of the aerobic catalytic oxidation both in the model patterns and in oil hydrocarbon have been contemplated. The target oxidation products are obtained with high selectivity that can be ascribed to the intrinsic property of CNTs to have the double opposite functioning in the oxidation environment.

It has been established that as prepared CNTs contains $Fe_7C_3$ and iron in the α-form/ and purifying CNTs from metal carbides by treatment with hydrochloric acid leads only to a different packing of the metal atoms in the crystal lattice to afford $Fe_3C$ and γ-iron [2].

- modification and functionalization of CNTs is one is most powerful tools to expand an area of its application. The scope encompasses also grafting of the functional groups with potential anti-oxidative activity – these are phenolic and secondary amine groups exerting mesomeric effect at aromatic ring, TEMPO-stable radical, 1,4 – benzoquinone fragment, fullerene and iodine groups.
- Iodination of MWCNTs was carried out in a sealed quartz ampoule under increased pressure (approximately ~ 20 bar) at 400 $^{o}$C for 2 hours. The activity of the J@MWCNTs sample was studied by the kinetic method.The kinetic laws of the oxidation reaction were studied according to the amount of oxygen absorbed in the equipment for oxygen uptake at constant pressure. In experiments, various quantities of cumene and J@MWCNTs were used and, as a standard, experiments were carried out at temperatures of 60°C at 20 kPa of oxygen pressure. In all experiments, induction periods were observed at the beginning of the reaction reaching in some experiments to 17 and even 40 minutes. Besides, the iodine-containing MWCNTs have a considerable impact on the reaction rate within post-induction plot, showing 2 times reduction from 101 to 45 $mm^3O_2\ min^{-1}$ that eventually leads to stopping the reaction after a certain period of time. This line provides a new guide to effects of iodine-containing nanocarbon compounds on oxidation of hydrocarbons.

[1]. Zeynalov E.B., Nagiyev T.M. et al. Carbonaceous nanostructures in hydrocarbons and polymeric aerobic oxidation mediums. 2018, ch.16, 631-681, Elsevier, Oxford, UK

[2]. Zeynalov E.B., Allen N.S. et al. Journal of Physics and Chemistry of Solids, 2019, 127(4), 245-251.

KL-09

# COMPLEXES OF OIL PORPHYRINS WITH D-METALS, THEIR STABILITY AND USE IN CATALYSIS

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Interest in the porphyrin complexes of transition metals is growing due to the possibilities of their use as catalysts. Synthetic metalloporphyrins are practically insoluble in hydrocarbons and require the use of complex and expensive additional chemicals to homogenize the system. In this regard, natural metalloporphyrins are of particular interest, which, due to the presence of ether, ester fragments and alkyl radicals in the side branches, dissolve well in hydrocarbons. Among natural metalloporphyrins, oil metalloporphyrin complexes are particularly interesting, which are distinguished by their simplicity of preparation and potential applications in petrochemical processes [1,2].

The study of the properties and use of natural metalloporphyrins in the development of new highly selective methods for the oxygenation of hydrocarbons at moderate temperatures is an urgent problem. The present work is devoted to the extraction of metalloporphyrins from oil residues and the creation on their basis of effective catalytic systems for the oxidation of alkenes. The separation of metalloporphyrins from oil residues was carried out using new bifunctional organic extractants having the nature of keto-alcohols and providing a greater degree of extraction of porphyrins in comparison with the known traditionally used extractants [3].

The results of a study of a number of new bifunctional organic reagents as extractants for the selective extraction of oil porphyrins from asphaltenes are presented, their spectral characteristics are studied, the dependence of the degree of extraction on the mass ratio of the extractant and the crude oil is revealed. The best results were obtained with a mass ratio of 1:30. The isolated mixture of metalloporphyrins is first subjected to demetallization with hydrochloric acid (pH = 1-2), turning into a mixture of porphyrins, then, to obtain individual metal porphyrin complexes, the required transition metal ions are introduced into the porphyrin ring by treating the mixture with these metal salts. It was shown that the yield of synthesized oil porphyrins is 42-85%, depending on the nature of the metal. The composition and structure of the synthesized oil metalloporphyrins containing iron, cobalt, nickel, manganese and their oxygen spesies adducts are established by modern methods of physico-chemical analysis [4]. The catalytic properties of synthesized metalloporphyrins in the epoxidation of unsaturated alkenes have been investigated. Their dioxide adducts were obtained, and an alternative mechanism was proposed for the oxidation of alkenes with the formation of rezonance oxinoid structures as a result of the decomposition of the oxygen complexes of metal porphyrins.

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# İNVİTED LECTURES

IL-01

# REAGENTS FOR OIL PRODUCTION BASED ON SULPHOETHERS OF LIGNOSULFONATE AND STARCH

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In oil production, the issues of reducing complications in drilling oil and gas wells are always relevant. We have studied and tested in field conditions when drilling intervals folded with unstable clay rocks, the use of compositions based on starch and lignosulfonate-sulfocarboxyethers of starch modified by fly. The preparation of ether by us is considered as a two-stage process, where in the first stage starch oxidation is carried out to obtain a carboxy derivative, in the second stage sulphation of the obtained carboxy starch is carried out. The IR spectrum of the obtained starch sulfolignocarboxy ester (reagent ЛКР-1) in the range of 400-4000 cm-1 is shown in Figure 1.

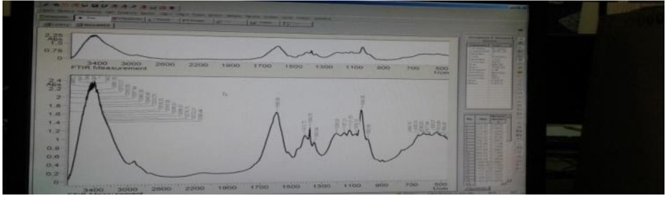

Fig. 1 .IR spectrum of the obtained preparation ЛКР-1

The appearance of absorption bands in the IR spectrum (Fig.1) of sulfolignocarboxy starch ester at 822 cm-1 (ν C-O-S) and 1240 cm-1 (ν S = O) are consistent with the data of chemical analysis and clearly indicate the formation of sulfoester groups in the composition of modified starches (Fig.2).

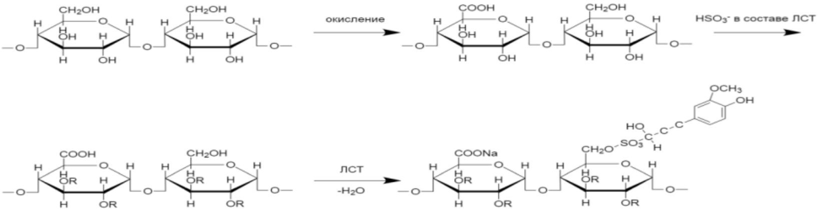

Fig. 2. Starch Sulfolignocarboxyester Production Scheme (ЛКР-1)

A distinctive property of the obtained composition (reagent ЛКР-1) is increased stability of parameters in aggressive well conditions. Drilling fluid system with addition of ЛКР-1 is stable to action of polyvalent cations, contamination with cement, high content of active clay phase, action of acid gases and high temperatures.

IL-02

# PREPARATION ELECTRIC CONDUCTIVITY NANOCOMPOSITIONS OF OLYGOMERS AROMATICS AMINES

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These compounds are polyfunctional aromatic polyconjugated homo- and cooligomers They show semiconductivity, paramagnetism, thermal stability, catalytic activity and in most cases possess solubility and meltability. As a result such high-molecular compounds and their compositions with fibres, thermoplasts, resins and elastomers are widely used in creation of sensors, transformers and «smart materials» of various purpose and also in textile industry [1-4]. The purposeful change and control of electrical properties of such materials at keeping of solubility and meltability is actual and important problem. The preparation of electro-conductive polymers in nanosizes, optimization and stabilization of their electric properties and also creation of their nanocompositions with matrix polymers are more interesting and tempting, as they have more wide possibilities for development of polymer materials with high and stable electric conductivity.

Olygomers aromatics amines (oligoaniline–OA, oligomethylaniline-OMA, oligoparafenylendiamine-OPFDA) in nanosizes with more high electric conductivity has been synthesized by oxidative polycondensation of aromatics amines in the presence of $[NH_4]_2S_2O_8$ (APS) or $K_2S_2O_8$ in a medium of HCl under action of ultrasound waves. For revealing of aromatics amines optimal parameters of synthesis of aromatics amines in nanosizes the process has been carried out in atmospheres of air and nitrogen, at various values of pH medium and ratios monomer: oxidizer (mol) and measurement of the electric conductivity of each synthesized sample by a method of four points.

Conducting composite based on aromatics amines is prepared in the presence of new hydrophilic template: sulfanilic acid derivative of poly (styrene–alt–maleic anhydride) (PSMA-SU) as a matrix polymer during the in situ chemical oxidative polymerization of aromatics amines. PSMA-SU can be used template as matrix to linearly guide the growth of a secondary polymeric reaction. Template is made with grinding powder to form a fine powder of PSMA. Then sulfanilic acid was used for modification of PSMA fine powder in presence of trim ethylamine. Prepared OMA-PSMA-SU composites by this method have excellent solubility in water due hydrophilic interactions in its template and electrical conductivity values of 0.41 S/cm are obtained for it by the four probe method. Produced all polymers and copolymers were characterized by 1HNMR and FT-IR spectroscopy. It has been determined that nanooligomers of aromatics amines and their oligomer-polymer nanocompositions show high and stable electroconductivity ($6.1-24.5\ Om^{-1}\cdot cm^{-1}$, $0.15-2.2\ Om^{-1}\cdot cm^{-1}$), and the sizes of oligomethylaniline particles are 50-100 nm. This type of oligomers and their nanocompositions can be used in microelectronics, in the textile industry, in the preparation of coatings with protective and antistatic properties from the influence of UV rays and their nanocompostions are the perspective polymer materials for microelectronics.

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IL-03

# SPIN CATALYSIS OF N-SULFINYLAMINES CYCLOADDITION WITH DIENES

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Compound containing the NSC groups are known as N-sulfinylamines (also called as sulfinylimides, iminooxosulfuranes, N-sulfinylimine, N-sulfinylanilines in the literature). [1-3]. The *N*-sulfinylamine compounds, R–NSO, could be presented in two possible structural forms, *cis* and *trans* (or *syn*, *Z* and *anti*, *E*) [2]. HNSO species (as well as anion $NSO^-$) are isoelectronic with a non-linear $SO_2$ molecule; thus, they are also bent to non-linear form and two structural isomers are possible for HNSO.

Density functional theory (DFT) with the B3LYP functional is used in present work for geometry optimization, electronic structure and force field analysis.

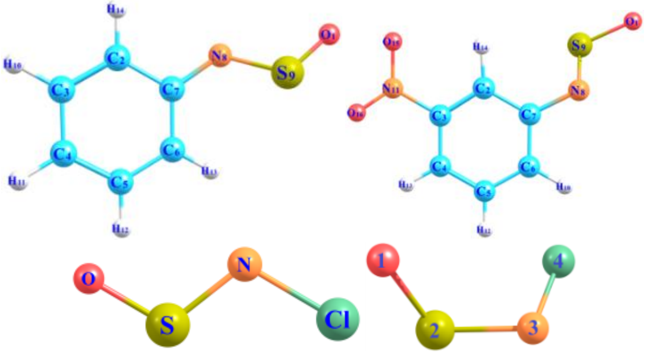

Fig 1 . Atomic numbering of phenyl- and *m*-nitro-N-sulfinylaniline including the structure of the singlet (left) and triplet (right) states of the Cl-N=S=O molecule.

All calculated N-sulfinylanilines are planar in the ground state and show the *trans* form, but in the $T_1$ state they are non planar with a strongly distorted NSO group intermediate between *cis* and *trans* structures . This $T_1$ state shows n-π* type orbital structure with NSO spin localization and low repulsion of lone pairs which affords the cycloaddition reactions.

Density functional theory has been applied to a number of N-sulfinylamine molecules in the ground singlet closed-shell state ($S_0$) and in the triplet excited state ($T_1$). DFT calculations show that these compounds are characterized by the low-lying $T_1$ excited state with a strong spin-density localization on the -N=S=O group, which can explain a number of specific chemical properties of N-sulfinylamines such as their reactions with acidic proton-active compounds, Diels-Alder cycloaddition with dienes and instability in the moisture.

The relatively large calculated spin-orbit coupling matrix element between $T_1$–$S_0$ states explains an efficient rate constant for the $S_0 \rightarrow T_1$ excitation induced by heating and internal magnetic forces. We explain some chemical reactions of N-sulfinylimines by spin-catalysis concept.

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# ORAL COMMUNİCATİONS

**OC-01**

# ISOPROPYL ALCOHOL WASTE IS AN ALTERNATIVE SOURCE OF PYROLYSIS PROCESS

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It is known that the development of the petrochemical industry in modern times is directly related to meeting the demand for low molecular weight olefins. Suffice it to say that low-molecular olefins such as ethylene and propylene are used in a wide range of products, both in the polymer industry and in the organic synthesis industry. Examples include polyethylene and polypropylene, 1,2-dichloroethane, ethyl alcohol, ethylene oxide, ethylene glycol, vinyl chloride, isopropyl alcohol, allyl chloride, allyl aldehyde and allyl alcohol, acrylonitrile, glycerine and other valuable products.

Pyrolysis of hydrocarbons is used to meet the high demand for ethylene and propylene. The condensation products formed during the pyrolysis process precipitate on the surface of the pyrolysis furnace pipes in the form of coke. As a result, the heat exchange process in the pipes is disrupted, the hydraulic resistance in the pipes increases and even blockages form. The yield of coke formed depends on both the composition of the raw material and the conditions of the pyrolysis process (temperature, pressure, contact time or feed rate, the amount of water vapor used as a diluent). That is why the study of the effect of the parameters of the pyrolysis process on the composition of pyrolysis products, including coke production, is one of the most important issues.

Research work on the use of alternative raw materials during the pyrolysis process, pyrolysis furnace is devoted to the study of ways to reduce and eliminate the coking of pipes [1].

Oligomerization of propylene occurs in the production of isopropyl alcohol in the presence of sulfuric acid. Depending on the conditions of the hydration process, the yield of the obtained oligomers for propylene is up to 10%. It consists of 50% dimer, 20% trimer, 10% tetra- and pentamers and 20% oxygen compounds. This mixture, which is an industrial waste, can be used as a raw material additive in the pyrolysis process. The main raw material for the pyrolysis process was a fraction of straight-distilled gasoline with a boiling point of 70 ÷ 1150C obtained from the refining of oil from the Chirag field, one of the most promising new oil fields in Azerbaijan.

The study examined the effect of temperature (750, 800 and 8500C), the amount of water vapor and the rate of delivery of raw materials (contact time) on the yield of coke in pyrolysis products. The research was conducted in a laboratory facility assembled on the basis of a reactor with a volume of 32 cm3, made of quartz glass and equipped with an electric heater. Chromatographic analysis method was used to analyse the obtained products.

Studies have shown that when the pyrolysis process is carried out in the presence of water vapour, the raw material decomposes deeper, partially preventing the secondary (repeated) conversion reactions of hydrogen pyrolysis, formed by the reaction of water vapour with coke at high temperatures. As a result, the total yield of ethylene and propylene, the target product, increases significantly, while the yield of coke decreases to a minimum. It was found that when up to 5% of isopropyl alcohol production waste is added to the pyrolysis feedstock as an alternative feedstock, the process performance not only does not change, but also partially improves.

Thus, the use of wastes obtained in the production of isopropyl alcohol in the presence of sulfuric acid as an alternative raw material in the pyrolysis process can be considered a technologically, economically and environmentally efficient method.

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**OC-02**

# COLLOIDAL STABILITY OF COMPOSITIONS BASED ON İNDUSTRİAL OİL, HIGH ALKALINE CALCIUM SULPHONATE AND FUNCTIONALLY SUBSTITUTED SULFIDES BY DYNAMIC LİGHT SCATTERING DATA

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The method of dynamic light scattering (DLS) was used to study the colloidal stability of the compositions based on industrial oil I-40A, highly alkaline calcium sulfonate and functionally substituted sulfides $R^1$ - S - $R^2$, where $R^1$ is $C_4H_9OCOCH_2$-; $R^2$ is $CH_2CH_2X$, where X is Cl (I), Br (II), OH (3), -$CH_2$-$C_6H_4$-OH (4), -$CH_2$-CH ($CH_3$) -OCO- $(CH_2)_3$-$CH_3$ (5). The size of the "hydro- dynamic" diameters of the particle and their size distribution in compositions within temperature range 278-343K was determined using Horiba LB 550 particle size analyzer. The table 1 shows the values of the parameters of the DLS spectra.

Table 1. The values of the DLS parameters at 40 ° C of base oil I-40A containing: a) high-alkaline calcium sulfonate K-312 and b) high-alkaline calcium sulfonate K-312 and compound 4 at a concentration of 1 wt.% of each additive.

| Composition | Diameter of the particles in the liquid phase, nm | | | | | | Span | Diffusion Coef., $m^2$/sec.,$E^{-11}$ |
|---|---|---|---|---|---|---|---|---|
| | for 10, 50 and 90 % particles | | | Median | Average size | Moda | | |
| | 10 | 50 | 90 | | | | | |
| | 4,5 | 6,1 | 7,9 | 6,1 | 6,1 | 6,2 | 0,56 | 3,8 |
| | 3,1 | 4,7 | 6,5 | 4,7 | 4,8 | 4,8 | 0,73 | 4,8 |

DLS data shows that the initial base oil and its compositions with the above sulfide compounds are molecular systems, and the particle size in these systems is less than one nanometer. Particles with an average size of 6.1 nm and a size distribution of 4.5 to 7.9 nm were found for the composition of base oil I-40A with a highly alkaline additive of calcium sulfonate K-312. The sulfides intoduced into these composition changes the spectral picture. Particles with a diameter of 2 to 6.5 nm with an average diameter of 4,4-4.8 nm are observed. Studies show that the average particle size remains virtually unchanged when the system heats up to 55°C. The mechanism of the interaction of compositions components which leads to stabilization of the colloids is considered.

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**OC-03**

# SYNTHESIS AND APPLICATION OF AMIDOAMINE COMPLEXES OF NATURAL PETROLEUM ACID OF CHLORINE ATOM

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In the research, allyl esters of carbonic acids were obtained in the presence of ionic liquid catalyst, and by exposing them to hydrochlorination reactions, their chlorinated derivatives were synthesized, and then complexes with amidoamines of natural petroleum acid were obtained on their basis. The synthesized complexes were tested as inhibitors and it was found that chloride-containing amidoamine complexes of natural petroleum acids can be offered as inhibitors with high protective effect in acidic environment, as well as in biocorrosion.

Corrosion, which has been an urgent problem in recent years, has always been in the spotlight in a number of industries, especially in the transportation sector of the oil refining industry. The effectiveness of the ways to prevent the corrosion process is the selection of inhibitors and their multifunctionality. In the present study, this problem has been addressed, and the multifuntionality of the complexes synthesized; that is the ability for the same complex to show a high protective effect in $CO_2$, $H_2S$ environments and as well as in biocorrosion, has been demonstrated. It should be noted that the allyl esters of carbonic acids (malein, benzoic, phthalic, α-naphthylic vinegar) synthesized in the study were synthesized in the presence of ionic liquid catalyst N - methylpyrrolidone hydrosulfate for the first time, and after their hydrochlorination reaction was over, their complexes with natural petroleum acid (NPA) amidoamines, synthesized according to known methods [1], were obtained and tested as an inhibitor. The synthesized allyl esters were hydrochlorinated and their structures were confirmed by IR and NMR analyzes.

| The formula of the compound | Boiling point, °C | Output, weight % | $\rho_4^{20}$, g/sm$^3$ | $n_d^{20}$ |
|---|---|---|---|---|
| $C_6H_5COOCH_2CH{=}CH_2$ | 188-190/12 mm Hg | 80 | - | - |
| $C_{10}H_7CH_2COOCH_2CH{=}CH_2$ | 210-215/ 5 mm Hg | 80-82 | 1,0654 | 1,5290 |
| $CH{=}CH(COOCH_2CH{=}CH_2)_2$ | 175-180/5 mm Hg | 80-85 | 1,0798 | 1,4678 |
| $(CH_2)_4(COOCH_2CH{=}CH_2)_2$ | 175-178/10 mm Hg | 92,3 | 1,0190 | 1,4523 |
| $C_6H_4(COOCH_2CH{=}CH_2)_2$ | 280-285/5 mm Hg | 75-80 | 1,1414 | 1,5230 |
| $C_6H_5COOCH_2CH_2CH_2CI$ | 180-187/10 mm Hg | 50 | 1,1628 | 1,5220 |
| $C_6H_4(COOCH_2CH_2CH_2CI)_2$ | 294-305/4 mm Hg | 55 | 1,2659 | 1.5060 |
| $CH{=}CH(COOCH_2CH_2CH_2CI)_2$ | 180-190/4 mm Hg | 60,0 | 1,2350 | 1,4912 |
| $(CH_2)_4(COOCH_2CH_2CH_2CI)_2$ | 190-198/8 mm Hg | 58,0 | 1,2240 | 1,4715 |
| $C_{10}H_7CH_2COOCH_2CH_2CH_2CI$ | 200-210/5 mm Hg | 56 | 1,2128 | 1,5850 |

It has been determined that chloride-containing amidoamine complexes of natural petroleum acid have a 96-98% protective effect in $CO_2$, $H_2S$ environments and in biocorrosion it has 100% bactericidal properties.

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OC-04

# IMPROVING THE QUALITY OF ENGINE FUELS

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The level of development of motor fuels in modern times requires a new range and quality for them. This problem has become very relevant recently.

It should be noted that the octane number of gasoline produced only from Azerbaijani and Central Asian oils, although relatively high, does not exceed 65. Even for distillates of these oil is characterized by a sharp decrease in octane number with increasing temperature. It was preferable to use a gasoline fraction between -95oC, because it does not contain n-pentane. in turn it is divided into lower boiling fractions.

As we know, gasoline contains ketones, alcohol, ether, etc. The addition of such multifunctional components (oxygenates) improves the environmental and operational performance of motor fuels. On the other hand, oxygenates have a high antidetonination ability. [1,2].

Although the production of high-octane motor fuels is technologically promising, the development of this method, as well as the construction of a new technological device, requires a lot of money. This is often not profitable. The addition of (obvious) additives as a component of gasoline has been growing rapidly in recent years.

Carbitol compound (CB) was applied as an additional component in the present study. Carbitols are usually monoalkyl esters of diethylene glycol and consist of the formula R (OCH2CH2) 2OH, where they are R-alkyl radicals. has the same chemical properties.

In the study, the gasoline fraction was divided into two groups: low-boiling (g.b.-95oC) and high-boiling (95oC-190oC). Concentration of KB added to the gasoline fraction (mass%) 0; 0.5; 1.0; 2.5; 4.0; Was 6.0. According to these figures, the values of the octane number of the gasoline fraction obtained are 82.5; 84.9; 89.8; 93.1; Was 96.0.

The distribution coefficient of detonation resistance was also studied. When the density of KB added to the gasoline fraction was 2.5%, the distribution coefficient of detonation resistance was 0.88 for the low-boiling fraction, while the value of this coefficient was 0.87 for the high-boiling fraction. As you can see, the difference is negligible.

Thus, the carbitol compound added to gasoline as oxygenate in the study selectively maintains the antidetonization properties relatively narrowly in the narrow gasoline fraction (g.b.-95oC) and increases the octane number in the directly expelled gasoline fraction.

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OC-05

# IODINATED MULTI-WALLED CARBON NANOTUBES AND THEIR ANTIOXIDANT PROFILE

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Stabilization of the original properties of polymers against thermo-oxidative onrush is usually doing by means of an addition of low-molecular substances- primary and secondary antioxidants, thermo-stabilizers, anti-ozonants, deactivators of metals, multifunctional stabilizers and others, is vital problem which does not need to have additional explanation.

Among these existing approaches, nanomaterials represent one of the most promising frontiers in the research for improved antioxidants. Some nanomaterials exhibit intrinsic redox activity that is often associated with radical trapping and/or with superoxide activities.

This paper presents results of a study of iodine doped multiwalled carbon nanotubes (MWCNTs) to ability to reveal anti-oxidative activity.

Iodine grafted multi-walled carbon nanotubes (I-MWCNTs) were sybthesized and tested with respect to their capacity to retard the aerobic oxidation of hydrocarbons. The model cumene initiated (2,2'-azobisisobutyronitril) oxidation was employed to estimate the oxidation rates. This approach was based on the known intrinsic anti-oxidtive ability of MWCNTs which should be synergetically combine with capability of covalently anchored iodine groups to quench free alkyl radicals.  The kinetic experiments have shown that the presumption was substantive and expected effect has been achieved. The iodination allows to shift the electron density along with surface of the nanotubes urging intensive scavenging free radicals and thereby provokes the heightened anti-oxidative activity of I-MWCNTs. The iodinated MWCNTs demonstrate feasibility to be used as an effective constituent part of a stabilizer's package for polymers since even tiny iodine covalently linked groups afford strong additional anti-oxidative effect. Many points in this field are so far open but one is undoubted - the results create a definite ground for further fruitful investigations and discussions.

The remains of transitions metallic catalyst which are usually present in channels of as-CVD-prepared MWCNTs samples are a sturdy barrier to uncover the inherent anti-oxidative activity of the nanotubes. The problem can be solved by stepwise processing of the nanotubes by reagents which can be rapidly react with carbides and metallic residues. By such a manner an initial metallic inclusions content can be maximally decreased.

The iodinated samples of MWCNTs have been obtained and characterized by SEM Fourier transform–IR and  EDX-ray spectroscopy.

The heightened ant-oxidative capacity of I-MWCNTs has been concisely and convincingly shown by the kinetic experiments. The effect was affected with both the intrinsic electron affinity of the MW nanotubes configuration and grafted iodine groups.

The iodinated MWCNTs "work" even in negligible concentrations that therefore may be considered as an effective constituent part of a stabilizer's package for polymers. At that, the objects are also able to bear functions of compatibilizers and fillers. Anyway it gives substantial impetus and basis for the further elaborations.

**OC-06**

# METAFORMING IS A HIGH-EFFICIENT TECHNOLOGY FOR PRODUCING HIGH-OCTANE GASOLINES

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In modern oil refining, naphtha is used for the production of gasoline base, which is usually subjected to deep hydrotreating to remove harmful compounds, and is divided into two streams (light and heavy), each of which is sent for separate processing (reforming and isomerization complexes). After these complex catalytic processes, excess benzene is isolated from the resulting reforming gasoline and, as a result of compounding with isomerate gasoline and other additives, commercial high-octane motor gasoline is obtained.

The use of a one-stage process could replace all of the above disadvantages and would significantly reduce the cost of gasoline production.

This problem is designed to solve the technology "Metaforming", which, in contrast to reforming and "Zeoforming", allows you to bring the yield of commercial high-octane gasoline to 92-95% based on the initial hydrocarbon fraction taken. The “Metaforming” technology does not use hydrogen and expensive catalysts containing noble metals, the production of commercial gasoline, bypasses the compounding stage, and gas formation was minimized.

We have carried out work, the essence of which is that because of the interaction of low-octane gasolines with methanol in the presence of an aluminosilicate catalyst, the octane number of gasoline increases. At the same time, the yield of high-octane gasoline reaches 92-95% based on the feedstock - straight-run gasoline.

A low-octane gasoline fraction (octane number 57, ρ_ (4) ^ 20 = 0.711) from the primary distillation of oil was used as a raw material.

The process was carried out in the presence of an aluminosilicate catalyst at a space velocity of 1-2 h-1, a temperature of 360-3800 C, and a pressure of 7-8 atm.

It was found out that during the process the reactions of aromatization of aliphatic hydrocarbons, alkylation of benzene, cleavage of methanol, aromatization and esterification, as well as reactions of isomerization, cyclization and oligomerization occur.

The reactions of isomerization, oligomerization, cyclization, esterification in this process are exothermic and proceed with the release of heat, which leads to a decrease in energy costs.

The main products in the proposed process are as follows (%): high-octane gasoline (77-80), liquefied gas (8-10), fuel gas (1-2), water (9-10).

The superiority of the proposed technology lies in the fact that the process is carried out at low pressure and temperature, there are no precious metals in the composition of the catalyst used and additional desulfurization of the raw material is not required.

The proposed process allows us to increase the octane number of low-octane primary gasoline by 26-27 points.

Another advantage of this production is that as a result of benzene alkylation with methanol, the amount of benzene in gasoline is significantly reduced.

OC-07

# INFLUENCE OF TEMPERATURE ON FRACTIONAL COMPOSITION OF PRODUCTS OXYCRACKING VACUUM GASOIL

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Of undoubted scientific and practical interest is the study of the influence of technological parameters, in particular, the temperature of oxidative catalytic cracking (oxycracking) of vacuum gas oil [1,2] on the performance of the products obtained.

So, to evaluate the qualitative composition of liquid products of the conversion of vacuum gas oil as complex mixtures under oxycracking conditions, we used their fractional composition, i.e. temperature limits of boil-off of individual fractions. The data obtained served as the basis for constructing the curves and establishing the potential content of individual fractions in the catalyst. The obtained curves of the fractional composition (Fig. 1) made it possible to reveal the potentials of the four fractions in accordance with their industrial temperature ranges of the beginning and end of boiling: I fraction - from C5 to 195 (200) ° C, II fraction - from 195 (200) to 300 ° C, III fraction - from 300 to 420 ° C and IV fraction - above 420 ° C (Fig.).

Data on the effect of temperature can be illustrated as follows (Fig. 1 a): the sequence of fractions relative to the content of fractions I, II and III (50-195 (200) ° C, 195 (200) -300 ° C and 300-420 ° C, respectively ) is identical: 500 ° C> 550 ° C> 450 ° C. The presence of a fraction> 420 ° C in the studied temperature range for oxycracking was not detected. Attention should be paid to this fact, since in the products of traditional catalytic cracking, the fraction> 420 ° C accounts for at least 3% of the mass. Also, among the characteristic features of the influence of the temperature regime, it is necessary to note the difference in the temperatures of the beginning and end of the boiling of liquid catalyzate. The lowest temperature of the beginning and end of boiling is characteristic for the products obtained at 500 ° C and is 61 and 370 ° C, respectively. The highest rates were observed for products of 450 ° C temperature regime (100 and 420 ° C, respectively). Judging by these differences, the fractions obtained under different technological conditions of the oxycracking process have a significantly different hydrocarbon composition.

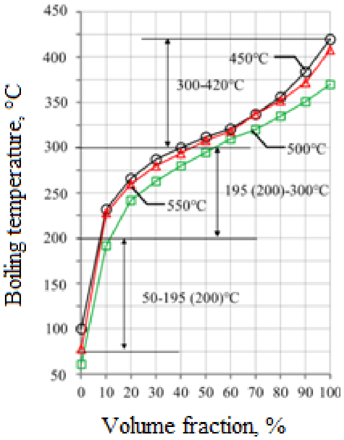

**Figure:** Dependence of the fractional composition of liquid catalyzate on temperature. (Process conditions: duration 900 sec, degree approx. - 1%, contact time - 1.7 sec.)

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**OC-08**

# PHASE EQUILIBRIA IN THE SnTe-$Sb_2Te_3$-Te SYSTEM, CRYSTALLINE STRUCTURE AND THERMODYNAMIC PROPERTIES OF INTERMEDIATE PHASES

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Ternary tetradymite-like compounds $A^{IV}B^{V}_2Te_4$, $A^{IV}B^{V}_4Te_7$, $A^{IV}B^{V}_6Te_{10}$, etc., formed in the systems $A^{IV}$Te-$B^{V}_2Te_3$ ($A^{IV}$-Ge, Sn, Pb; $B^{V}$-Sb, Bi), are thermoelectric materials with low thermal conductivity [1]. In addition, relatively recent studies have shown that these compounds are three-dimensional topological insulators and are extremely promising for various applications ranging from spintronics and quantum calculations to medicine and security systems [2].

One of the ways to obtain new multicomponent phases and materials is to study phase equilibria in the corresponding systems.

This paper presents the results of studying the phase equilibria and thermodynamic properties of the SnTe-$Sb_2Te_3$-Te system by DTA (NETZSCH 404 F1 Pegasus differential scanning calorimeter), XRF (Bruker D8 diffractometer, CuKα radiation) and SEM (Tescan Vega 3 SBH), as well as measurement of electromotive forces (EMF) of concentration relative to SnTe circuits.

The alloys of the system were prepared by fusing the previously synthesized and identified binary compounds and elemental tellurium in evacuated (~ $10^{-2}$ Pa) quartz ampoules, followed by homogenizing annealing at 650 $^{0}$K for 1000 h.

Based on the obtained experimental data, a new, refined T-x diagram of the SnTe-$Sb_2Te_3$ quasi-binary section was constructed. It was found that it is characterized by the formation of ternary compounds $SnSb_2Te_4$ and $SnSb_4Te_7$, melting with decomposition by peritectic reactions at 868 and 865 $^{0}$K, respectively. The system also contains wide ranges of solid solutions based on SnTe (~ 10 mol%) and $Sb_2Te_3$ (~ 20 mol%).

A diagram of solid-phase equilibria at 650 K and a projection of the liquidus surface of the SnTe-$Sb_2Te_3$-Te system are also plotted. It was found that the liquidus surface consists of 5 fields corresponding to the primary crystallization of elemental tellurium, solid solutions based on SnTe and $Sb_2Te_3$, and ternary compounds $SnSb_2Te_4$ and $SnSb_4Te_7$. The parameters of the tetradymite-like crystal lattices of the $SnSb_2Te_4$ and $SnSb_4Te_7$ compounds were determined by the indication of the powder X-ray diffraction patterns, and the partial and integral thermodynamic functions of the revealed ternary compounds were calculated from the EMF measurements.

The obtained compounds and phases of variable composition are of great interest as potential topological insulators.

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**OC-09**

# X-RAY ANALYSIS OF Mg-Zn-O CATALYSTS

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Early we have shown that the activity of the binary magnesium-zinc oxide catalysts depends on their composition. Therefore, this work concerns is devoted to the study of the phase composition of binary magnesium-zinc oxide catalysts.

Binary magnesium-zinc oxide catalysts of different compositions were prepared by co-precipitation method from aqueous solution of nickel magnesium nitrate and zinc nitrate. Thus 9 samples of catalytic systems Mg-Zn-O were prepared in various ratios of components satisfying the following conditions:

mMg/nZn, wherein m,n=1÷9, m+n=10.

X-ray study of the phase composition of the prepared catalysts was carried out on an automated powder diffractometer «D2 Phaser» of the «Bruker» company (CuKα radiation, Ni filter, $3\leq 2\theta \geq 80°$). In the figure 1 have shown the diffractograms of results of X-ray studies of Mg-Ni-O catalysts.

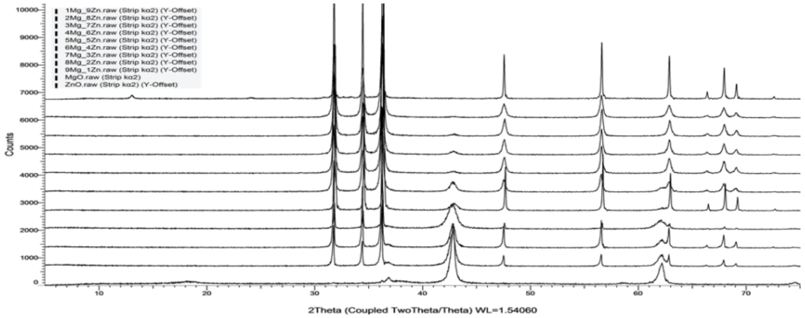

**Figure 1.** Diffractograms of all samples of Mg-Zn-O catalytic system

Based on the X-ray studies, it was found that in the Mg-Zn-O catalyst system, the formation of two phases is observed, namely magnesium oxide and zinc oxide. The peak ratio of these compounds, as can be seen from the diffraction patterns, varies according to the composition of the binary catalysts. We also found that the formation of chemical compounds between magnesium and zinc oxides is not observed.

We also calculated the crystallinity of all samples using the DIFFRAC.EVA program. Obtained results presented on the table 1.

Table 1. The degree of crystallinity of binary magnesium-zinc oxide catalysts of different composition.

| Atomic ratio of magnesium to zinc | 1-9 | 2-8 | 3-7 | 4-6 | 5-5 | 6-4 | 7-3 | 8-2 | 9-1 |
|---|---|---|---|---|---|---|---|---|---|
| The degree of crystallinity, % | 84.4 | 85.1 | 84 | 84.8 | 84 | 87.3 | 71.3 | 85.6 | 83.7 |

As can be seen from table 1, the degree of crystallinity of the Mg-Zn-O catalytic system practically does not depend on the catalyst composition.

**OC-10**

# COMPOSITES ON THE BASIS OF MODIFIED PHENOL-FORMALDEHYDE OLIGOMERS

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Since phenol-formaldehyde oligomers (FFU) have easy-to-take technology and high reaction ability, they are intended to be used in the preparation of various purpose composites (both of the rezol type and novolac type) for coordination, corrosion inhibitor, modifier in the rubber industry, in the purchase of sulfocationites and so on. However, many of the shortcomings of phenol-formaldehyde oligomer, including low adhesion capacity and heat resistance, fragility, the presence of a large amount of free phenol and formaldehyde (13 - 15% and 6-8%, respectively) in the composition of the finished oligomer on the basis of the front, were undesirable both ecologically and economically. To obtain the relatively ecologically clean, high physico-chemical and physico-mechanical properties of FFO, it was first modified by the method of copolycondesization with compounds containing amino and amide groups (14 names), unsaturated aliphatic epoxy groups (6 names), acetylene series epoxy group (4 names), propalgyl esters (3 names) and allyl esters (3 names). The main indicators of so-oligomers synthesized for the first time were determined by modern research methods. In parallel, the unmodified FFO was analyzed for comparison. It turned out that the modification is a chemical modification, and the reaction takes place with the participation of functional groups, as a result of which these side effects were repeatedly improved depending on the nature and composition of the modifier used. The process was also optimized using the multi-factor experience planning method when studying the process of obtaining and hardening a modified FFO. The kinetics of a reaction is studied modifications of the FFO method of copolycondensation. It is found that the induction time in copolycondensation reactions involving modifiers decreases with increasing component density and temperature. As a result, the copolycondensation reaction is referred to the first composition by the consistency of the components and the catalyst.

The process of thermal destruction of the modified FFO has also been studied. It turned out that this process is complicated, carries a tiered character, and the process of destruction goes in three stages. In the confirmed optimal variant (during synthesis) of the sopolycondesation process, the reaction mass (0.3 g.) the main indicators of nanoparticle sooligomer were studied. It was found that nanoparticles, which were added a small amount to the reaction mass during synthesis, caused the rise of the main indicators of the sooligomer. From the DT and TQ analysis it was found that the process of destruction in FFO began at 180 - 200 ºC, in MFFO at 220-230 ºC, in nanoparticles MFFO after 390 ºC and mass loss at 405 ºC is 12.57 %. The presence of functional groups such as amine, amide, hydroxyl, carboxyl, methylol, epoxide, etc. in the modified FFO gave the basis that they should be used as a binding agent in the preparation of different purpose composites. Thus, for the first time on the basis of FFO oligomers modified with 30 modifiers, adhesive compositions, ion exchangers, in the rubber industry for the first time in our republic (imported from abroad and expensive), replacement of RU-1 modifier, in the purchase of friction-resistant compositions, in the protection of equipment used in various aggressive environments from corrosion, as well as in the prevention in the preparation, etc. used, reflected in the relevant documents (15 acts, 30 author's certificates and patent). Currently, research work is underway on the application of nanoparticles so-oligomers.

**OC-11**

# COMPOSITE FILLED WITH OAK AND PINE CONE POWDER

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Recently, there has been increased interest for the natural particle reinforced polymer composites which have great offerings to different type of application areas such as packaging, construction, furniture, electronics and automotive industries. To make stronger the polymer matrices, the utilization of natural fillers instead of traditional reinforcement materials provides benefits such as easy processing, lower cost and lesser environmental pollution [1]. Increasing for the availability of new generation bio-based composite structures leads to the decrease of petroleum based toxic products usage. Coconut fiber, kenaf fiber, almond shell, nut shell, peanut shell and walnut shell were combined with thermoset or thermoplastic matrixes for comprising composites. In the present study, two different filler were applied in order to get an environmentally friendly coating.

The components used in the preparation of the composition are biopolymer and modified phenol – formaldehyde oligomer. Having high physical, mechanical, and exploitation indices and being technologically easily obtained phenol - formaldehyde oligomer is widely applied in various industries [2]. However, being fragile, containing more amount of ecologically poisonous free phenol and free formaldehyde having relatively low level of heat resistance and stickiness, to some extent inhibits the use of phenol - formaldehyde oligomer in some areas. In order to eliminate these disadvantages, phenol formaldehyde oligomer has been modified with oxamide in the laboratory reactor and its main physical - mechanical properties have been studied [3]. By modifying PHFO its fragility was eliminated and the growth of heat resistance was achieved. Modified resol type phenol - formaldehyde oligomer used as a liaison. As a biopolymer oak and pine cone powder were applied as a filler.

Being one of the high molecular biopolymers oak and pine cone mainly consists of cellulose and lignin oak and pine cone taken as a filler leads to further improvement of physical - mechanical properties of the cover composition. Oak and pine cone powder have been studied by means of thermo gravimetric analysis (TGA) and IR spectroscopy.

Currently, the research is being carried out in this direction on the basis of biopolymers. The main purpose of the presented research is to study oak and pine cone composition as a biopolymer, its physical and mechanical properties and to use it as a filler in the preparation of the composition.

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**OC-12**

# SEPARATION OF NAPHTALINE FROM PYROLYZE LIQUIDS IN EP-300 EQUIPMENT

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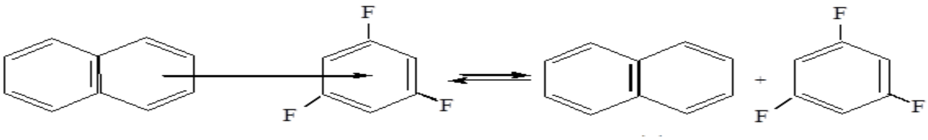
The Republic of Azerbaijan produces a large number of petrochemical products, organic compounds and polymers. Among these production areas is the Ethylene-Polyethylene Plant, which operates under the auspices of the Azerkimya Production Association under the State Oil Company of the Republic of Azerbaijan. The EP-300 plant at the plant undergoes a pyrolysis process, which produces a large amount of white pyrolysis resin, a liquid product of pyrolysis, such as a large cubic residue. The main component of the resulting resin are polycyclic aromatic hydrocarbons, [1] which are based on naphthalene.

The separation of multinucleated aromatic hydrocarbons from the wastes of petrochemical plants by 1,3,5-trifluorbenzene was developed for the first time and the reaction is carried out as follows:



The main advantage of using trifluorbenzene is that it can be easily separated from the system by forming weak clathrates with aromatic hydrocarbons and that trifluorbenzene does not need to be recycled. The main interesting and advantage of the work is that it is not necessary to use alkalis and other reagents to break down this type of clathrates. Along with naphthalene, for the first time, anthracene and phenanthrene were studied separately by clathrate formation. However, naphthalene has been of major interest in research.

For the purposeful use of naphthalene separated from the cubic residue [2], it is possible to synthesize □ -chloromethylnaphthalene in the presence of zinc chloride as a paraformaldehyde and catalyst using the Blan method, from which it is proposed to obtain 4 ammonium salts [3], which improve the rheological properties of heavy oils. . It is also possible to add 4 ammonium salts as an additive to surfactants used in firefighting.

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**OC-13**

# PHASE COMPOSITION AND MAGNETIC PROPERTIES OF PRODUCTS OF HYDROTHERMAL TREATMENT OF MN (Fe, Co) / Bi / La NITRATE MIXTURESS

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Complex oxides with a spinel structure based on transition metals have a set of properties that allow them to be used as electrodes, magnetic materials, and catalysts. The development of methods for the synthesis of these structures is still of great interest [1, 2].This work presents the results of studies of the phase composition and magnetic properties of products of hydrothermal treatment at a temperature of 200 ° C for 3 hours in an autoclave of a mixture of manganese (iron, cobalt), bismuth and lanthanum nitrates, taken in a ratio of 1: 2: 1 in a formic acid medium ... According to XRD data, the main products of this treatment are metallic Bi, lanthanum bicarbonate La (OH) CO3, cobalt carbonate and oxalate CoCO3, CoC2O4, oxides Mn3O4, Fe2O3, FeLaO3. All synthesized samples exhibit superpara / ferromagnetism. In fig. 1 shows X-ray diffraction patterns of solid samples after hydrothermal treatment at 200 ° C for 3 hours in an autoclave with a mixture of nitrates: a) Mn (NO3) 2 · 2H2O / Bi (NO3) 3 · 5H2O / La (NO3) 3 · 6H2O , b) Fe (NO3) 3 · 9H2O / Bi (NO3) 3 · 5H2O / La (NO3) 3 · 6H2O, c) Co (NO3) 3 · 6H2O / Bi (NO3) 3 · 5H2O / La (NO3) 3 · 6H2O, taken in a ratio of 1: 2: 1 in formic acid.

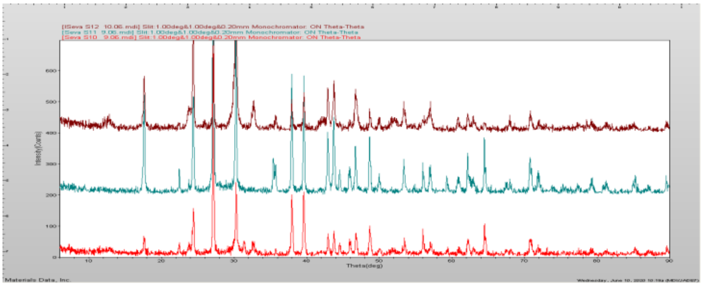

Figure: 1. X-ray diffraction patterns of solid samples after hydrothermal treatment at 2000C for 3 hours in an autoclave of a mixture of nitrates: a) Mn (NO3) 2 · 2H2O / Bi (NO3) 3 · 5H2O / La (NO3) 3 · 6H2O, b ) Fe (NO3) 3 · 9H2O / Bi (NO3) 3 · 5H2O / La (NO3) 3 · 6H2O, c) Co (NO3) 3 · 6H2O / Bi (NO3) 3 · 5H2O / La (NO3) 3 · 6H2O , taken in a ratio of 1: 2: 1 in formic acid medium.

The work was carried out with the financial support of the SOCAR Science Foundation (contract No. 09 LR-AMEA).

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**OC-14**

# COMPARATIVE STUDY OF SORPTION OF SILVER(I) IONS ONTO SYNTHETIC CHELATING ADSORBENTS FROM AQUEOUS SOLUTIONS

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The pollution of environment has been causing worldwide concern. Heavy metal ions are among the environmental pollutants and even at low doses have negative effects on humans.

Silver is one of the heavy metal ions. Silver compounds can released into environment from different sources and cause a big detrimental to human’s life. Thus, the application of different treatment methods for Ag(I) removal from objects of environment is actual. The most effective method for the removal of silver(I) ions from aqueous solutions is sorption.[1-3]

This work is dedicated to the comparative study of sorption of trace amounts of silver(I) using synthetic chelating polymeric adsorbents modified with o-phenylenediamine, m-aminophenol and 1,2,3 triphenylguanidine from aqueous solutions. The synthesis of sorbents was carried out by a known method. [4] For the synthesis of the sorbent formalin was used as a crosslinking agent. The equilibrium concentrations of silver (I) ions in the liquid phase were measured using the well-known reagent 2,2'-di (2,3,4-trihydroxyphenylazo) biphenyl.

The effect of various sorption parameters such as pH, initial metal concentration, contact time and ionic strength on removal of silver(I) ions were investigated. Sorption experiments were carried out using batch systems at room temperature. The optimum pH for removal of silver(I) ions when using synthetic chelating polymeric adsorbents modified with m-aminophenol and 1,2,3 triphenylguanidine is pH = 6. Optimal ionic strength achieved at a value of $\mu$=1,0 when using synthetic chelating polymeric adsorbents modified with o-phenylenediamine and 1,2,3 triphenylguanidine and of $\mu$ =0,6 when using synthetic chelating polymeric adsorbent modified with m-aminophenol. The sorption capacity of the sorbents and the percentage recovery were determined from the difference in the initial and final concentrations of silver(I) in the aqueous solution.

At the final stage the desorption process was carried out. Desorption process allows to find out the possibility of the regeneration and reuse of the exhausted adsorbents. This process was carried out using different organic ($CH_3COOH$) and mineral acids ($HNO_3$, $H_2SO_4$) with same (0,5; 1,0; 1,5; 2,0 M) concentrations. The best elution properties toward silver(I) ions when using synthetic chelating polymeric adsorbents modified with o-phenylenediamine and 1,2,3 triphenylguanidine possessed the 0,5 M $HNO_3$ and for adsorbent modified with m-aminophenol 1 M $HNO_3$.

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**OC-15**

# SPECTROSCOPIC INVESTIQATION COMPLEX FORMATION OF Cr(VI) AND Co(II) USING O-HYDROXYTHIOPHENOLS AND HYDROFOB AMINS

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In this work, we studied complexation in a liquid-liquid extraction system containing Cr (VI) and Co (II), o-hydroxythiophenols (HTP) [2-hydroxy-5-chlorothiophenol (HCTP), 2-hydroxy-5-bromothiophenol (HBTP) and 2-hydroxy-5-iodothiophenol (HITP)] and hydrophobic amines (Am) {*o*-, *m*-, *p*-tolidine}.

To find out the oxidation state of chromium in mixed ligand complexes (MLC), we conducted two series of experiments. In the first series, we used Cr (VI), and in the second series we used Cr (III), obtainned by adding an additional reducing agent ($SnCl_2$ or KI). It was found that the spectrophotometric characteristics ($\lambda_{max}$Cr(VI)- HTP = $\lambda_{max}$ Cr (III)-HTP) MLC Cr (VI) and Cr (III) were identical, i.e. upon interaction with HTP, Cr (VI) was reduced to Cr (III).

MLC of Cr (III) and Co (II) was studied using spectrophotometry. After a single extraction with chloroform, 97.4-98.8% of Cr (III) and Co (II) was extracted as an MLC. For the formation and extraction of complexes of Cr(III) and Co(II), pH 3.0-5.4 and 3.3-6.8 respectively, are optimal. The optimal condition for the formation and extraction of these complexes is the concentration of $(1.3\text{-}1.5)\times10^{-3}$ M HTP and $(1.2\text{-}1.5)\times10^{-3}$ M Am. The $Cr^{3+}$ and $Co^{2+}$ extracts obey Beer's law at concentrations of 0.5-24 and 0.2-22 μg/ml, respectively.The maximum optical density of the complexes of Cr(III) and Co(II) is achieved within 12 and 10 minutes, respectively. The absorption maxima of the ternary complexes Cr (III) lie in the range 437-440 nm (in the case of Co(II) 545-560 nm). Molar absorption coefficients for Cr (III) complexes $(3.1\text{-}3.94)\times10^{4}$ (in the case of Co (II) $(3.43\text{-}4.14)\times10^{4}$). The molar relationships between the components of the ternary complex were found by several methods: the relative yield method, the linear method, and the equilibrium displacement method (Cr:HTP:Am=1:3:3 and Co:HTP:Am=1:2:1). It has been established that the complexing form of chromium (III) and cobalt (II) is $Cr^{3+}$ and $Co^{2+}$, respectively. Calculations showed that MLC in the organic phase does not polymerize and is in monomeric form ($\gamma$ = 1.01-1.05). It was found that a large number of alkaline, alkaline earth elements and rare earth elements do not affect the determination of Cr (VI) and Cr (III).

Under already established optimal conditions, the proposed method was used to determine Cr (III) and Co in oil ($X-= (2.32\pm0.30)\times10^{-6}$ % Cr and $X-= (5.73\pm0.29)\times10^{-5}$ % Co) and oil products ($X-= (1.73\pm0.27)\times10^{-6}$ % Cr and $X-= (2.89\pm0.35)\times10^{-5}$ % Co). The results obtained are in good agreement with certified values and are comparable with the results obtained by known methods. This method is environmentally friendly, since the extraction is carried out in a medium with pH and has good potential for use in determining Cr (III) and Co after extraction in the organic phase at the microgram level.

**OC-16**

# EFFECT OF TEMPERATURE ON HYDROCRACKING OF VACUUM GAS

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In recent years, there has been a rapid increase in diesel engines due to economic and environmental challenges. Due to the transition to diesel fuel in many countries, the country's economy needs to meet the demand for diesel. Hydrocracking is the most effective of the secondary refining processes to obtain diesel fraction from heavy crude oil. Hydrocracking is considered not only as an additional source for the production of diesel fraction, but also as one of the most effective methods for the hydro-enrichment of catalytic cracking raw materials. The main factor in the successful implementation of hydrocracking of various raw materials in the industry is the correct choice of catalysts. These catalysts, in addition to their high hydro-desulfurization activity, must have high hydrogenation and degradability at low temperatures to fully hydrogenate unsaturated, diene and partially polycyclic aromatic hydrocarbons. These hydrocarbons not only reduce the thermal stability of fuels, but also lead to the rapid coking of both catalysts and technical equipment during subsequent processing. These catalysts, which have been proven in practice, have been gradually replaced by more efficient and inexpensive alumina-molybdenum catalysts. The latter has high disintegration, hydrogenation and deoxidation properties when used for heavy raw materials, high selectivity and low susceptibility to coking when used in medium distillates [1-2]. Many attempts have been made to optimize the amount of active ingredients and improve the quality properties by modifying these types of catalysts. The aim of the thesis is to obtain high-quality raw materials for environmentally friendly diesel fuel and catalytic cracking process by hydrocracking of vacuum gas oil from Baku oils in the laboratory with the participation of a modified Ni, Mo-containing aluminosilicate catalyst. The hydrocracking of the vacuum gas oil was carried out in a flow-type Hungarian unit with a pressure of 3-8 MPa, a temperature range of 400-460 $^{o}$C and a reactor volume of 200 ml. The hydrogenate obtained from the process was expelled in an atmospheric-vacuum unit and separated into gasoline (g.b.-200 $^{o}$C), diesel fraction (200-360 $^{o}$C) and residue > 360 $^{o}$C Each fraction was studied separately.The effect of regime parameters on the process of hydrocracking of vacuum gas oil was studied. When studying the effect of temperature on the hydrocracking process, it was found that when the temperature is increased from 400 to 460 $^{o}$C,the yield of the diesel fraction increases from 35 to 50% by weight. The yield of the gasoline fraction is 0-6% by weight, the yield of the residual fraction is reduced from 65% to 45%.As the temperature increases from 400 $^{o}$C to 460 $^{o}$C, the amount of sulfur in the diesel fraction decreases from 0.01% to 0.005%, and the iodine content decreases from 9 to 5 g J2 / 100 g.Thus, it is possible to obtain high-quality diesel fraction from hydrocracking of vacuum gas oil from Baku oil mixture.

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OC-17

# SOLID HOUSEHOLD WASTE MANAGEMENT IN AZERBAIJAN

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For a long time in the world, household waste is not just treated as waste. Thus, developing countries are currently looking for the best option in the field of household waste management - their collection, sorting, transportation, disposal and disposal. Azerbaijan is already among these countries. Undoubtedly, the fact that the composition of wastes varies, such as paper, plastic and polymer materials, ferrous and non-ferrous metals, as well as rare elements of electronic devices, and sometimes environmentally hazardous, requires a different approach to the problem. Waste generated in the pulp and paper, chemical, petrochemical, mining and metallurgical industries has toxicological effects on the environment and human health, and waste management is becoming a major policy of states to reduce its impact [1].

Waste management must be integrated. World experience also shows that successful results can be achieved only by a comprehensive approach to waste management. This process includes landfills, recycling, incineration of wastes and other methods. Incineration of wastes in factories and thus the production of alternative energy is one of the most widely used methods of neutralization in the modern world [1,2].

Currently, the most advanced countries in Europe and Asia prefer the method of incineration in the process of household waste management. For example, Denmark and Sweden have been leaders in waste energy generation for more than a century. European countries such as Luxembourg, the Netherlands, Germany and France are giving more space to incineration in the field of household waste management. Waste incineration is particularly widely used in Japan. In total, about 600 waste incinerators around the world burn more than 130 million tons of waste per year, of which 100 PC (petacoul) of electricity is produced annually. This is equivalent to the electricity needs of about 10 million European consumers. As for the Waste Incineration Plant built in Balakhani settlement.

The plant, which is being built under a contract with the company, has the capacity to dispose of 500,000 tons of solid waste and 10,000 tons of medical waste per year. As a result of the plant's operation, the total mass of waste will be reduced by 3 times and the volume by 10 times. In terms of production capacity, the plant is the largest of its kind in Eastern Europe and the Post Sovet Union Countries. Built using fourth-generation (4G) technology, this state-of-the-art plant fully meets the EU's most stringent environmental standards.

Industrial processing of solid waste focuses on the incineration of waste to generate heat and electricity, as heating technologies also provide effective neutralization of toxic and contaminated components in solid waste. Reducing the amount of waste sent for incineration as a result of pre-sorting requires expensive heating and gas treatment plants and reduces capital costs by 25% compared to the incineration of original solid waste. In addition, the extraction of environmentally hazardous components by sorting reduces the content of harmful substances in gas emissions, simplifies gas purification, reduces the cost of gas treatment plants and reduces the negative environmental impact of the burner. Pre-sorting, 20-25% profit from sales of commercial products allows you to get [2,3].

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**OC-18**

# MODELING AND OPTIMIZATION OF $CO_2$ SEPARATION PROCESS FROM GAS MIXTURES

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At present, the application of methods of mathematical modeling of the adsorption process of gas mixtures during scientific research has led to an increase in the amount of data, reliability, as well as the intensification of these technological processes. This allows you to predict the parameters of the process in a timely manner. In particular, it reveals the need for adsorption of gas mixtures to separate them from undesirable components. The gas industry, whose operation affects air pollution, includes gas production, gas processing and gas transmission facilities. The analysis of the technology of purification of gas mixtures from undesirable components of these enterprises was carried out [1]. The technology of purification of gases from various gas mixtures is carried out in accordance with the mass exchange. It is known that the content of hydrogen sulphide in gas mixtures is 7%, $CO_2$ 4-11%, nitrogen 14-31%. Information on various sources and the amount of pollutants released into the environment ($H_2S$, $CO_2$, $N_2$, etc.) as they enter the environment is needed to assess the state of biosphere pollution and to determine the most effective measures to reduce air pollution. The adsorption method allows complete removal of undesirable components from the gas mixture. All this has led to the widespread use of adsorption processes in the modern oil refining, chemical and gas industries. Mathematical modelling of industrial adsorbers in a stationary adsorbent layer is based on a mathematical description of heat and mass transfer in individual adsorbent grains [2]. Based on the above, the relevance of the separation of undesirable components ($H_2S$, $CO_2$, $N_2$, etc.) from gas mixtures by adsorption is increasing. In the research work, the adsorption processes of dry gas were studied under the following conditions: at a temperature of 20-40$^0$C and high pressures. The work is devoted to the adsorption of $CO_2$ from gas mixtures on NaX-type adsorbents. The amount of $CO_2$ adsorption in the dry gas mixture was determined gravimetrically using Rubotherm devices. In this case, the adsorption temperature is also determined. These parameters have also been studied in various adsorbents. The maximum adsorption capacity for $CO_2$ occurred when a NaX adsorbent was used. Adsorption has also been studied on activated carbon and zeolite 5A. Their adsorption isotherms have also been studied. The adsorption isotherm was found to correspond to the type of Langmuir isotherm. When studying the adsorption dynamics of a multi-component gas mixture, the output adsorption curves were also obtained. In particular, various methods for cleaning natural and industrial gases have been analyzed. Separation of natural gas at low temperatures, mechanical cooling, absorption method and adsorption methods were studied. It was found that the adsorption method is the most cost-effective and environmentally friendly method. Recent results show that the use of adsorption methods remains relevant today.

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**OC-19**

# RESEARCH OF PROCESSING TECHNOLOGY OF DRY GAS OBTAINED IN THE PROCESS OF COKE PRODUCTION IN "EP-300" UNIT

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The integration of oil refining and petrochemical industries, the efficient use of by-products generated during the process, along with the target products, opens wide opportunities for scientific research to increase raw material resources, refining depth, economic efficiency of production (1). It is known that diene and olefin gases are released during thermocatalytic refining of oil. The diversity of the composition, whether small or large, limits the possibility of using these gases in any process, and therefore there is a need for scientific research for each individual case.In addition to coke at the coke production unit at the H.Aliyev Oil Refinery, the plant produces dry gas, stable liquefied gas "head", coking gasoline, light gas oil (household stove fuel component) and heavy gas oil (boiler fuel component) [2]. In the presented work, the possibilities of more efficient use of dry gas obtained during the process were investigated. Thus, the Coke plant produces 90,000 tons of dry gas per year. The obtained dry gas is used as fuel in the plant. The composition of the dry gas from the coke plant consists of the same chemical composition as the dry gas from the catalytic cracking plant and the pyrogas from the EP-300 plant. The chromatographic composition of the dry gas obtained during the processing process in the raw material combination is 27-29% ethane-ethylene, 19-21% propane-propylene fraction. It is important to separate the components of the gas, which are many times more valuable than the cost of fuel gas, using the potential reserves of the gas separation unit of the EP-300 unit. Dry gas contains up to 0.98-1.02% hydrogen sulfide. This creates conditions for environmental stress during combustion. In addition to economic efficiency, it is important to develop an efficient technology for the processing of dry gas from the coke plant in terms of environmental ecology. Based on technological research, it was determined that they are.

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**OC-20**

# DETERMINATION OF SULFATREDUCTION BACTERIA AND SOME OTHER MICROORGANISMS IN LAY WATER

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At present, the main volume of oil in our country is extracted by pumping oil fields by sea, river and sewage. In this case, damage to oil fields by sulfate-reducing bacteria and other microorganisms poses a significant risk. The formation of these microorganisms complicates the operation of fields, accelerates the corrosion of oilfield equipment, as well as leads to a decrease in the quality of oil and the difficulty of its refining. The most common way to solve the problems of oil production is the use of chemical methods for the preparation of process fluids, which is difficult at all stages, and is usually associated with the use of expensive reagents: bactericides, corrosion and salinity inhibitors. Bactericides, which kill bacteria, and bacteriostats, which slow down the growth of microorganisms over time, are commonly used for this purpose. Bactericides have found widespread application in the fight against microbiological corrosion, but their use has shown that there is no universal bactericide. Thus, in any case, during the application of the bactericide, it is necessary to thoroughly develop the protective effect of various reagents against bacteria, taking into account the specific living conditions of microorganisms. The purpose of the work is to conduct microbiological analysis of sulfate-reducing bacteria and other microorganisms in the produced waters and oil of the Absheron Peninsula, as well as to study the development of sulfate-reducing bacteria in oil culture waters. During the research, microbiological analysis of produced water and oil samples taken from the Balakhani and Bibi-Heybat fields was carried out, and the amount of some microorganisms in them was determined by inoculation in solid nutrient media (Cox method).APA (meat peptone agar) and SA (suslo-agar) solid nutrient media were used to determine the amount of bacteria. The growth of microorganisms takes place in a thermostat at a temperature of 30-32$^0$C. The number of bacterial cells is calculated after 1-3, and the number of fungal cells after 5-7 days. The McCrady method and the Postgate environment were used to calculate the amount of sulfate-reducing bacteria.The results of the research show that the amount of microorganisms (bacteria - $15 \cdot 10^4$, fungi - $29 \cdot 10^3$, sulfate-reducing bacteria - $14 \cdot 10^5$) in the produced water samples taken near the Bibi-Heybat field compared to the samples taken from the Balakhani area (bacteria - $13 \cdot 10^4$, fungi-$16 \cdot 10^2$, sulfate-reducing bacteria-$11 \cdot 10^2$). Apparently, this is due to the fact that the amount of oil in the produced water samples taken near the Bibi-Heybat field is less (6.5%), and in other samples the amount of oil is higher (9%). Oil creates unfavorable conditions for microorganisms, impedes their life and reduces their number. When determining the number of microorganisms in the oil, it was found that the number of microorganisms (bacteria - $19 \cdot 10^4$, fungi - $36 \cdot 10^5$, sulfate-reducing bacteria - $16 \cdot 10^6$) predominates in the oil sample taken from the Bibi-Heybat field. This can be explained by the fact that during oil extraction, the oil mixes with the formation water and thus becomes infected with microorganisms. This work was carried out with the financial support of the State Oil Company of the Republic of Azerbaijan (SOCAR) - Grant № 10LR-ANAS.

**OC-21**

# ADSORPTION TREATMENT OF INDUSTRIAL WASTEWATERPETROLEUM PRODUCTS

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At present, a major scientific and technical problem is the ecological protection of the natural environment from its pollution with industrial waste. The ingress of organic pollutants into water basins occurs when industrial wastewater is discharged from the implementation of technological processes of production and processing of products. A distinctive feature of wastewater discharged to city treatment facilities is that they are mostly freed from large inclusions of mineral origin and are largely contaminated with organic matter. Various methods are used to purify wastewater from oil products, among them a special place belongs to adsorption methods, which are mainly used for deep purification [1,2]. To create a sorbent that has the ability to absorb oil products, it is necessary to use a matrix that has natural properties to absorb oil products. Carbon materials are mainly used as adsorbents for the extraction of organic substances from aqueous solutions, since the energy of van der Waals interaction of molecules of organic substances with carbon atoms forming the surface of carbon bodies is much higher than the energy of interaction of these atoms with water molecules. In this work, it is proposed to use activated carbon of hazelnut peel for adsorptive treatment of wastewater contaminated with oil products. The research work was carried out on a continuous operation unit.Analysis of patent - literature data shows that in a number of cases, samples based on materials of carbon origin are used as sorbents. The work investigated the properties of the adsorbent, such as moisture, density, porosity. The absorbing properties of adsorbents were investigated and coal from the peel of hazelnuts was selected. Tables on the absorption capacity of various adsorbents are given. Were studies on the effect of temperature on the drying process of the adsorbent and the optimal temperature turned out to be $250^0$C. The oil capacity of the adsorbent was 650 mg / m3.The rate of adsorption is determined, which is proportional to the fraction of the free surface and the concentration of the adsorbent with

$$w_{adc} = k_{adc}(1-\theta)c$$

For adsorbent $w_{dec} = k_{dec}\theta$

From these two equations for the degree of surface filling, the Langmuir isotherm is obtained

$$\theta = \frac{kc}{1+kc}, \qquad k = \frac{k_{adc}}{k_{dec}}$$

On the basis of the above equations, the adsorption isotherms of petroleum products on activated carbon prepared from the peel of hazelnuts were obtained. In this case, the degree of desorption is 98.9% by weight. The optimal parameters of the process are: temperature $20^0$C, atmospheric pressure, amount of adsorbent 30 g.

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**OC-22**

# ABOUT THE EFFECTS OF ELECTRONIC WASTE ON HUMAN HEALTH AND ENVIRONMENT

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Nowadays the level of application of information and communication technologies (ICT), including computer and networking, electrical and electronic devices, is widely used in almost all areas. Electronic devices are converted into electronic waste after the expiration date.

Hazards of wastes and also electronic wastes (E-waste) on human health and the environment have included in the list of global threats as the depletion of the ozone layer, the greenhouse effect, desertification, etc in the UN's documents on sustainable development and environmental issues.

Operating for many years, ED loses its properties and becomes a serious threat to human health and the environment if it is not properly disposed of. The problem is particularly serious in countries where the central processing of E-waste does not generally have a management system. On the other hand, the management of high-risk E-waste as ordinary solid waste pollutes the atmosphere, soil and water in addition to the loss of many materials like precious and rare metals. Therefore, the establishment of an E-waste management system, which is an integral part of the waste management system, is a necessary and urgent issue for every country.

It is estimated to 20 tons of subsoil and topsoil assets per person are produced every year to meet the natural needs of humans, and for these 2000 kV/hour energies and 5000 liters water is used. In this production process, 80-90% of the primary raw material is discarded as waste and the final product becomes waste after losing its usefulness [2].

Therefore, according to one of the famous ecologists, the manufacturing of products is mainly waste production. In this production process, as a result of burning fuel for energy besides the loss of large water resources, 0.1 tons of toxic (harmful) substances (CO, $SO_2$, NO, $CH_4$, dioxins, etc.) which are dangerous for human health and the environment, are thrown.

However, to date, there are no concepts of "e-waste", "e-waste management" (EWM) in the national legislation of the Republic. For this reason, e-waste includes "waste", "waste management", oil and gas, processing, petrochemical, etc. in the above documents. industrial and solid household waste. However, they differ in terms of environment, toxicological and physiological effects, and the specific legal framework and economic governance mechanisms established on the basis of environmental law. At the same time, e-waste is sharply distinguished from industrial and solid household waste in terms of techniques and technologies for selective collection (separately as a type), recovery and recycling. On the other hand, E-waste is an irreplaceable (alternative) source of raw materials.

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**OC-23**

# WAYS TO PROTECT THE ATMOSPHERE FROM INDUSTRIAL POLLUTION

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Industrial wastes, regardless of their source and type, disturb the ecological balance, pollute the atmosphere, litter the environment, reduce the land fund, and increase the erosion of useful lands. Therefore, one of the main tasks ahead is to address the issues of efficient use of industrial waste, regular work by specialists in the field of waste-free or low-waste technology. To maintain the ecological balance, integrated use of natural resources, prevention of environmental pollution. restrictive mechanisms and the need to apply modern technology. Also, ways to minimize and eliminate damage to the environment by industrial enterprises should be developed. [1].

The main purpose of air protection is to reduce the impact of emissions on the human body and to apply appropriate methods for this purpose. In this case, the specifics of the mutual location of residential areas with industrial enterprises should be taken into account. In this case, serious attention should be paid to soil, climate and relief conditions. Production facilities should be built in areas that are well covered by the wind. Living areas should also not be higher than areas where construction companies are located [1].

To ensure the health of the population, sanitary protection zones should be separated from production areas and residential areas. This zone is determined depending on the capacity of the new production facility, the type of substances released into the atmosphere and the degree of impact on the body, the course of technological processes. Depending on the nature of the impact of the substances on the human body, the production areas are divided into 5 groups, and for each group the width of this zone is 1000 for group I, 500 for group II, 300 for group III, 100 for group IV, and 50 meters for group V. Enterprises that do not emit harmful substances into the environment may be located inside residential areas. Machine-building enterprises usually belong to groups IV and V [2].

The main sources of air pollution are toxic gases from production processes and transport. As the intensification of production and the increase in the number of vehicles lead to further pollution of the atmosphere, a number of measures are taken to protect the atmosphere in large industrial cities, which are carried out mainly in three directions:
1. Reduction and neutralization of the total amount of substances (pollutants) released into the atmosphere; 2. Disposal and neutralization of pollutants; 3. Placement of polluting enterprises around the city according to the plan, taking into account the natural conditions [2,3]. In order to protect the air basin of the republic, first of all, it is necessary to rebuild the existing polluting industries, reduce and neutralize the total amount of pollutants emitted into the atmosphere by applying modern technological equipment and cleaners, create low-waste and non-waste production areas. The list of atmospheric protection measures includes the construction of taller waste pipes in polluting enterprises, the creation of green protection zones consisting of trees and shrubs that can withstand the effects of gases and dusts in the air and trap dust, soot and various gases in the air [3].

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OC-24

# INTEGRATED APPROACH TO OPTIMIZE THE PROCESS PRODUCTION PLANNING WITH ACCOUNTING OF UTILITY SYSTEM

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The mathematical model of integration of production planning and the energy system for the petrochemical oil refining complex is used to optimize the energy consumption of the petrochemical process and to maximize the overall profit of the oil refining complex (ORC). It is shown that a method which takes into consideration the integration of production planning and its energy supply system, in comparison with the method of sequential calculation gives credible results for organizing the effective functioning of industrial ORC. The reason for it is that in the used approach intermediate products of energy resources are fully utilized, and production units have greater processing potential. The integrated approach, which combines the production and the utility systems is optimized in the model of mixed integer non-linear programming (MINLP) using the example of ORC  and, as calculations show, provides a more efficient relationship between the production unit and the utility system units. The integrated approach, which combines the production and the utility systems is optimized in the model of mixed integer non-linear programming (MINLP) using the example of ORC and, as calculations show, provides a more efficient relationship between the production unit and the utility system units. The MINLP approximation was performed using the APM MATLAB interface. This interface is a tool that makes APMonitor optimization algorithms available directly from within the MATLAB environment, enabling users to easily define mathematical programming models and solve them.

The APMonitor is optimization software for mixed-integer and differential algebraic equations, allow also to transform the differential equations into a Nonlinear Programming (NLP) form. It is coupled with large-scale solvers for linear, quadratic, quadratically constrained quadratic, mixed integer linear and mixed integer nonlinear programming (LP, QP, QCQP, NLP, MILP, MINLP). For a more faster solver, the "built- in" branch and bound capabilities of APOPT (Advanced Process OPTimizer) software package  were used. The advantage of APOPT software package is in suitable for solving large-scale optimization problems of any of LP, QP, QCQP, NLP MILP and MINLP forms.  Modes of operation include data reconciliation, real-time optimization, dynamic simulation and nonlinear predictive control. The energy consumption model of a production unit is introduced taking into account the relationship of energy consumption with the operating mode of production units and their performance. The material balance of the intermediate product, such as fuel gas and fuel oil, as well as the balance of energy production and consumption by various utility systems are optimized considering the energy used. On the example of the study of a real industrial ORC, the effectiveness of the approach being considered has been demonstrated, which leads to a sharp decrease in operating costs for the entire ORC and a significant improvement in energy conservation and reduction of emissions.

We should note that this model can be used to integrate production and utilities systems and help refineries achieve lower energy costs along with higher profit. The integrated method can also help to expand the operational capabilities of the utility systems and increase the productivity of utility services and use fuel of own production efficiently when planning the effective operation of the entire oil refining complex.

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OC-25

# REGULARITIES OF RHENIUM AND RUTHENIUM COORDINATION WITH ORGANIC NITROGEN-CONTAINING LIGANDS

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In recent years, the coordination chemistry of rhenium and ruthenium have developed significantly due to the successful use of complex rhenium compounds for the diagnosis and treatment of cancers of various human organs.

Coordination compounds with a certain type of ligand and a certain structure have a different radiotherapeutic effect; therefore, studies in this area for obtaining compounds with the desired composition and properties are of great interest [1-4].

This work presents the results of studies carried out in the field of synthetic and structural chemistry of rhenium and ruthenium complexes with organic N-donor ligands: o-phenanthroline, imidazole, benzimidazole, nicotinic acid, and phthalocyanine. The choice of these ligands is associated with the presence of donor atoms of different nature in their composition.

Methods of synthesis have been developed and the structure and properties of new complexes of rhenium and ruthenium with organic ligands have been studied. All synthesized compounds were characterized by infrared spectroscopy (IRS), electronic absorption spectra (EAS), mass spectra, proton magnetic resonance (PMR), and elemental analysis data. The thermal and magnetic properties of the synthesized compounds have been studied.

The choice of organic solvents for carrying out complexation reactions was dictated by the solubility of the initial complex and ligand. The reactions were carried out either until a stable color change or until the complete dissolution of the initial complex, if it was insoluble in the given solvent.

It was found that the nature of the binding of the organic ligand, nicotinic acid, and, therefore, the composition of the obtained complexes depends on the acidity of the medium. All complexes contain acid molecules linked through the nitrogen atom of the heterocycle. The coordination of nicotinic acid through the oxygen atom of the carboxyl group occurs when the reaction is carried out in a neutral group, when the reaction is carried out in a neutral and alkaline environment.

Based on the totality of the results of the studies, it was revealed that during the synthesis of phenanthroline complexes, a rearrangement occurs due to dehydrohalogenation and the transition of the outer-sphere ligand into the inner sphere of the complex. The composition of benzimidazole complexes depends on the concentration of hydrogen halide in the medium. At high concentrations, complexes of the onium type are formed; at low concentrations, complexes with monodentate coordinated ligands through the unsubstituted nitrogen atom of the imidazole ring.

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**OC-26**

# THE ROLE AND USE FLUID IN THE DRILLING OF OIL-GAS WELLS IN AZERBAIJAN

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It is known that in drilling oil and gas wells, the drilling fluid is used to drill boreholes in the ground. There are the following types of drilling mud: 1. Water-based drilling mud; 2. Oil-based drilling mud; 3. Synthetic based drilling mud;

Drilling fluids are characterized by some quality parameters: specific gravity or density, viscosity, water content and thickness of the clay layer, stability, amount of sand, amount of gas, amount of hydrogen ions, resistance to electric current, temperature effects. For example, water supply the rocks absorb the fluid used, and this absorption causes swelling. Viscosity is the resistance of a fluid to sliding, and so on [1]. Drilling fluids - Must provide accident-free drilling conditions and high-quality opening of productive horizons with high technical and economic performance through the application of complex technical measures and technical means. As a result of the research, it was determined that the following requirements should be observed when using drilling mud. When drilling oil-saturated strata, the density of the drilling mud must be determined by the density for the horizon, which is the maximum gradient of the formation pressure in the appropriate conditional interval. The density of the drilling mud at the appropriate drilling intervals is calculated by the fact that the hydrostatic pressure generated by the drilling mud column in the well exceeds the formation pressure by the following: 1) 10-15% - for wells with depth up to 1200 m (for intervals from 0 to 1200 m), but not more than 15 kgf / cm2 (1.5 MPa); 2) 5-10% - for wells with depth up to 2500 m (for intervals from 1200 m to 2500 m), but not more than 25 kgf / cm2 (2.5 MPa); 3) 4-7% - for wells with a depth of more than 2500 m (for intervals from 2500 m to the project depth), but not more than 35 kg / cm2 (3.5 MPa) [1,2].

The chemical composition, density, filtration of drilling mud in the intervals, consisting of clays, argillites, clay shales, salts, prone to loss of stability and fluidity, are determined on the basis of ensuring the stability (strength) of the well walls. In this case, the repression shall not exceed the limit set for the entire interval of appropriate drilling conditions. It is not allowed to exceed the density of circulating drilling fluid (gas-free) more than 0.02 kgf / cm2 in the amount specified in the project (except for the elimination of gas-oil manifestations).

Drilling mud treatment is carried out according to the well design and developed recipe. In this case, the requirements must be observed when working with chemical reagents and protective equipment must be used (if necessary). It is forbidden to increase the density of the drilling mud in the well by injecting the weighted solution in separate portions (except in cases of elimination of oil and gas manifestations) [2].

When applying hydrocarbon-based drilling fluids (lime-bitumen, invert-emulsion, etc.), measures should be taken against pollution of workplaces and gasification of the atmosphere. In order to control gasification, regular analysis of the air should be carried out in the block (ground) near the rotor, near the vibrating valve, in the pumping station, and measures should be taken to eliminate gasification.

Drilling operations around the world have seen an increase in the number of average global oil rigs recorded in 2018 compared to the average number of global oil rigs in 2016.

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**OC-27**

# EFFECT OF SATURATION OF FATTY ACIDS ON THE EFFECTIVENESS OF CORROSION INHIBITORS BASED ON THEIR BASIS

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The main reasons for reducing the resource of almost all types of oil refining equipment are corrosion damage and their erosion-mechanical wear. the use of corrosion inhibitors is one of the practical methods of protecting metal equipment [1].

The mechanism of action of corrosion inhibitors is explained by adsorption on the metal surface with the blocking of active centers and, as a consequence, a decrease in the intensity of corrosion. The possibility of adsorption of inhibitors on a metal surface depends on the nature and surface charge of the metal, the chemical composition of electrolytes, the molecular structure and electronic characteristics of the inhibitor molecules.

Analysis of the market for modern corrosion inhibitors has made it possible to identify a promising raw material base for their production. This is, first of all, a raw material of plant origin, which is renewable and safer from an environmental point of view, which can be various vegetable oils [2].

In the presented work, comparative tests of monoethanolamine salts of sulfo-derivatives of oleic and linolenic acids were carried out as inhibitors of carbon dioxide corrosion of steel grade C1018 and it was found that with an increase in the unsaturation of the used fatty acids, the effectiveness of the inhibitors increases. The corrosion inhibition efficiency when using an inhibitor based on linolenic acid (MEASL) is 91.7-98.2% at a concentration of the used inhibitor of 50-100 ppm, while for an inhibitor based on oleic acid (MEASO) at the same concentrations the degree of protection is 57.03-92.6%.

| inhibitor | concentration ppm | velocity of corrosion , mm/g | braking efficiency,% | total metal loss,mgsm$^2$/hour | Surface Coating Values, θ |
|---|---|---|---|---|---|
| - | 0 | 3,5 | - | 6,48 x10$^{-3}$ | - |
| MEASO | 50 | 1,50362 | 57,03 | 3,69 x10$^{-3}$ | 0,570 |
|  | 75 | 0,62473 | 82,15 | 1,16 x10$^{-3}$ | 0,821 |
|  | 100 | 0,25848 | 92,61 | 4,8 x10$^{-4}$ | 0,926 |
| MEASL |  |  |  |  |  |
|  | 50 | 0,28768 | 91,78 | 5,1 x10$^{-4}$ | 0,918 |
|  | 75 | 0,09316 | 97,3 | 1,8 x10$^{-4}$ | 0,970 |
|  | 100 | 0,06234 | 98,2 | 1,1 x10$^{-4}$ | 0,982 |

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**OC-28**

# ECOLOGICAL ANALYSIS OF THE CURRENT STATE OF THE TRANSPORT SECTOR IN AZERBAIJAN

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Ensuring high socio-economic performance and performance of many industrial enterprises located in our country, especially in large cities, requires a developed transport system that meets global trends. Insufficient development of the transport system creates significant limitations for the development of other industries and is one of the factors that can negatively affect the development of their competitiveness. At the same time, despite the region's high priority for the development of the transport system, the density of intercity and international roads in the northern, western and southern parts of the country, limited traffic capacity, insufficient communication with international technical rules and requirements remain one of the most pressing issues today. In some cases, there are environmental problems. Expansion of highways, destruction of roadside greenery, modernization of highways are inevitable [1].

In some cases, the use of obsolete and physically obsolete vehicles reduces traffic safety and has a negative impact on the environment. The lag in the modernization of the vehicle fleet in our country is a serious problem. According to official statistics for 2019, the number of vehicles in our country is 1,398,824. Vehicles under 5 years of age account for 3.27% of the country's transport fleet (45,383 units), Vehicles aged 5-10 years account for 14.9% of the country's transport fleet (207,392 units), Vehicles older than 10 years vehicles make up 81.78% of the country's transport fleet (1135021 units). As can be seen, a large part of the country's transport fleet consists of vehicles older than 10 years. Most of these cars were imported to our country in the early 90s of the last century. 40.5% of the transport fleet in our country are Russian-made (Moskvich, Vaz 06, Vaz 07, Volga, etc.), and 16.97% are German-made Mercedes cars. These processes ultimately have a negative impact on human health and lead to the deterioration of the transport system in the region [2].

To normalize the ecological situation in our country, along with the use of new vehicles, it is necessary to dispose of obsolete and substandard vehicles. Theoretical research is needed to substantiate the urgency and modernity of the problem, to determine the organizational scheme and methodological support for the evaluation of the performance of the vehicle recycling system, created as a special infrastructure within the industry. The urgency of the problem is reflected in the "State Program on Road Safety in the Republic of Azerbaijan for 2019-2023" approved by the decree of President Ilham Aliyev. According to the State Program, the relevant government agencies should develop and implement a vehicle utilization program to improve the level of road safety, improve the environmental situation, as well as to stimulate local car production to ensure the disposal of obsolete, technically safe and environmentally unfit vehicles [2].

Since the beginning of the XXI century, the interest in this field has sharply increased in the Republic of Azerbaijan. In 2018, according to the World Bank, the Republic of Azerbaijan ranked 123rd out of 167 countries. For the development of the transport complex in the Republic of Azerbaijan, it is necessary to determine the direction of certain modes of transport, taking into account a unified system of priorities, the prospects for the development of transport-related industries and social and environmental problems in the region.

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OC-29

# BASED ON BENTONITE CATALYSTS FOR LIQUID PHASE HYDROXYLATION OF PHENOL TO DIHYDROXYBENZENES

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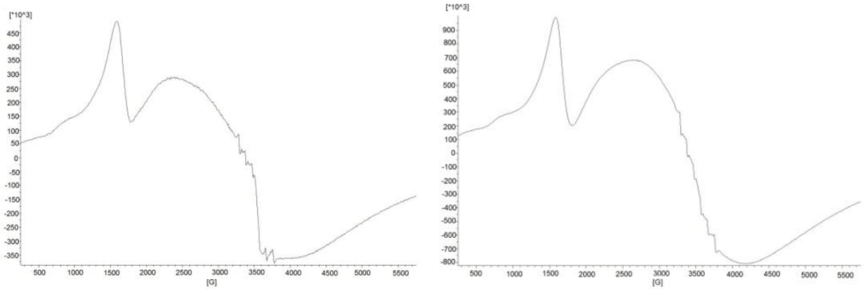
Catalytic wet peroxide oxidation (CWPO) of phenol to dihydroxybenzenes is one of the most promising processes, both technological and economical aspects [1,2]. Pillared clays have been studied as potential micro / mesoporous materials for use as catalysts and catalyst supports due to their well-controlled pore structure and catalytic properties [3]. In this work, we present the results of the synthesis by hydrothermal treatment followed by calcining at 400 ° C in an air stream samples of bentonite modified with iron oxides and testing them as catalysts for the reaction of liquid-phase hydroxylation of phenol into dihydroxybenzenes with hydrogen peroxide. It was shown that heat treatment after the introduction of iron significantly enhances the catalytic activity of iron / bentonite samples, mainly due to the improvement of hydrophobicity in micropores. The catalysts were characterized using X-ray fluorescence (XRF) microscopy, X-ray diffraction (XRD), N2 adsorption / desorption, electron paramagnetic resonance (EPR), Fourier transform infrared spectroscopy (FTIR) and thermal (TG / DTG) analysis.

Figure 1 shows the EPR spectra of samples registered at room temperature of bentonite samples: a) the initial and b) modified with iron and calcined at 400 °C for 4 hours in an air stream.



a) b)

Figure 1. EPR spectra of samples registered at room temperature of bentonite samples: a) the initial and b) modified with iron and calcined at 400 °C for 4 hours in an air stream.

Based on the data obtained, the nature of the active sites is discussed and the activity of FeOx structures with superpair / ferromagnetic properties for this hydroxylation reaction is discussed.

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OC-30

# ABOUT REACTION OF DEHYDROGENATION AND OXIDATIVE DEHYDROGENATION OF ISOPROPYL ALCOHOL OVER Ti-V-O CATALYST

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Earlier, in [1], we performed a thermodynamic calculation of the reactions of dehydrogenation and oxidative dehydrogenation of isopropyl alcohol into acetone. It was found that the magnitude of the change in Gibbs energy is negative for both studied reactions at temperatures above 300K. It was found that in order to obtain acetone, it is preferable to carry out both reactions at temperatures below 600K. In this work, we studied the dehydrogenation and oxidative dehydrogenation of isopropyl alcohol over Ti-V-O catalysts.

Binary titanium-vanadium oxide catalysts of various compositions were prepared by coprecipitation from aqueous solutions of titanium tetrachloride and metavanadate tetrachloride. The activity of the synthesized catalysts in the reactions of the conversion of isopropyl alcohol to acetone was studied in a flow-through installation with a tubular reactor in the temperature range 100-500°C. Analysis of the initial reagents and reaction products was carried out by chromatographic method.

The activities of the synthesized Ti-V-O samples were studied in the reaction of dehydrogenation and oxidative dehydrogenation isopropyl alcohol. It is established that the products of the isopropyl alcohol dehydrogenation reaction are propylene and acetone. Studies have shown that the dehydrogenation reaction of isopropyl alcohol over Ti-V = 5-5 catalyst begins at 150°C with the formation of trace amounts of propylene and acetone. A further increase in temperature leads to an increase in the yields of these products. The maximum yield of acetone is observed at 300°C and is equal to 10.3%. At this temperature, the formation of 63.3% propylene is also observed. It should be noted that the yield of propylene with increasing reaction temperature increases in the entire studied temperature range. The conversion of isopropyl alcohol also increases with increasing reaction temperature and reaches up to 90% at 400°C.

A study of the conversion of isopropyl alcohol in the presence of oxygen showed that, during the oxidative dehydrogenation of isopropyl alcohol, in addition to propylene and acetone, a significant amount of carbon dioxide is also formed. From the obtained results it is seen that the oxidative dehydrogenation reaction of isopropyl alcohol over Ti-V = 5-5 catalyst begins at 150°C with the formation of 3.1% propylene and 0.6% acetone. With increasing reaction temperature, the acetone yield passes through a maximum (14.2%) at 200°C. The propylene yield also passes through a maximum with increasing reaction temperature and its highest yield is 45% at 200°C. Beginning from 200°C, the formation of carbon dioxide is observed in the products of the oxidative dehydrogenation reaction of isopropyl alcohol, the yield of which increases with increasing reaction temperature and reaches 64.8% at 400°C. The conversion of isopropyl alcohol in the reaction of its oxidative dehydrogenation in the studied samples reaches up to 90%.

Thus, on the basis of the conducted studies, it can be said that the reaction rate of the conversion of isopropyl alcohol in the presence of oxygen is higher than in absence of oxygen. It should also be noted that the adding of oxygen into the initial mixture leads to a change in the direction of conversion of isopropyl alcohol into formation of the product of deep oxidation carbon dioxide.

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**OC-31**

# DISTRIBUTION OF CARBOHYDROGEN GROUPS IN PRODUCTS PRODUCED IN THE PROCESS OF HYDROGENIZATION OF LIGHT PYROLYSE RESET

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Production of pyrolysis resin exceeds 60 million tons worldwide, and 50% of this resin burns directly during processing without processing. Which is a valuable raw material that can be used in the petrochemical industry [1]. In this regard, in the course of current research, the composition of light pyrolysis resin was hydrogenated in the presence of a catalyst "Nickel on chisel". The result of the research and analysis of the obtained product is shown [2].

4 samples taken from the presented work were discussed: sample 1- primary raw material; the sample was processed for 2-60 minutes at a temperature of 100oC; the sample was processed for 3 to 120 minutes at a temperature of 100 ° C; The sample was processed at 80° C for 4 to 120 minutes.

The figure shows the distribution of the hydrocarbon group in the studied samples. In Example 1, 50% monoaromatic hydrocarbons, 17% n-paraffin, 17% olefin, 8% naphthene, 4% isoparaffin, 4% polyaromatic hydrocarbons is shown in the raw material.

The composition of the hydrocarbons changed after the experiment. In Example 2, at a temperature of 100 ° C for 60 minutes, the percentage of monoaromatic hydrocarbons increased from 50% to 74% and that of polyaromatic hydrocarbons increased from 5% to 12%. With increasing time, the amount of monoaromatic hydrocarbons in sample 3 was 77% at 120 ° C and 100 ° C. In Sample 4, the content of monoaromatic hydrocarbons was 77% at 120 minutes at 80oC. However, the amount of n-paraffin decreased from 17% to 13% in sample 2, 11% in 3 and 10% in 4. In Example 4, the change was very small in the experiment performed at 80 ° C for 120 minutes.

Thus, the distribution of hydrocarbon groups in the products obtained in the process of hydrogenation of light pyrolysis resin allowed to determine the high activity of naphthenes in the hydrocracking of the catalyst to aromatic hydrocarbons, dehydration of naphthenes, hydration of unsaturated hydrocarbons and n-paraffins.

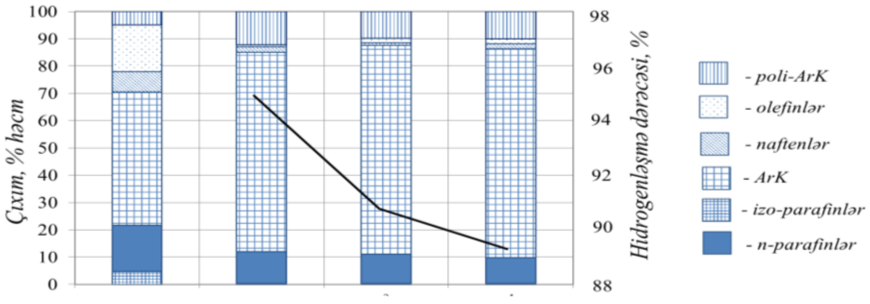

Figure. Distribution and degree of hydrogenation of hydrocarbon groups.

The results of the hydrocarbon samples obtained show that the catalyst is rich in dehydrated and hydrogenated infinity as well as destructive hydrocracking and naphthenes during the reaction.

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**OC-32**

# SYNTHESIS OF ION-EXCHANGE MATERIALS

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One of the main issues of polymer chemistry is the acquisition of new composite materials. Polymer-based materials are used in almost all industries. It is known that due to the easy technology for the production of polymeric materials and products based on them, as well as their operational properties, they are widely used in almost all industries. Due to this, the amount of polymer waste increases sharply, and this indicator is ~ 5% annually. Polystyrene is one of the most widely used polymers in industry, accounting for ~ 8% of all industrial and household waste. This leads to the formation of waste. Utilization, incineration of these wastes and their formation in the form of islands are environmentally harmful. Therefore, the recycling of polymer waste is one of the most pressing issues in the world.

The object of the study was waste polystyrene (WPS), i.e. samples taken from the interior walls of the 1979 «ORSK» refrigerator, was cleaned, washed and crushed.

Sulfocationites with such properties as extensive sorption, mechanical properties, etc. were obtained on the basis of the finished polymer carcass, i.e. using a polymer composition made of waste polystyrene by the method of mechanochemical modification. Modified systems based on decommissioned polystyrene and polyvinyl chloride (PVC) in suspension were obtained. Sulfocationites synthesized on the basis of these systems have improved physical and mechanical properties and the degree of swelling. The inclusion of a polymer with the functional group -*Cl* in the polystyrene waste strengthens the intermolecular bonding due to the weak structuring effect, which leads to an increase in the mechanical resistance of the carcass to synthesize sulfocationites.

Mechano-chemical modification of polystyrene waste with polyvinyl chloride was carried out. The process was carried out by capillary viscometry over a wide temperature, time and displacement stress range.

Modified systems were sulfonated at 40°C for 4 hours in the presence of concentrated sulfuric acid, anhydrous $AlCl_3$ catalyst, and thus ion exchangers were obtained. Physico-mechanical properties of synthesized sulfocationites, such as static and dynamic exchange capacity, mechanical resistance, swelling coefficient were studied. It was noted that the above-mentioned indicators of sulfocationites obtained on the basis of WPS:PVC mechano-chemically modified systems are satisfactory in comparison with KU-2 sulfocationite used in industry.

We offer the use of synthesized ion exchange resins in industrial water desalination.

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**OC-33**

# DYNAMIC VOLCANIZED NANOCOMPOSITES BASED ON TER-MOELASTOPLASTS AND KAOLIN

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Due to their valuable complex of properties, thermoplastic elastomers obtained on the basis of incompatible polymer mixtures are in great demand. Dynamically vulcanized thermoplastic elastomers are even more promising [1-4]. Mixing random polypropylene (RPP) with butadiene-nitrile rubber of SKN-18 or SKN-26, or SKN-40 grades without any modifiers, as well as a compatibilizer, does not contribute to the production of compatible polymer mixtures. Unsatisfactory miscibility of non-polar RPP with polar SKN contributed to the production of low-strength and exfoliating mixtures. In this regard, we made an attempt to use graft copolymer of polypropylene with methacrylic acid (PPMAA) as a compatibilizer, which contributed to a significant improvement in the physical and mechanical characteristics of polymer mixtures. To conduct research in this direction, polymer mixtures of RPP with 40 wt% were used as composite materials. content of SKN of various brands. These compositions were used as a polymer matrix to obtain nanocomposites on their basis. In this case, kaolin was used as filler. It should be noted that in polymer mixtures containing SKN-18 and SKN-26, the PPMAA concentration in the mixture was 5% by weight, and in the samples where SKN-40 was used as the elastomeric component, the PPMAA concentration was 7% by weight. It has been found that the introduction of even a small amount of kaolin nanoparticles leads to a noticeable improvement in the physicomechanical characteristics of nanocomposites. The effect of the concentration of dicumyl peroxide (DP) on the regularity of changes in the physical and mechanical properties of nanocomposites has been studied. Regardless of the SKN brand, the maximum value of the breaking stress was established only at 0.5% mass content of the PD. At the same time, the relative elongation remains mainly at the level of 30-60%. An increase in the PD content in the considered concentration range leads to a change in the structure of the polymer matrix (RPP + SKN). As a result of the formation of a cross-linked spatial structure, a regular decrease in the MFI of the samples is observed, which, when using a PD in an amount of 1.5 wt%. and above, it completely loses its ability to flow. In other words, the SCN phase turns into a discrete one. Apparently, these changes in the structure can be explained by an increase in the density of the network in the rubber, as a result of which the material stops flowing and becomes continuous. Since SCN vulcanization proceeds in the process of mixing, under the action of shear stresses, the destruction of the rubber particles incapable of flow occurs.

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**OC-34**

# PROPERTIES OF LINEAR LOW DENSITY POLYETHYLENE

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As result of the modification of polyolefin, composite materials based on them were obtained for the use in special equipment in order to entrain their heat resistance. Data analysis DTA (differential thermal analysis) of the DTA curve of this polyethylene sample suggests a bimodal nature of their MWD (molecular weight distribution) which differs from polyethylene with unimodal MWD and a series of endo oxidation effects with a maximum temperature of 245, 335, 358 and 435 °C.

Linear low density polyethylene (LLDPE) is synthesized in the presence of a titanium-chromium catalyst and differs from each other by the length of the side branch. LLDPE-1 is a copolymer of ethylene with hexene-1, where the butyl groups ($-CH_2- CH_2- CH_2- CH_3$) are side branches; LLDPE-2 is a copolymer of ethylene with octene-1, where the side branches are hexyl groups: ($-CH_2- (CH_2)_3- CH_2-CH_3$); LLDPE-3 is a copolymer of ethylene with decene-1, where the side branches are octal groups: ($-CH_2-( CH_2)_5- CH_2- CH_3$).

Unlike low density polyethylene, obtained at high pressure, the structure of which is characterized by the content of side branches of various lengths, LLDPE obtained at low pressure (up to 4.0 MPa) contains the same type of side branches. Moreover, the size of the latter, as indicated above, depending on the commoners, can vary from $C_4$ to $C_8$, in the case of LLDPE-1 and LLDPE-3, where $\alpha$-$C_6$ and $\alpha$-$C_{10}$ were used as comonomers, respectively. This is a fundamentally important difference between LLDPE and LDPE and it largely determines a set of exceptionally high performance properties of LLDPE. Figure.1 presents a schematic representation of the structure of LDPE, LLDPE and HDPE.

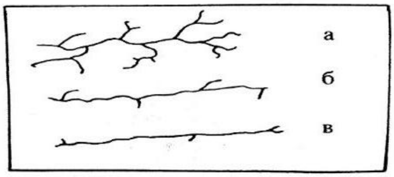

Figure. 1. Fig. 1. Schematic illustration of the structure of LDPE - a, LLDPE - b and HDPE - c.

Violation of the linear structure of polyethylene is long and short-side chains and olefin saturation. Despite their small content in the general structure of linear polyethylene they have a significant impact on the physicochemical properties of the polymer

The density of polyethylene samples strongly depends on the cooling rate, $T_g$ increases from -106 ℃ to 62 ℃ with increasing cooling rate. With an increase in MFR**,** a pronounced Properties of linear low density polyethylene .

**OC-35**

# THE RESEARCH OF MAGNETIC COMPOSITE MATERIALS WITH POLYMER MATRIX

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One of the important directions in the development of modern polymer technologies is the creation of magnetic polymer composites in which dispersed particles of magnetic material are evenly distributed in the polymer matrix. Improving the magnetic properties of both hard magnetic and soft polymer composites is achieved by increasing the proportion of magnetic powder in the composition and the use of powders with the best magnetic characteristics. [1] However, an increase in the degree of filling inevitably leads to deterioration in the mechanical properties of the composition. In this regard, studies of the interfacial interaction of the polymer and the magnetic filler, which provides the mechanical properties of magnetic polymer composites, are of particular importance. In addition, the interaction at the interface can affect the magnetic properties of the composites. Assessing the energy of this interaction is a complex experimental and theoretical task that requires taking into account the phase and relaxation states of the polymer matrix. The purpose of the work is to develop effective ways to obtain magnetically active polymer sorbent composites, which combine the presence of magnetic centers with the presence of pores suitable for sorption of certain substrates, and to establish factors affecting their structure, magnetic and sorption characteristics.

The use of such materials in sorption processes makes it possible to replace the complex procedure for separating spent sorbent from solution with a simple magnetic separation method. Magnetic polymer granules can be obtained by depositing iron oxides directly in a polymer matrix that limits the growth of magnetic particles, as a result, their size becomes smaller than in the absence of polymer, and magnetic properties are improved. For the synthesis of magnetic elastomers used silicone polymer matrix. Silicone oligomer with vinyl and hydride groups at 100-150$^0$C interacts in the presence of a platinum catalyst. Magnetic particles are introduced into the matrix: Fe - 2 μm, $Fe_3O_4$ - 0.2-0.4 μm. In a magnetic field, the polymer macromolecules are oriented, and in the presence of magnetic particles, the elastomers are structured. To achieve high magnetic characteristics of magnetic elastomers, it is known that it is necessary to introduce the maximum possible number of magnetic fillers. However, at a very high value of the degree of filling, the material loses cohesive strength. At various degrees of filling with magnetic particles of 3, 5, and 10 volume% Fe, structured elastomers with various elastic characteristics were obtained. There is a different viscoelastic behavior of the polymer when exposed to a uniform magnetic field during various deformation processes. The residual deformation in a uniform magnetic field depends on the type of magnetic particles and increases with an increase in their content.

[1]. León-González M.E., Pérez-Arribas L.V., Chemically modified polymeric sorbents for sample preconcentration, 2000, J. Chromatogr. A, 902, 3-16.

OC-36

# SYNTHESIS AND RESEARCH OF THE LANTHANUM COMPLEX WITH O-PHTHALIC ACID

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Institute of Catalysis and Inorganic Chemistry named after M.F.Nagiyev of the National Academy of Sciences of Azerbaijan2Azerbaijan State Oil Academy Scientific Research Institute "Geotechnological Problems of Oil, Gas and Chemistry" sb_mamedova@mail.ruComplexes of rare earth elements (REE) with monocarboxylic aromatic acids, for example, with benzoic acid and its derivatives, have a wide range of applications and have been widely studied [1,2]. The study of the structural features of these complexes makes it possible to proceed to the synthesis and study of complexes of rare earth elements with dicarboxylic (phthalic) acids.Lanthanum phthalate was synthesized by an exchange reaction between a soluble lanthanum salt and sodium phthalate, obtained by the interaction of o-phthalic acid with sodium hydroxide. The main factor influencing the formation of the complex is the pH-environment, which should be equal to 6.5.The resulting complex was investigated by IR spectroscopy and X-ray analysis. It can be seen from the diffraction pattern that the values of the interplanar distances (d, Å), the relative intensities (I / I0) of the diffraction lines of the obtained product and the initial phthalic acid differ greatly.The method of IR spectroscopy was used to determine the coordination of $C_6H_4$ $(COO)_2$- and the presence of water molecules in the form of OH- and HOH-1 groups. The IR spectra of the complex did not show absorption bands of non-ionized carboxyl groups - COOH at 1720-1700 cm-1. Instead, absorption bands are observed at 1548 cm-1, typical of asymmetric and symmetric stretching vibrations of the carboxyl residue.It was also found that these bands are shifted to the low-frequency region more strongly than in the complexes of monocarboxylic acids. This fact proves that both hydrogen atoms of the carboxyl groups of phthalic acid are replaced by lanthanum. The absence of absorption bands at 1620-1610 cm-1, attributed to bending vibrations ð (HOH), indicates the formation of an anhydrous complex of lanthanum with o-phthalic acid.

[1]. Poray-Koshits, MA, Crystal chemistry and stereochemistry of monobasic carboxylates of transition metals, Zh. struct. Chemistry. 1980. T.21. Number 3. Pp. 146-180.

[2]. Ashurova S. A. Diss. ... Candidate of Chemical Sciences. Baku: INFKh AN Azerbaijan. 1999, p.133

OC-37

# ENVIRONMENTAL EFFECTS OF MOLYBDENE (VI) COMPLEXATION WITH PRICHALLOLE-BASED REAGENTS

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Homogeneous and multicellular complexes (MLC) of metals have a wide range of applications. These complexes are widely used in various fields of science, technology, medicine and environmental control. The analytical methods developed among such complex compounds differ in sensitivity and selectivity and allow to determine the minimum amount of the element in different mixtures. The presented work is devoted to the separation, concentration and determination of molybdenum (VI) in environmental facilities in this area. In this study, molybdenum (VI) was systematically identified with pyrogallol-based azo dyes (2,3,4-trihydroxy-4-sulfoazonaftol ($R_1$) and 2,3,4-trihydroxy-4'-fluorazobenzene ($R_2$)) with different sugars and surfactants. (SPCl, SPBr, STMABr) The conditions of formation, physicochemical and optical properties of MLK were studied in detail. It was found that this metal ion forms intensively colored complex compounds with the proposed reagents. It is known from the literature that mixed-ligand complex compounds are widely used to increase the analytical parameters of complex compounds [1-2].

The molybdenum (VI) ion forms an intensely colored complex with reagent $R_1$. The optimum conditions for the resulting complex are pH 2 (□max-460 nm) and the maximum luminosity of the reagent is 304 nm. To determine the optimal conditions for the formation of the complex, the light spectrum was extracted depending on the pH of the system (pH 1-14). The figure shows the pH dependence of the complexation of molybdenum (VI) with $R_1$.

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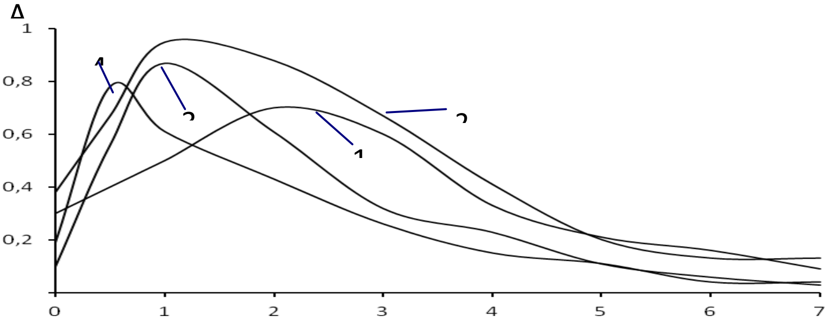

Fig. 1. Dependence of light pH of molybdenum (VI) complexes formed with or without SAM on the solution: 1-$MoR_1$, 2-$MoR_1$-SPCl, 3-$MoR_1$-SPBr, 4-$MoR_1$-STMABr

As can be seen from the figure, the optimal pH of the complex formed by molybdenum (VI) with R1 is 2, and after pH 2 a decrease in the optical density of the complex is observed. Thus, the optimal pH of the complex shifts to an acidic environment, the value of the optical density increases at the optimal pH, and hypochromic or batochromic displacement occurs at maximum light.

[1]. Алиева Р.А., Мирзаи Дж.И., Абдуллаева К.С. Сорбционно-фотометрическое определение молибдена (VI) с 2,3,4-триокси-4'-фторазобензолом и 1,10-фенантролином в природных водах // Журнал Заводская лаборатория, 2014 № 1, с. 15-19

[2]. Абдуллаева К.С. Концентрирование и определение микроколичеств молибдена (VI) комплексообразующим полимерным сорбентом // Журн. Химические проблемы, 2016, №2, стр. 158-163

**OC-38**

# ACQUISITION TECHNOLOGY OF CHLOROMALEIC ACID BISPHENYL ESTERS

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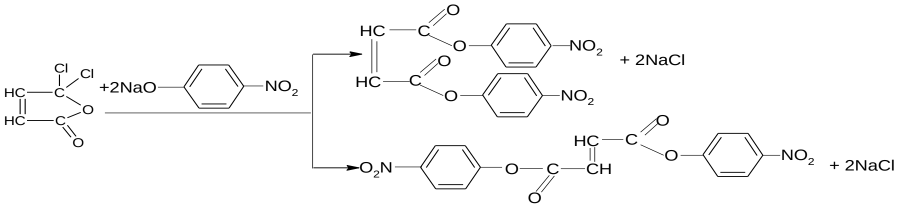
The spatial structure of biologically active compounds has a decisive influence on their properties. In this regard, the search for drugs with biological activity, as well as the identification of the correlation between the activity and the structure of the synthesized compounds is an urgent problem [1].As you know, all the proposed substances have phytotoxicity of various degrees of activity. The most toxic for seedlings were bis (2,5-dichlorophenyl ether) dichloromaleic acid, bis (3,4-dichlorophenyl ether) dichloromaleic acid and bis (2, 4, 6-trichlorophenyl ether) dichloromaleic acid. As shown by the research results, it is not always possible to make a clear correlation, since an increase in the number of chlorine atoms or nitro groups did not always lead to positive effects.For a number of years at the Institute of Catalysis and Inorganic Chemistry, original work has been carried out on the study of the preparation of bis-phenol esters of chlorine derivatives of maleic acid. Distinctive features of the investigated processes are high yields of whole products with high selectivity.The coefficients of the regression equation were calculated and, after insignificant coefficients, the corresponding dependences of the yields of bis (4-nitrophenir ester) maleic and fumaric acids on the controlled parameters were obtained in the form of the following normalized regression equations:

$$\widehat{Y_1} = 42.13 - 13.37X_1 + 4.81X_3 - 5.48X_1^2 - 5.03X_2^2 - 4.61X_3^2$$

$$\widehat{Y_2} = 51.74 + 21.33X_1 - 5.76X_2 + 6.20X_3 - 3.64X_3^2$$

The mechanism can be expressed:



The development of modern chemical science requires a deeper study of reactions that make it possible to create flexible and economic processes.

We have developed a scientific basis for a flexible technology for the production of various polychlorinated 2.5-dihydrofuranones-2 based on maleic anhydride (MA) and with phosphorus pentachloride (PF). It is shown that carrying out the reaction in a melt with constant distillation of by-products during its course leads to high yields and selectivities for the target products. Thus, it was shown that the synthesized bis-phenolic ethers exhibit biologically active properties.

[1]. Traven, V.F. Organic chemistry: textbook T.2 / V.F. Grass. - M: Binom. Knowledge Laboratory, 2016 .

# POSTER PRESENTATIONS

**PP-01**

# SYNTHESIS OF BISBUTYLXANTOGENATES AND RESEARCH IN LIQUID OILS

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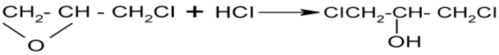
In the presented work the synthesis and study of the properties of bisbutylxanthogenates containing hydroxyl, complex ether groups in the structural structure on the basis of epichlorohydrin are given. Initially, 1,3-dichloroisopropanol was synthesized by the addition of gaseous hydrogen chloride to epichlorohydrin by a known method:



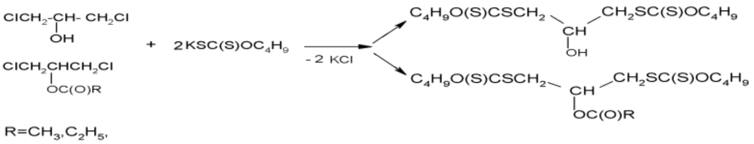
$n_D^{20}$ = 1.4821; $d_4^{20}$ =1.3632 MR$_D$ tap. – 26,96; MR$_D$ hes. – 27,313.

Then the esterification reaction was carried out with 1,3-dichloroisopropanol in the presence of KU-2 catalyst of carbonic acids according to the following scheme:

$$ClCH_2\text{-}\underset{OH}{CH}\text{-}CH_2Cl + RCOOH \longrightarrow ClCH_2\text{-}\underset{OC(O)R}{CH}\text{-}CH_2Cl$$

R-$CH_3$, $C_2H_5$

Bisbutylxanthogenates were synthesized from the 1: 2 interaction of the synthesized 2-acyloxy-, propioniloxy 1,3-dichloroisopropanol with potassium butyl-xanthogenate. The reaction was carried out in an acetone medium at 40-450C for 6 h.



Optimal conditions for obtaining 2-acyloxy-propylene-1,3-bisalkylxanthogenates were found in the scheme as a result of various reactions, mainly under different conditions, temperature, resistance of the reaction and the nature of the solvent.

The synthesized substances were purified by column-chromatography, and their structures were confirmed by IR and NMR spectra.

The lubricating properties of the obtained 2-acyloxy-, propioniloxy propylene-1,3-bisbutylxanthogenates were studied in accordance with GOST 9490-75 in a four-wheel friction machine. Studies have shown that the synthesized bisbutylkylsantogenates improve the anti-corrosion and abrasion properties of lubricants and may be recommended as an additive.

**PP-02**

# HYDROGEN PRODUCTION FROM CARBON DIOXIDE REFORMING OF METHANE OVER HYDROTALCITES CATALYSTS DERIVED

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Considerable attention has been paid to the catalytic reforming of $CH_4$ with $CO_2$ to synthesis gas in recent years. This reaction has very important environmental implication since both $CH_4$ and $CO_2$ contribute to the green house effect [1, 2]. Therefore, it is important to develop new catalyst with a high activity and selectivity. In this paper, we intend to compare different types of catalyst: NiMgAl, CoMgAl, NiMgLa and CoMgLa. These samples were prepared by coprécipétation at constant basic pH and calcined at 450°C. The catalysts obtained are characterized by ICP method, XRD, FTIR and BET methods. The data obtained from chemical analysis of the calcined catalysts confirmed that $(M^{+2})/n(M^{+3})$ ratio is close to the intend value of 2. The XRD patterns exhibit the characteristic diffractions of hydrotalcite-like layered double hydroxide materials. Room temperature FT-IR spectra were recorded in the range 4000-400 $cm^{-1}$, on a Perkin Elmer spectrometer. These catalysts are tested for methane dry reforming reaction versus time on stream at 650°C. It was found that performances of catalysts after 8h in reaction indicates that within this period nor or little deactivation takes place over them. In these experiments conditions, co-catalysts did not show any catalytic activity. However, when CoMgAl catalyst is reduced at higher temperature (650°C) for 8h, the better catalytic performances were observed.

**Acknowledgements**

The authors would like to thank the General Directorate for Scientific Research and Technological Development (DGRSDT) of the Algerian Ministry of Higher Education and the Spanish ministry of Science for funding and technical support.

[1]. J.M. Lavoie, Review on dry reforming of methane, a potentially more environmentally-friendly approach to the increasing natural gas exploitation, Frontiers in Chemistry, 2 (2014).

[2]. Z. Abdelsadek, M. Sehailia, D. Halliche, V.M. Gonzalez-Delacruz, J.P. Holgado, K. Bachari, A. Caballero, O. Cherifi, In-situ hydrogasification/regeneration of NiAl-hydrotalcite derived catalyst in the reaction of CO 2 reforming of methane: A versatile approach to catalyst recycling, Journal of CO2 Utilization, 14(2016).

**PP-03**

# NITROGEN CONTAINING ALKYLPHENOLATE ADDITIVE FOR MOTOR OILS

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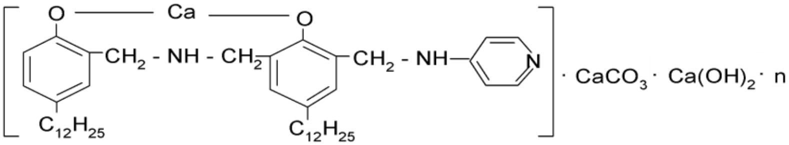
Recently, extensive research has been conducted abroad, as it is important to improve the structure, quality and renew the range of alkylphenolate additives [1].

The demand for modern lubricants makes it necessary to synthesize and study new modifications of alkylphenolate additives of better quality than current industrial analogues.

High alkaline alkylphenolates play an important role in preventing oxidation and corrosion by neutralizing the acids formed during the operation of the oil [2].

In order to obtain higher properties of motor oils, the carbonated calcium salt of codensation product alkylphenol, formaldehyde, ammonia and 4-aminopyridine - AKI-137 additive was obtained.

The intended formula of the additive:



+

The obtained additive is a basic liquid, the alkaline content is 140-160 mgKOH / g, sulfate ash is 14.5-14.6%.

Physicochemical and functional properties of AKI-137 additive were studied in M-8 oil by standard methods. The resistance of the additive to oxidation is determined in accordance with GOST 11063-77, corrosion properties GOST 20502-75, washing properties GOST 5726-2013.

Physical-chemical and functional properties of AKI-137 additive were studied in comparison with analogues ВНИИНП-714 and OLOA-218A (carbonated calcium disulfide alkylphenolates) and AKI-136 (carbonated calcium salt of the condensation product of formaldehyde and 4-aminopyridine of alkylphenol) additives.

AKI-137 additive has high anti-corrosion, anti-oxidation and washing properties.

The functional properties of the AKI-136 additive lag behind those of the AKI-137 additive, which has three nitrogen atoms in its molecule.

AKI-137 is a multifunctional additive and its anticorrosion properties are superior to ВНИИНП-714 and OLOA-218A commodity additives.

[1]. Selezneva I.B., Levin A.Y., Trofimova G.L., Ivanova O.V., Budanovskaya G.A. New high alkaline alkylphenolate additive to motor oils // Chemistry and technology of fuels and oils, №4, p.10-12.

[2]. Kotov S.V., Zerzeva I.M., Guseva I.A., Naukin P.V., Timofeeva G.V.,Balkan N.S. Synthesis of magnesium containing high alkaline alkyl salicylate additive // Petrochemistry, 2019, №2, p.234-240

**PP-04**

# EFFICIENT REMOVAL OF SULFUR AND NITROGEN COMPOUNDS FROM TRANSPORTATION FUELS USING IONIC LIQUIDS VIA MICROWAVE OXIDATION TREATMENT

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Effective and complete removal of sulfur (S) and nitrogen (N) compounds from fuel oil is important to meet the new requirements of environmental agency. Two Bronsted acid pyridinium-based ionic liquids (IL) were synthesized via microwave irradiations and used as both catalyst and extracting agent for the oxidation of real diesel fuel in the presence of combined oxidants. It was shown that increasing the acid site strength leads to an increase of S-removal from diesel fuel. The best results were obtained in the presence $H_2O_2/H_2SO_4$-$[CH_2COOHPy][HSO_4]$ catalytic system. The main factors affecting the process consisting of IL dosage, temperature, oxidant dosage, time and power of microwave irradiations (MW) were investigated in detail. The proposed method was demonstrated to be potentially applicable for the simultaneous extractive oxidesulfurization (ODS) and oxidenitrification (ODN) of diesel fuel (S= 541 ppm, N= 178 ppm) and real transportation fuels without any specific adaptation. Under optimal conditions oxidation, the S-removal reaches 98.34% and more than a 84 % denitrification degree of real diesel fuel were obtained (the oxidation conditions: oxidant/fuel volumetric ratio=0.03, 3 mL of IL, 400 rpm, 60°C, 700 W, 120 s), and the proposed mechanism is expressed in Figure 1. The synthesized IL could be reused/recycled for consecutive treatment-runs..

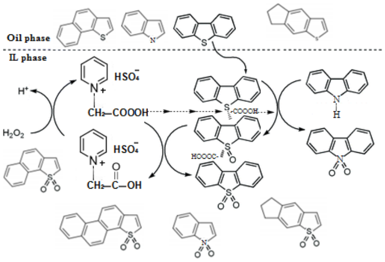

**Figure 1.** Figure caption.

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[2]. Duan, Z., Gu, Y., Zhang, J., Zhu, L., Deng, Y. Protic pyridinium ionic liquids: synthesis, acidity determination and their performances for acid catalysis. J. Molecular Catalysis A: Chemical. 250, 163-168 (2006). doi:10.1016/j.molcata.2006.01.035.

**PP-05**

# SYNTHESIS AND STUDY OF SOME DITHIOPHOSPHORIC ACID DERIVATIVES IMPROVING TRIBOLOGICAL CHARACTERISTICS LUBRICANTS

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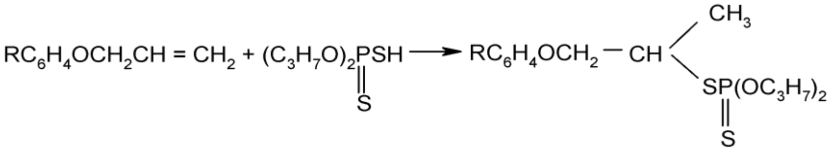
In connection with the tightening of requirements for lubricating oils and the need to expand the raw material base, the need for the synthesis of new additives for lubricating oils is one of the urgent problems of modern petrochemistry.

The selection of additives for lubricating oils is mostly carried out empirically. Despite the large number of works in the field of additive chemistry, the relevance of the synthesis of new types of compounds that improve the tribological characteristics of oils is far from exhausted.

S, P - containing organic compounds, especially derivatives of dithiophosphoric acids, are one of the additives possessing both antioxidant and antiwear and extreme pressure properties.

Allylaryl ethers are a valuable raw material base for many organic syntheses; organic compounds obtained on their basis can be used in many sectors of the national economy, in particular, as additives to lubricating oils, biocides, insecticides, etc.

We have synthesized S, P - containing compounds by adding dithiphosphoric acid to allylaryl ethers according to the following scheme:



$$RC_6H_4OCH_2CH=CH_2 + (C_3H_7O)_2\underset{\underset{S}{\|}}{P}SH \longrightarrow RC_6H_4OCH_2-CH\left\langle\begin{array}{l}CH_3\\ S\underset{\underset{S}{\|}}{P}(OC_3H_7)_2\end{array}\right.$$

Diphosphoric acids belong to nucleophilic reagents, their addition to allylaryl ethers occurs quite easily by heating in a water bath at a temperature of 70C for 6-7 hours.

The obtained (□-methyl-□-aroxy) ethyl esters of diisopropyldithiophosphoric acid are light yellow liquids, readily soluble in organic solvents, mineral oils and insoluble in water.

The study of tribological characteristics of the obtained compounds in SN-1200 oil showed their effectiveness, especially in terms of antiwear properties.

In addition, these compounds also have antioxidant properties and can be recommended for the lubrication of gear, worm and hypoid gears of cars.

**PP-06**

# CARBON DIOXIDE SOLUBILITY IN THE IONIC LIQUID 1-HEXYL-3-METHYLIMIDAZOLIUM HEXAFLUOROPHOSPHATE

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During the past several years greenhouse gases have shown an increasing concentration in the atmosphere. Some examples of such gases are water vapor, carbon dioxide, methane, and nitrous oxide. Greenhouse gases absorb infrared energy radiated from the earth, resulting in a rise tropospheric temperature. Thus, reducing carbon dioxide ($CO_2$) emissions into the atmosphere from industrial processes is very important. Recently, significant progress has been made in the application of ionic liquids (ILs) as alternative solvents for $CO_2$ capture, thanks to their broad range of liquid temperatures, high thermal and chemical stabilities, and other physical and chemical properties. They have been suggested as potentially "green" replacements for conventional organic solvents, because they are nonvolatile, nonflammable, thermally stable, and recyclable. Recently, significant progress has been made in the application of ILs in various branches of industry, one of them as an alternative solvent for $CO_2$ capture. Additionally, there is a great interest in the solubility of gases in ILs for separation technology, which is the most expensive part of many industrial chemical processes.

In the present work, we report the high-pressure $CO_2$ solubility in the ionic liquid 1-hexyl-3-methylimidazolium hexafluorophosphate [HMIM][$PF_6$], at temperatures $T$ = (273.15 to 413.15) K and pressures $p$ up to about 5 MPa (performed by a pressure-drop isochoric method). This work is a continuation of a series of $CO_2$ solubility investigations in ionic liquids [1,2].

The experiments to determine the high-pressure $CO_2$ solubility in [HMIM][$PF_6$] are performed by a pressure-drop isochoric method. A pressure transducer indicates the pressure of the $CO_2$ in the gas reservoir, which is measured with an experimental uncertainty of $\Delta p$ = 0.1 %. Temperature inside the gas reservoir is controlled using the heating system and was measured using the (ITS-90) PT100 thermometer with an experimental uncertainty of $\Delta T = \pm$ 45 mK. The temperature in the measuring cell, $T$ = (273.15 to 413.15) K, is controlled by a thermostat with an uncertainty of $\Delta T = \pm$ (30 to 100) mK and measured using the another two (ITS-90) PT100 thermometer.

The solubility measurements were carried out in intervals of $\Delta T$ = 20 K within the investigated temperature range, and at four different determined pressure steps starting with about 5 MPa and ending with about 0.5 MPa. A detailed outline of the device and procedures is given in previous papers [1,2]. Within the $p,T$-range investigated, $CO_2$ displayed a solubility in [HMIM][$PF_6$] from a mole fraction $x$ = 0.0356 and a corresponding molality $m$ = 0.1182 $\text{mol}\cdot\text{kg}^{-1}$ at $T$ = 413.15 K and $p$ = 0.414 MPa up to $x$ = 0.5710 and $m$ = 4.2635 $\text{mol}\cdot\text{kg}^{-1}$ at $T$ = 293.15 K and $p$ = 4.465 MPa. The estimated total uncertainty of $CO_2$ solubility in the IL using this method was approximately $\Delta x = \pm 0.0001$ mole fraction or $\Delta m = \pm 0.0001$ $\text{mol}\cdot\text{kg}^{-1}$. The measured $CO_2$ solubilities as a function of temperature and pressure were fit to virial equations.

The solubility of $CO_2$ in [HMIM][$PF_6$] steadily decreases with increasing temperature (i.e., at a fixed pressure, less gas is dissolved in the IL when temperature increases). A function of Henry's law constant versus temperature was established from the solubility data. Thermodynamic state properties (such as the Gibbs energy of solvation $\Delta_{\text{sol}}G$, enthalpy of solvation $\Delta_{\text{sol}}H$, entropy of solvation $\Delta_{\text{sol}}S$, and heat capacity of solvation $\Delta_{\text{sol}}c_{\text{p}}$) of the solution were calculated at different temperatures $T$ from the correlation of Henry's constant. This was done by applying fundamental thermodynamic relations of solution to evaluate the solute–solvent molecular interactions. The impact of different cations and anions on the solubility is a key feature of ionic liquids and will be discussed.

The University of Rostock thanks for the support of experimental works.

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PP-07

# COMPARISON BETWEEN NANOFLUIDS AND SURFACTANTS AS INHIBITORS OF ASPHALTENES PRECIPITATION

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Asphaltene is one of the heaviest and most polar fractions of the reservoir oil, known as the fraction soluble in aromatic solvents such as toluene and xylene but insoluble in light alkanes

such as n-pentane and n-heptane. Asphaltene exists in equilibrium with other constituents of crude oil at certain reservoir conditions. Any change in equilibrium conditions, such as pressure, temperature, or oil composition can lead to aggregation and precipitation of asphaltene particles out of crude oil. The precipitated asphaltene causes many problems in production process by plugging equipments and wellbore tubing.

Finding a solution against precipitation problem is our main goal of work, that’s why we have used two chemical products to study their effects on asphaltene stabilization inside crud oil which are nanofluids and surfactants.

We have observed that surfactants react by a chemical way with asphaltene molecules so as to put them in suspension in crud oil, however the nanofluids cannot act as asphaltene precipitant in strongly acidic conditions, and, moreover, they may play as a dispersant, enhancing the stability of the asphaltene. In the case of nanofluids containing TiO2 nanoparticles at acidic conditions, we found that TiO2 nanoparticles enhances stability of asphaltene in the fluid, hence a higher precipitation onset point. On the basis of the experimental results and observations, this is the result of a hydrogen bond formed between asphaltene and TiO2 nanoparticles.

**PP-08**

# VALUATION AND STUDY OF THE ACTIVITY OF AN ESSENTIAL OIL EXTRACTED FROM A MEDICINAL PLANT MYRTLE

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The proposed study is to assess the inhibitory effect of a common myrtus plant species on strains responsible for urinary tract infections [1] by the application of two different techniques, hydrodistillation and extraction by Soxhlet in order to obtain better yields and good characteristics of the oil [2]. The yields obtained by hydrodistillation and Myrtle soxhlet are respectively: 10.06 and 13.33%. The physicochemical characterizations were carried out by CGSM. The antibacterial activity of Myrtle oil against Escherichia coli was remarkable with inhibition diameters greater than 20 mm. Myrtle oil inhibits the growth of yeasts and weakens the growth of Staphylococcus aureus which is said to have a bacteriostatic effect.

*Acknowledgements* The financial support of

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**PP-09**

# REPAIR OF GLASS FIBRE/UNSATURATED POLYESTER COMPOSITE

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Composite materials are revolutionary materials that have large assets. However, in spite of the big development which know these composite materials, their durability towards certain types of stress remains to be elucidated. Thus, their behavior under stress: Mechanics (shocks, tiredness, creep), thermal (excessive rise of temperature), ageing (temperature, moisture, chemical aggressiveness) is far from being completely understood and requires to be studied of advantage. These diverse stresses can generate harmful damage, so that a repair is necessary for the maintenance of the part in service.

The aim of this work is to study the behavior of E-glass fiber unsaturated polyester composites, subjected to repeated impact, to propose an adequate repair then to find the optimal repair by experimental and numerical approach.

The experimental results show the existence of two types of damage: a damage of the resin (matrix cracking) and fiber ruptures. Then, with the increase in the number of impact, the damage is accentuated in-depth until the complete perforation of the plate.

The repair of the perforated plates confirms that the performance of repairs strongly depends on the geometry and the nature of the patch used. The repair of the perforated plates confirms that the method of repair the most adapted to the studied material is repair by stratification with circular patch.This method can restore the initial resistance of material.The results of the digital simulation show a perfect coherence with those of the experimental tests.

**PP-10**

# STUDY OF THE PROPERTIES OF THE ISOPRENE POLYMERIZATION PRODUCT BY THE MODELING BASED ON THE MONTE CARLO METHOD

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Currently, the range of synthetic rubbers is quite wide. This is due to the low-quality indicators of natural rubber for the creation of industrial rubber goods. In this regard, studies of polymerization processes are of great interest both for mod-ern science and for the world production of synthetic rubber. The production of synthetic rubbers (isoprene, butadiene, butadiene-styrene, butadiene-nitrile, etc.) is based on the processes of polymerization and polycondensation [1]. One of the most common industrial polymeric materials is isoprene-rubber. But its production is a complex technological process carried out in the presence of catalysts of the Ziegler-Natta type.

The study of this process becomes possible when constructing a mathematical model [2]. One of the modeling approaches used in the study of polymerization processes is the statistical approach. The statistical approach allows an exhaustive description of the detailed structure of macromolecules in terms of several probabilistic parameters [3]. This approach to modeling polymerization processes is the basis of the Monte Carlo method. The model is a collection of particles corresponding to individual molecules or macromolecules. This allows to accumulate information about the amount, length, and composition of the resulting polymer macromolecules and at any time to obtain the actual values of the molecular characteristics of the polymerization product. It allows to observe the polymer in dynamics [4].

We use a statistical approach to modeling the batch process of solution polymerization of isoprene on the NdCl3-nIPA-TIBA-PP catalytic system (IPA is isopropyl alcohol, TIBA is triisobutylaluminum, PP is piperylene). To illustrate the work of the developed program based on the proposed algorithm, a computational experiment was carried out to study the process of isoprene polymerization in the presence of a neodymium-containing catalytic system with next conditions:

– isoprene molar concentration – 1.39 mol/L;
– diisobutylaluminum hydride molar concentration – 0.000177 mol/L;
– triisobutylaluminum molar concentration – 0.00168 mol/L;
– molar concentration of active sites – 0.00014 mol/L.

The constructed model allows one to study the properties of the polymerization product and predict the values of the characteristics of the polymer. Fig. 1 shows the dependence of the values of the polymer polydispersity index on the conversion of monomers. The dots in the figures represent the results of a laboratory experiment for conducting a batch process of isoprene polymerization in the presence of a neodymium-containing catalytic system. The polydispersity index is determined by the ratio of the weight average and number average molecular weight. It characterizes the width of the molecular weight distribution of the resulting product [8]. The analysis of the results of the computational experiment shows that when the monomer conversion reaches 80%, the polydispersity index equals 2.1, which is typical for the model Flory distribution, while the experimental value is in the range 2.3-2.35. The results of the statistical approach show satisfactory agreement with the results of the laboratory experiment. The relative difference between the calculated values for the polydispersity index is no more than 9.0% (the maximum value corresponds to the conversion of 80%).

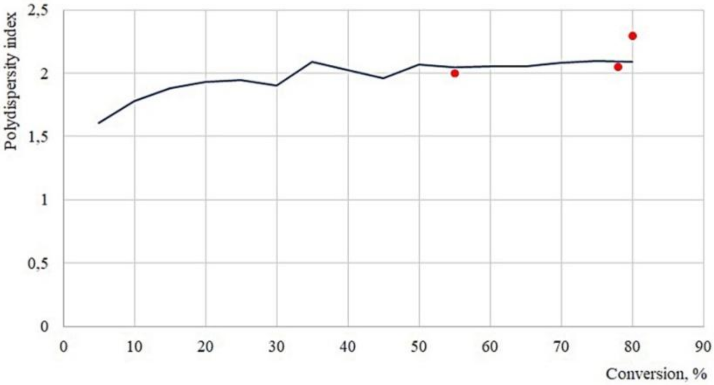

**Figure 1.** Dependence of the values of the polydispersity index of the polymer from monomer conversion (dots – laboratory experiment data, line – results of computational experiment).

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**PP-11**

# CHARACTERIZATION OF ASPHALTENE DEPOSITS FORMED IN PRODUCING WELLS

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Asphaltene chemical identity as well as its behavioral tendency to precipitate have always been an essential topic in oil production and remains uncertain. Many onshore oilfields in Algeria are challenged with asphaltenes deposition in their producing wells. To avoid plugging and operations post-plugging, industrials, generally use direct injection of chemical dispersant and inhibitors in wells. Understanding asphaltenes behavior can help in establishing cost-effective preventing and remediation strategies with appropriate chemicals. In this study, the chemical composition and the physical-chemical behavior of two asphaltenes samples obtained during oil production and originating from Algerian Oil wells are characterized and analyzed by spectroscopic techniques through $^{13}$C NMR, FTIR and DRX. The main differences in the structural parameters with regard to the molecular architecture and the size of the aromatic cores, differentiating them are highlighted. How these characteristics are impacted by temperature and pressure is also examined and compared with asphaltene derived from crude oil under laboratory conditions.

**PP-12**

# BIOCOMPOSITE MATERIALS WITH INDICATOR PROPERTIES FOR RESPONSE OIL SPILLS AND OIL PRODUCTS IN WATER AREAS

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One of the main and large-scale pollutants of water areas is oil and oil products (O and O). Oil production, its transportation and processing inevitably lead to the release of H and OP into the environment as a result of accidents. A comprehensive solution to the problem of liquidation of oil and oil spills includes diagnostics and removal of hydrocarbons from the water surface. To date, there are a number of methods for the elimination of large accidental oil and oil spills in water areas, but all of them are not universal and impeccable from an environmental point of view. In addition, the urgent task of monitoring water areas, timely determination of the hydrocarbon composition of oil spills and identification of oil and oil products on the water surface in real time. The biocomposite materials with indicator properties (BKM-I) created by us make it possible to promptly obtain information on the hydrocarbon composition of contaminating oil products at the spill site, as well as to remove films of H or oil products after collecting their bulk during spill response. BCM-I represent a polymer matrix with incorporated plant structures, immobilized associations of microorganisms-degraders of hydrocarbons and indicator threads. The polymer matrix serves as a sorbent for H and NP, as a carrier for immobilized microorganisms-destructors of hydrocarbons and as a support for indicator threads. Incorporation of plant fragments into the polymer matrix allows creating a habitat for microorganisms close to natural, as well as providing them with biogenic elements. Hydrocarbon oxidizing microorganisms immobilized on a polymer matrix are capable of biodegradation of H and PP to CO2 and water. BKM-I indicator zones allow monitoring the presence of H and OP water in real time.

Water contaminated with oil    Water contaminated with oil – BKM-I    After 7 days of cleaning, BKM-I detects the absence of hydrocarbons in the water

Advantages of using BKM-I:

1. Indicator elements in the composition of BKM-I allow you to quickly get on-site information about the hydrocarbon composition of H and OP present in water;
2. Application of BKM-I allows to combine 3 stages of purification into one: sorption of oil from the surface of the water area; production of non-toxic, biodegradable dispersants that destroy oil slick; destruction of oil hydrocarbons to ecologically safe products (CO2 and water) inside the BKM-I;

3. The use of BKM-I allows to solve the problem of utilization of waste sorbents without turning them into a source of secondary pollution;

4. The use of BKM-I allows you to remove microorganisms-destructors of hydrocarbons from the reservoir after the end of the cleaning process.

The degree of biodegradation of H and OP in water for 25 days is up to 98%.

Physicochemical studies were carried out with the financial support of the Russian Foundation for Basic Research within the framework of the implementation of scientific project No. 18-29-05067

**PP-13**

# SYNTHESIS AND APPLICATION OF CHLORO COMPLEXES ON THE BASIS OF IMIDAZOLINE DERIVATIVES OF NATURAL OIL ACIDS

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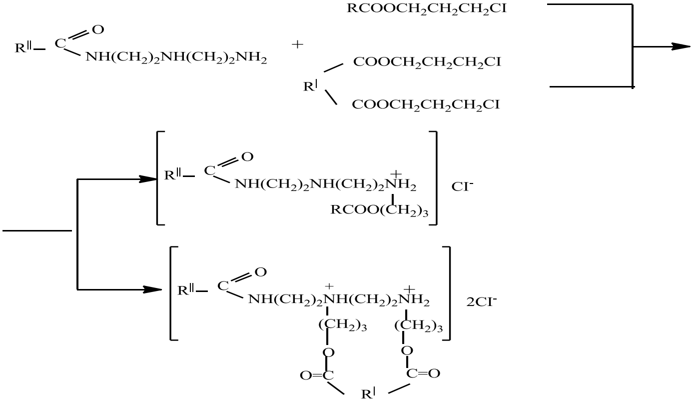
In a number of industrial and machinery fields, including the oil and gas extraction and refining sector, metal equipments are subject to corrosion as a result of the aggressive effects of the environment, resulting in losses, leading to environmental problems. The choice of inhibitors as a solution to this problem is considered very expedient [1]. On the other hand, it is known that natural petroleum acids are oxygen compounds separated from oil fractions and have a wide range of applications. Thus, their derivatives have a wide range of applications in the production of corrosion inhibitors, surfactants, emulsifiers, plasticizers, bactericides.

In the presented research work, imidazole derivative was synthesized on the basis of petroleum acid, then chlorinated derivatives of carbonic acids were synthesized and imidazoline-based complexes were obtained and tested as inhibitors. The imidazole derivative of the natural fatty acid was synthesized by the interaction of the fatty acid with diethylenetriamine. The synthesis is carried out by heating with 240$^0$C at a ratio of 1: 1 mol for 3.5 hours with intensive mixing, after which the reaction time is stirred until the temperature drops below 50-60$^0$C and is completed by obtaining a dark solid product - imidazoline.

With synthesized the imidazoline allyl esters of carbonic acids (maleic, benzoic, phthalic, α-naphthyl vinegar) were synthesized as other raw materials in the presence of ionic liquid catalyst N-methylpyrrolidone hydrosulfate, after their hydrochlorination was carried out, complexes with more complex structures were obtained



where $R^{||}$ - a radical showing a mixture of alky;-, isoalkyl-, napthene, R= $C_6H_5$ (1); $C_{10}H_7CH_2$- (2) $R^{|}$= -CH=CH-(3); -$(CH_2)_4$(4)-; $C_6H_4$-(5).

The structures of the obtained complexes have been confirmed by modern analytical methods and they have been tested as inhibitors in both acidic environment and biocorrosion, and have been proposed as inhibitors in both H2S, CO2 and biocorrosion due to their high 96-100% protective effect.

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**PP-14**

# 2-HYDROXY-3 [1 (3) -METYLTSKYLOHEXYL] -5-METHYLBENSYLAMINOETHYLNONYLYMYDAZOLINES SYNTHESIS AND STUDY OF PROPERTIES

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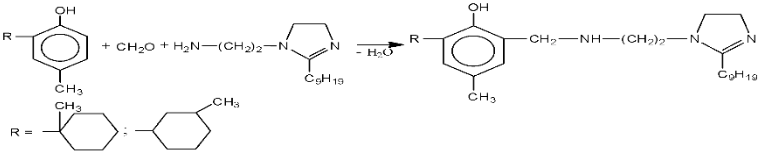
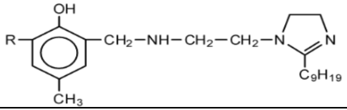
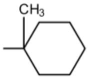
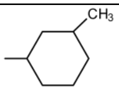
In the present work, the interaction of 2 [1 (3) -methylcyclohexyl] -4-methylphenols with formaldehyde and aminoethylnonylimidazoline obtained from the catalytic cycloalkylation of para-cresol with 1- and 3-methylcyclohexenes is derived from Mannix bases as M-8 engine oil [s].

2 [1 (3) -methylcyclohexyl] -4-methylphenols, 30% formalin and aminoethylnonylimidazole were used as raw materials for the production of 2-hydroxy-3 [1 (3) -methylcyclohexyl] -5-methylbenzylaminoethylnonylimidazoles. 2 [1 (3) -methylcyclohexyl] -4-methylphenols were obtained from cycloalkylation reactions of para-cresol with 1- and 3-methylcyclohexenes in the presence of zeolite-Y catalyst absorbed by orthophosphate acid [2].

Methylcyclohexylimidazoles are obtained from the interaction of 2 [1 (3) -methylcyclohexyl] -4-methylphenols with formaldehyde and amine in a 1: 2: 2 ratio.
The aminomethylation reaction follows the following equation:



As a result, targeted products with a yield of 71.7-79.3% were obtained.
Physicochemical parameters of synthesized 2-hydroxy-3 [1 (3) -methylcyclohexyl] -5-methylbenzylaminoethylnonylimidazoline are given in the table.
Table 1. Physico-chemical properties of 2-Hydroxy-3 [1 (3) -methylcyclohexyl] -5-methylbenzylaminoethylnonylimidazole

|  | $T_{qayn.}$, $^oC$ (666.5 Pa) | | | M.k. | Tapılmış, %<br>Hesablanmış, % | | |
|---|---|---|---|---|---|---|---|
| R =  $C_{29}H_{50}N_3O$ | 218-226 | 1.6534 | 1.130 | 456 | 6.3<br>5.8 | 1.0<br>0.3 | .2<br>.8 |
|  $C_{29}H_{50}N_3O$ | 214-223 | 1.5903 | 1.116 | 456 | 6.3<br>5.6 | 1.0<br>0.4 | .2<br>.7 |

The synthesized substances were tested in M-8 engine oil as a high temperature resistant antioxidant and effective results were obtained.

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**PP-15**

# STUDY OF BACTERICIDAL-INHIBITORY PROPERTIES OF AMINO ACIDS OBTAINED ON THE BASIS OF SYNTHETIC PETROLEUM ACIDS

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Damage to nature, including wildlife, is enormous due to the release of toxic chemicals and petroleum products into the environment as a result of corrosion accidents. Thus, in all oil-industrial countries, the bulk of oil is obtained mainly by injecting water of various origins into oil wells. In this case, the wells are infected with sulfate-reducing bacteria (SRB) and other microorganisms of origin, which complicates the operation of the field.

SRB sulphates (SO42-) are a physiological group that derives energy by reducing to hydrogen sulfide (H2S) and oxidizing organic compounds or hydrogen. Thus, they carry out respiratory processes in anaerobic form, ie with sulfates, not oxygen. As a result, metal equipment quickly collapses. In this regard, one of the simplest and most economically feasible methods for corrosion protection of equipment in the oil and gas industry is the use of inhibitory bactericides. In this regard, the main purpose of the study is to study the synthesis of synthetic petroleum acids (SNA) by catalytic oxidation of naphthenic-paraffinic hydrocarbons in a mixture of Azerbaijani oils, the production of amino acids based on a mixture of these acids and ethanolamines and the impact of these compounds on sulfate-reducing bacteria.

The effect of synthesized amino ethers on the incubation period of SRB for 15 days was studied (Table).

| Complexes conditional name and composition | Concentration of a matter, C-mg/l | Number of bacterias (hüceyrə sayı/ml) | $H_2S$ Concentration mg/l | Bacteriside effect, Z-% |
|---|---|---|---|---|
| N-1(70% IPS) | 50 | $10^4$ | 213 | 58.2 |
| | 500 | $10^3$ | 136 | 73.3 |
| | **600** | **-** | **4.5** | **99.1** |
| | **700** | **-** | **-** | **100** |
| N-2 (70% IPS) | 50 | $10^4$ | 187 | 63.3 |
| | 500 | $10^2$ | 93.5 | 82 |
| | **600** | **-** | **-** | **100** |
| | **700** | **-** | **-** | **100** |
| N-3 (70% IPS) | 50 | $10^4$ | 221 | 57 |
| | 500 | $10^3$ | 153 | 70 |
| | **600** | $\mathbf{10^1}$ | **24** | **95.2** |
| | **700** | **-** | **-** | **100** |
| Control-I The amount of H2S in an environment without SRB | | 24 mg/l | | |
| Control-II The amount of H2S in an environment with SRB | | 510 mg/l | | |
| Control-III-Number of bacteria in the nutrient medium | | $10^8$ cell number/ml | | |

Note: N-1 - 70% solution of aminoefir in isopropyl alcohol based on CNT and monoethanolamine; N-2 - 70% solution of aminoefir in isopropyl alcohol based on CNT and diethanolamine; N-3 - 70% solution of aminoefir in isopropyl alcohol based on CNT and triethanolamine.

As can be seen from the table, all 3 samples at concentrations of 600-700 mg / l show bactericidal properties, completely stopping the life activity of SRB during the test period.

Thus, it can be concluded that the synthesized compounds have a high bactericidal effect at low concentrations and can be highly effective inhibitors that can be applied in the field of biocorrosion.

**PP-16**

# STUDY OF THE USE OF AMINES FOR THE SEPARATION OF NATURAL PETROLEUM ACIDS FROM PETROLEUM DISTILLATES

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Baku oil is rich in natural petroleum acids, which are distributed in various fractions during refining. Excess levels of these acids in petroleum products used as fuel, especially aviation kerosene, cause serious problems.

On the other hand, the fact that natural petroleum acids can be used as raw materials in the production of many valuable and multi-ton products also makes it important to remove them from petroleum products. Alkaline treatment is associated with a number of difficulties and requires the use of additional sulfate or chloride, and the resulting alkali and acid are released into the environment in the form of sodium sulfate or sodium chloride.

We have prepared 1, 2, 5, 10 and 20% solutions of natural petroleum acids in diesel distillates of Baku oil, and studied the possibility of separating acids from polyethylene polyamine (PEPA), ethylenediamine and hexamethylenediamine. The cleaning time was 15, 30 and 60 minutes, the cleaning temperature was 20 ° C, and the mole ratio of amine to natural petroleum acid was 1: 1, 1: 2 and 1: 3. Pre-treatment was carried out by preparing 5 and 50% solutions of amine in water.

The optimal cleaning parameters for each amine were selected according to the acid concentration. It has been established that natural petroleum acids can be separated by all three amines.

Note that the development of this method can also be useful for the separation of synthetic petroleum acids and synthetic oxyneft acids from oxides. Thus, during the production of synthetic acids by oxidation, the oxide contains up to 20-50% of acids, which is also important to separate from unoxidized hydrocarbons.

On the other hand, the amines used can be changed depending on the direction of use of the released natural petroleum acids. Thus, when the main goal is to obtain imidazoline amines and bisimidazoline amines, it is advisable to separate the acids with PEPA.

**PP-17**

# DIESEL-ALCOHOL -SURFACE-ACTIVE SUBSTANCE BLENDS AND THEIRS USE IN DIESEL ENGINES

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Nowadays one of the main trends in the production of environmentally friendly diesel fuel is the production of oxygen contained emulsion diesel fuel. Fossil derived oil and fatty acid based ethers and simple alcohols as oxygen-containing additives are considered one of the most effective means of this application. The presence of an oxygen atom in these additives ensures a more complete combustion of the fuel and ensures that the combustion content and limits are in complience with environmental regulation.

The core objective of carried experiment is to investigate the way of improving stability period for alcohol diesel fuel mixture and compounds with 95, 90 and 85% purity methanol mixing with commercial diesel fuel (CDF) by using surfactant of 3.3-dilinolenate dimethylol-1,1dimethylol-cyclohexanol-2 ethers (SAS1) studied. Hydrophilic-lipophilic balance (HLB) of the synthesized SAS1 determined. Stability factors of the compounds obtained by adding different amounts to the SAS1 into the CDF / methanol mixture were analyzed and identified that by mixing alcohol-methanol (95% purity) and SAS1 with the ratio of 1: 0.25 by 1% into the CDF increases the stability period of the compounds up to 150 days while increasing the alcohol and SAS1 volume up to 5% with the same ratio causes the stability drop till 120-95 days. For other alcohols it is 115-135 days and better transperancy kept. Futhermore, if the mixtures are stored at low temperatures the content of methanol in diesel fuel can be increased up to 3%. Comperative combustion products of compounds obtained from 90% of commercial diesel fuel with methanol and SAS1 in a ratio of 1:0.25 were investigated. CO content in exaust gasses in mixtures of 1-10% with its absolute methanol is 0.717-0.507% and reduced by 7-42%. Accordingly for NOx ranged from 0.0681% mass decreased to 0.0647-0.0490% mass, and SOx oxides decreases from 0.0630% mass to 0.0586-0.0510% mass that corresponds to 5-28% and 7-19% decreament respectively.

| Exhaust gases composition, % mass | CDF | CDF + methanol (abs), %mass | | | | | CDF methanol (90%)+ SAS1:0,25) % mass | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 3 | 5 | 7 | 10 | 1 | 3 | 5 | 7 | 10 |
| CO | 0,874 | 0,813 | 0,717 | 0,588 | 0,550 | 0,507 | 0,786 | 0,655 | 0,577 | 0,516 | 0,463 |
| NOx | 0,0681 | 0,0647 | 0,0599 | 0,0545 | 0,0517 | 0,0490 | 0,0630 | 0,058 | 0,052 | 0,049 | 0,046 |
| SOx | 0,0630 | 0,0586 | 0,0567 | 0,0542 | 0,0529 | 0,0510 | 0,0580 | 0,054 | 0,052 | 0,051 | 0,049 |
| Smoke, % mass | 22,4 | 20,61 | 19,48 | 17,92 | 16,13 | 12,32 | 19,71 | 18,37 | 17,02 | 15,23 | 11,65 |

**PP-18**

# SYNTHESIS AND BIOACTIVITY OF NOVEL RHODANIDE COMPOUNDS

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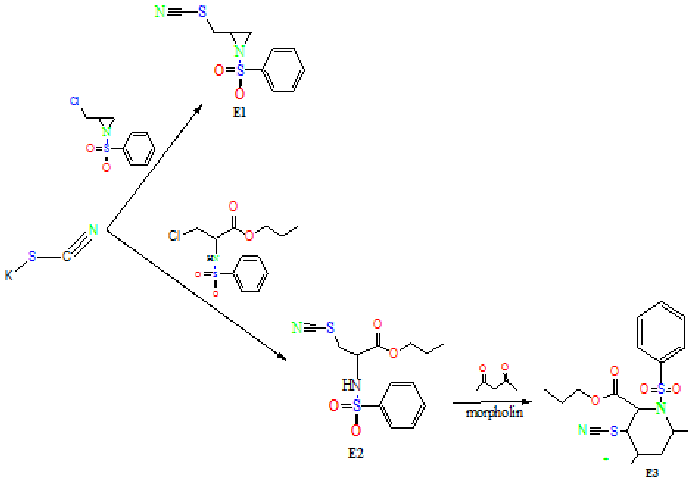
In this study, taking into account all of the above, as well as in the continuation of in the field of synthesis of various classes of organosulfur compounds, determining the relationship between their structure and antioxidant properties, a synthesis of rhodanides (E-1-E-3) of various structures was carried out by a known method and their various functional properties have been studied. New heterocyclic derivatives of rodanides have been synthesized by us. In the first step, 2-(isosyanothiometyl)-1-(phenylsulfonyl) aziridine was obtained from the action of potassium rodanide with 2-(chloromethyl)-1-(phenylsulfonyl)aziridine (E1). At the same time, butyl-3-(isocyanotio)-2-(phenylsulfon-amido) (E2) was obtained from the interaction of potassium rodanid with butyl-3-chloro-2-(phenylsulfonamido) propanoate. In the next step, butyl-3-(isocyanotio)-4,6-dimethyl-1-(phenylsulfonyl) piperidine reacts with butyl-3-(isocyanotio)-2-(phenylsulfonamido)-propanate (E3) with acetylacetone (pentane-2,4-dion)-2-carboxylate synthesized. The reaction is carried out in an aqueous medium according to the scheme:



**Scheme. Synthesis of new rhodanides (E1-E3).**

In addition, the inhibitory effects of these compounds on acetylcholinesterase (AChE), α-glycosidase (α-Gly), human carbonic anhydrase I (hCA I), and human carbonic anhydrase II (hCA II) enzymes have been investigated. It has been seen that all compounds have a better ability to inhibit compared to existing tried inhibitors. Among these, the best inhibitor against AChE enzyme is **E3** (Ki 52.07 μM and $IC_{50}$ 71.52), and against α-Gly, **E2** showed the highest effect (Ki 1076.38 μM and $IC_{50}$ 994.37). The best inhibitor against hCA I, and hCA II enzymes is **E3** compound. For hCA I and hCA II, $IC_{50}$ values were calculated as 3.93 and 8.44 μM and Ki values were measured as 57.64 and 79.75 μM, respectively fort his compound. Molecular docking results have shown that the most active compounds have binding affinity with -4.423, -6.204, -6.623, and -6.298 kcal/mol against hCA I, hCA II, AChE, and α-glycosidase enzyme, respectively.

**PP-19**

# SYNTHESIS OF CARBON NANOTUBES IN PRESENCE OF Ni-$Al_2O_3$

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It is known that the deposition of nano disperse powders of transition metals on carriers allows to obtain a homogeneous coating, which during subsequent processing is active in the reaction of decomposition of hydrocarbons to obtain CNTs [1-2]. At precipitation from solutions of nitrates of metals sol-gel method in the presence of a stabilizing agent of hydroxides of nickel and aluminum the formation of the active component as a whole is preserved: covering the surface $\gamma$-$Al_2O_3$ particles of metallic nickel further initiate the growth of CNTs.

Methane is part of natural gas and gas hydrates. Traditional catalysts of methane decomposition are metals of iron subgroup (Fe, Ni, Co, Re), which are most effective in the synthesis of CNTs [3] The use of catalysts (Ni- $Al_2O_3$) capable of accumulating the maximum amount of nano carbon on the carrier surface opens new prospects in this area. At the first stage have been synthesized Nano powders of aluminum and nickel hydroxides: to 2M solution of $Al(NO_3)_3$ $8H_2O$ and 0,05-0,25M solution of $Ni(NO_3)_2$ separately in presence of deionized water was added monoethanolamide (MEA) sol as a stabilizer at the room temperature for 1 hour, then raising the temperature to 95°C, after which it was repeatedly neutralized with distilled water, filtered, evaporated at 100°C and then incinerated in CVD at 850°C for 4 hours. The effect of the catalyst application method on the carbon product yield has been studied.

Table 1. The data of kinetic tests of 2.5 wt% Ni/$Al_2O_3$ samples prepared by different methods.

| № | Preparation conditions | Yield of CNTs, % | Deactivation time min |
|---|---|---|---|
| 1 | Synthesis of Ni/$\gamma$-$Al_2O_3$ by method sol-gel coprecipitation | 330 | 19 |
| 3 | Deposition of nickel hydroxide on $\gamma$-$Al_2O_3$ surface | 166 | 9 |

It has been revealed that when applying the samples based on nickel hydroxide obtained by the sol-gel method, the yield of the product is significantly higher. Thus, the sol-gel method provides a high yield of carbon product at a longer activity of the catalyst.

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**PP-20**

# SOLID-PHASE EQUILIBRIES IN THE $FeSe$-$FeIn_2Se_4$ -$FeSb_2Se_4$ SYSTEM

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Compounds of the $AB_2X_4$ type (A-Mn, Fe, Co, Ni; B-Ga, In, Sb, Bi; X-S, Se, Te) occupy an important place among layered chalcogenides. The phenomena of electronically or optically controlled magnetism are inherent in them and they are very promising for the creation of lasers, light modulators, photodetectors and other functional devices controlled by a magnetic field on their basis [1-4]. The dependence of the conductivity on the magnetic structure of these compounds, formed by an external magnetic field, makes them valuable as spintronic materials. Recently, a compound of this type, $MnBi_2Te_4$, was presented as the first antiferromagnetic topological insulator [5, 6].

In this work, in order to obtain new phases of variable composition based on compounds of the $AB_2X_4$ type, phase equilibria in the $FeSe$-$FeIn_2Se_4$-$FeSb_2Se_4$ system are studied.

For the experiments, the initial compounds FeSe, $FeIn_2Se_4$, and $FeSb_2Se_4$ were synthesized. The synthesis was carried out by direct interaction of the corresponding simple substances of high purity in evacuated to ~ 10-2 Pa and sealed quartz ampoules. Taking into account the high vapour pressure of selenium at synthesis temperatures, we used the two-zone method. The alloys of the system under study were prepared by fusing the synthesized and identified compounds also under vacuum conditions. To bring the alloys to an equilibrium state, the cast samples were thermally annealed at 800 K for 700 h and then quenched in cold water.

The studies were carried out by DTA (NETZSCH 404 $F_1$ Pegasus system, platinum-platinum-rhodium thermocouples) and XRD (D8 ADVANCE diffractometer from Bruker, CuKα radiation).

Based on the experimental data, a diagram of solid-phase equilibria was constructed at 800 K. It was found that this system is characterized by the formation of wide regions (up to 20 mol%) of solid solutions based on ternary compounds, which extend along the side system $FeIn_2Se_4$-$FeSb_2Se_4$ in the form of bands with a width 2-3 mol%. These phases of variable composition form two-phase fields between themselves ($\gamma_1+\gamma_2$) and with FeSe ($\alpha+\gamma_1$, $\alpha+\gamma_2$), delimited by a three-phase region $\alpha+\gamma_1+\gamma_2$ ($\alpha$-, $\gamma_1$-, $\gamma_2$ - solid solutions based on FeSe, $FeIn_2Se_4$ and $FeSb_2Se_4$, respectively).

The resulting new phases of variable composition are of interest as potential magnetic materials, in particular, magnetic topological insulators.

The work was carried out within the framework of the scientific program of the international laboratory "Advanced materials for spintronic and quantum computing", created on the basis of the Institute of Catalysis and Inorganic Chemistry of ANAS

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PP-21

# A NEW 9P–TYPE LAYERED VAN DER WAALS PHASE – $GeBi_4Te_4$ IN THE Ge-Bi-Te SYSTEM

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Tetradymite-like layered ternary chalcogenides of heavy p-elements have been extensively studied as regards their well-known thermoelectric and topological insulator properties. Particularly, $A^{IV}B^{V}{}_2Te_4$, $A^{IV}B^{V}{}_4Te_7$ ($A^{IV}$-Ge, Sn; $B^{V}$-Sb, Bi) etc. ternary compounds have been a subject of intensive studies lately [1-5]. However, recent studies shows that these systems also contains layered $A^{IV}B^{V}{}_2Te_4{\cdot}B^{V}{}_2$ phases where is an alternation of two-layer and seven-layer blocks [6, 7].

In this work, we report new mix layered 9P-type phase with $GeBi_4Te_4$ composition in the Ge-Bi-Te system.

High purity (99.999%, Alfa Aesar) Ge, Bi and Te elemental components were used to synthesize the $GeBi_4Te_4$ polycrystalline sample. The synthesis was carried out in evacuated (~$10^{-2}$Pa) quartz ampoule at 800ºC followed by rapid quenching in ice water. The resulting sample has been further annealed at 450ºC for 1000h to obtain a homogenous sample.

The synthesized ingot was investigated by Differential Thermal Analysis (DTA) and powder X-ray diffraction (PXRD) techniques. DTA was performed on LINSEIS HDSC PT1600 system, while PXRD was carried out on Bruker D2 PHASER. The XRD pattern was refined by means of EVA and Topas 4.0 computer programs.

According to the PXRD results, the synthesized $GeBi_4Te_4$ sample has a completely different diffraction pattern compared to $GeBi_2Te_4$ and Bi, which means that the sample is not a mixture of them. The powder diffraction pattern was qualitatively identical to the $SnBi_4Te_4$ compound we synthesized earlier [7]. We found that the $GeBi_4Te_4$ sample crystallizes in a rhombohedral structure with the space group $P3m1$ (# 156) and has the following lattice parameters: $a$ = 4.2298 (5) and $c$ = 17.3612 (25) Å. Taking into account the previously obtained data on the crystal structure of $SnBi_4Te_4$, it can be assumed that the crystal structure of $GeBi_4Te_4$ also consists of alternating seven-layer $GeBi_2Te_4$ blocks and bismuth bi-layers.

The DTA results show that the newly discovered phase melts with decomposition by peritectic reaction at 485 ºC.

The work has been carried out within the framework of the international joint research laboratory “Advanced Materials for Spintronics and Quantum Computing” (AMSQC) established between the Institute of Catalysis and Inorganic Chemistry of ANAS (Azerbaijan) and Donostia International Physics Center (Basque Country, Spain) and partially supported by the Science Development Foundation under the President of the Republic of Azerbaijan, a grant EİF/MQM/Elm-Tehsil-1-2016-1(26)-71/01/4-M-33.

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**PP-22**

# TEXTURAL FEATURES OF THE CATALYTIC SYSTEM HETEROPOLY ACID - TITANIUM OXIDE

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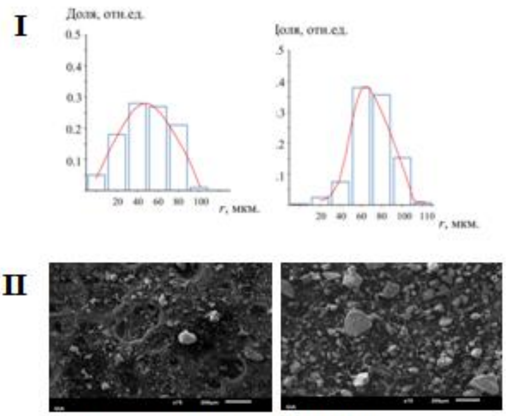
Previously published works [1, 2] discussed the results of catalytic conversions of isopropyl alcohol on the system heteropoly acid (HPA) HPA - η-alumina. Also, this system was characterized by the methods of X-ray phase analysis, scanning electron microscopy, elemental analysis, IR spectroscopy. The present study is a continuation of this direction, and is devoted to the study of the peculiarities of the effect of modification of titanium dioxide with phosphomolybdenum HPA.

It was found that the introduction of HPA leads to a decrease in the specific surface area and pore volume by 15.8-35% and 8.3-29.2%, respectively, relative to unmodified titanium dioxide. The presence of HPA is also accompanied by a decrease in the total pore volume. It can be assumed that when the CHP content is up to 10% wt. its compounds are located mainly in smaller pores (pores <5 nm in size are reduced by up to 10 times in comparison with the initial titanium dixide), which leads to their "overgrowth", while with an increase in the CHP content over 10 % wt., on the contrary, in a wide pore space.

According to the TEM data (Fig.), The surface of the initial titanium dioxide is represented by numerous isolated irregular crystallites, predominantly 21-60 μm in size. In addition to isolated particles, a small number of their aggregates with a size of 81-100 microns can also be seen. It should be noted that all HPA-containing samples, without exception, are characterized mainly by the content of crystallites of larger average sizes (41-80 μm) than the initial sample, which indicates a decrease in the dispersion of surface particles in the presence of HPA and is consistent with the above data of texture analysis.



**I** - crystallite size distribution;
**II** - TEM micrographs

**Figure:** Comparative TEM characteristics of titanium dioxide samples before (a) and after CHP injection (b, 7 wt% CHP); g - 10% of the mass. GPK; d - 13% of the mass. GPK):

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**PP-23**

# REFINING THE PHASE DIAGRAM OF THE Bi-Te SYSTEM AND THERMODYNAMIC PROPERTIES OF BISMUTH TELLURIDES

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Bismuth tellurides with a tetradymite-like layered structure are of great interest as multifunctional materials that combine the properties of a topological insulator with thermoelectric ones [1-3].However, the known phase diagram of this system does not reflect all the compounds formed in the system. This paper presents the results of refining the phase diagram of this system and studying the thermodynamic properties of bismuth tellurides.Alloys were prepared by fusing stoichiometric amounts of elementary components in evacuated quartz ampoules at 6500C with subsequent quenching in cold water. Then annealing was carried out at 250 °C (<30 at% Te), 350 °C (30-45 at% Te) and 4000C (> 40 at% Te) for 800-1000 h.The studies were carried out by DTA (NETZSCH 404 F1 Pegasus differential scanning calorimeter), XRF (Bruker D8 ADVANCE powder diffractometer) and measurement of the EMF of concentration chains of the type(-) Bi (solid) / ionic liquid, Bi3 + / (Bi in alloy) (solid) (+) (1)in the temperature range 27-170 0C. The electrochemical cell assembly and measurements are described in detail in [4].Based on the data obtained, it has been established that in the specified system, in addition to Bi2Te3 with congruent melting at 587 0C, the following compounds are formed that melt incongruently in peritectic reactions: Bi4Te5 (5620C), Bi8Te9 (5500C), BiTe (5390C), Bi4Te3 (4350C) ), Bi2Te (3920C), Bi7Te3 (3300C). According to the data of powder diffraction patterns, the types and parameters of the crystal lattices of the indicated compounds were determined.

From the measurement data of chains of type (1), linear equations of the type E = a + bT were obtained for different phase regions of the system, from which the partial thermodynamic functions of bismuth in alloys were calculated. On the basis of the phase diagram, potential-forming reactions for the above bismuth tellurides were determined and their standard Gibbs energies of formation and enthalpies of formation, as well as standard entropies, were calculated. The values obtained for Bi2Te3 are in good agreement with the literature data, and for the remaining compounds were determined for the first timeThe work was carried out within the framework of the scientific program of the international laboratory "Promising materials for spintronics and quantum computing", created on the basis of the Institute of Catalysis and Inorganic Chemistry of ANAS (Azerbaijan) and the International Physics Center Donostia (Spain) and partially funded by the grant EİF / MQM / Elm-Tehsil-1-2016-1 (26) -71 / 01/4-M-33.

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**PP-24**

# ACTIVITY OF Cr-Cu-O CATALYSTS IN THE ETHANOL CONVERSION REACTION

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We have previously shown that ethanol is converted at high speed into acetone, acetic acid on various binary chromium-copper containing catalysts. From the periodic literature it is known that the activity of the catalysts depends on their surface properties. In this regard, the present work is devoted to the study of the dependence of the activity of chromium-copper oxide catalysts on their acidic surface properties.

Chrome-copper oxide catalysts were prepared by co-precipitation of aqueous suspensions of chrome and copper nitrate. The activity of the synthesized catalysts was studied on a flow-through installation unit with a quartz reactor in the temperature range of 150-500°C. 5 ml of the studied catalyst with a grain size of 1.0–2.0 mm was loaded into the reactor and its activity was studied in the reaction of ethanol conversion. The yields of the ethanol conversion products, as well as the ethanol conversion, were determined by chromatograph method.

Studies have shown that the main product of the conversion of ethanol over chrome-copper oxide catalysts is acetic aldehyde. Ethylene, acetone, ethyl acetate, carbon dioxide, and carbon dioxide and other decomposition products are also formed as a by-product.

Activity of chrome-copper oxide catalysts we have compared with its acidity as a measure of which was taken the isomerization rate of butene-1 to trans- and cis-butene-2. Figure 1 shows the dependence of the yield of acetic aldehyde, the selectivity of the process for acetic aldehyde, and the conversion of ethanol on the degree of isomerization of butene-1 to butene-2 on binary chromium-copper oxide catalysts.

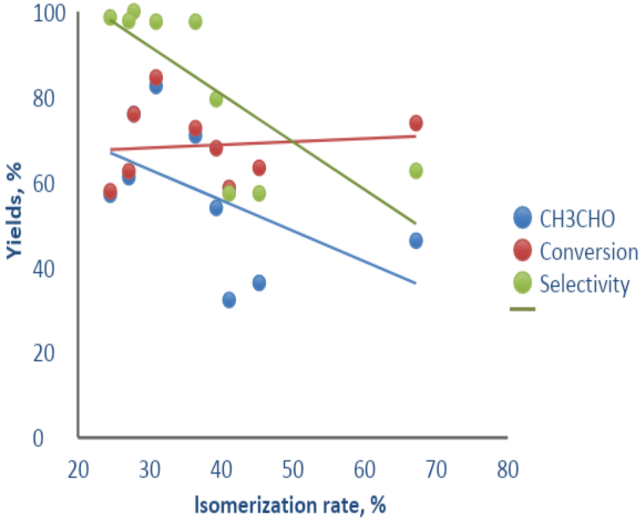

Fig. 2 Dependents of the yields of ethanol conversion products on isomerization rate.

As can be seen from Fig. 1, with an increase in the activity of chromium-copper oxide catalysts in the isomerization of butene-1 to butenes-2, the yield of acetic aldehyde and the selectivity of the process for acetic aldehyde decrease, while the overall conversion of ethanol does not change. This suggests that an increase in surface acidity leads to an increase in the rate of reaction by-products.

Based on obtained results we can say that the main product of the ethanol conversion reaction over chromium-copper oxide catalysts is acetic aldehyde, and its yield reaches up to 82.5% with selectivity 97.6%. Increase in surface acidity of chrome-copper oxide catalysts leads to decrease of yield of acetic aldehyde and its selectivity in the ethanol conversion reaction.

**PP-25**

# X-RAY STUDY OF BINARY COBALT-CERIUM, MAGNESIUM-CERIUM AND NICKEL-CERIUM OXIDE CATALYSTS

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We have previously shown that binary cerium containing catalysts have high activity in reaction of conversion into acetic acid, acetaldehyde, acetone, etc. and its activity depends on both the reaction temperature and the composition of the catalyst. In this regard, in this work, we carried out an X-ray study of binary cerium-containing catalysts.

Binary cobalt-cerium, magnesium-cerium, and nickel-cerium oxide catalysts of various compositions were prepared by mixing aqueous solutions, respectively, of nitrate salts of cobalt and cerium, magnesium and cerium, nickel and cerium. Thus, in each catalytic system Co-Ce-O, Mg-Ce-O and Ni-Ce-O, 9 samples were prepared in various ratios of components, satisfying the following conditions:

mA/nB, where A is Co, Mg and Ni; B - Ce; m, n = 1 ÷ 9; m + n = 10.

X-ray studies of binary cerium containing oxide catalysts were carried out on a Bruker D2 Phaser automatic powder diffractometer (CuKα radiation, Ni filter, $3 \leq 2\theta \geq 80$ °).

The results of X-ray diffraction studies have shown that two phases are formed in each catalytic system. In the Co-Ce-O catalytic system presence phases of $Co_3O_4$ and $CeO_2$, in Mg-Ce-O catalytic system presence phases of MgO and $CeO_2$ and in Ni-Ce-O catalytic system presence phases of NiO and $CeO_2$. It was found that the formation of new chemical compounds between oxides initial oxides is not observed.

We also calculated the degree of crystallinity of all the binary cerium containing catalysts studied by us using the DIFFRAC.EVA program using the D2 Phaser device, the results of which are presented in Table 1. As can be seen from Table 1, the degree of crystallinity of the samples of the Co-Ce-O catalytic system with an increase in the cobalt content in the composition of the binary catalyst sharply decreases from 75.8% for the Co-Ce = 1-9 sample to 12.9% for the Co-Ce = 9-1 sample. The degree of crystallinity of the samples of the Ni-Ce-O catalytic system also decreases with an increase in the content of the second component of nickel in the composition of the binary catalyst, but not as sharply as in the previous samples (from 78.7% for the Ni-Ce = 1-9 sample to 27.3 % on the sample Ni-Ce = 9 1. In contrast to the previous series of catalysts, the degree of crystallinity of the catalytic system Mg-Ce-O practically does not change with a change in composition.

Table 1.

Calculated degrees of crystallinity of the samples of the catalytic systems Co-Ce-O, Mg-Ce-O and Ni-Ce-O.

| Catalysts | The degree of crystallinity, % | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Atomic ratio of elements | -9 | -8 | -7 | -6 | -5 | -4 | -3 | -2 | -1 |
| Co-Ce-O | 5,8 | 6,5 | 8,6 | 4,7 | 1,5 | 7,1 | 5,5 | 4,5 | 2,9 |
| Mg-Ce-O | 8,3 | 8,5 | 9,0 | 8,1 | 7,4 | 6,0 | 4,5 | 0 | 7,3 |
| Mg-Ce-O | 8,7 | 8,2 | 0,5 | 5,9 | 9,1 | 0,6 | 2,0 | 8,8 | 7,3 |

Based on X-ray research we can say that binary cerium containing oxide catalysts with additions of cobalt, magnesium, and nickel consist of only two initial oxides and addition of the second element to the composition of the cerium-containing catalyst leads to a decrease in the degree of crystallinity of the samples for the Co-Ce-O and Ni-Ce-O catalytic systems, while for the Mg-Ce-O catalytic system it has practically no effect.

**PP-26**

# THE RESEARCH OF BITUMEN-POLYMER COMPOSITES WITH HYDRO-INSULATION PROPERTIES

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During the production processes of synthetic caoutchouc, rubber, polymer, as well as after the use and exploitation of rubber and polymer-based products, a large amount of unused waste is generated, which is harmful to the environment. A number of scientific research have been conducted on the possibility of using these wastes in the production of composites, waterproofing, pavement materials, which have a significant positive quality change, taking different brands of bitumen based subistant (1-4). In modern times, as the topicality of efficiency use of water increases, the solution of waterproofing problems, which is an important part of the construction industry, is becoming more urgent. It is known that polymeric materials have very high insulation properties and resistance to the impact of natural factors compared to bitumen. From this point of view, the research of various compositions and production technologies of bitumen-polymer-based waterproofing composites with high-quality operational properties is of great importance in both scientific and applied directions, arising from the requirements of modern times.

Due to its high adhesion and hydrophobic properties, bitumens are most commonly used in road construction, in the production of roofing, hydro-abrasion of building foundations, prevention of salinization, water leaks in water basins and open transmission canals, etc. are widely used. The presented research work is dedicated to the study of waterproofing oriented composites with high long-term performance characteristics.

It is known that extensive research is being conducted in the direction of modification with polymers or their industrial wastes to improve the basic performance of petroleum bitumens (2-4). These research, in addition to the direct solution of the goal, are no less important in terms of solving the global environmental problem created by our time. In this regard, the research of bitumen composites is of topical scientific and practical significance. It is known that the production and processing of polymeric materials, creating reuse technologies after exploitation and use of the production wastes generated as a result of industrial development and products prepared on the base of them play a positive and important role in solving environmental problems which are characteristic of the modern period, as well as it is also economically viable in terms of efficient use of hydrocarbon resources by creating conditions for their purposeful use.

Modern household waste contains a large amount of polymeric materials, including polypropylene waste, so they are considered important as recyclable raw materials. Polypropylene wastes are usually collected as a by-product in the form of the products obtained from obsolete polypropylene in the production process. Based on the results of experiments, it can be said that the properties of Baku 85/25 bitumen improve when 2-6 k.h. of polypropylene wastes are added to it. The penetration performance of the modified bitumen decreases significantly, and the softening temperature increases. These indicators confirm that polypropylene macromolecules are evenly distributed in the bitumen environment due to the used technology.

Given that in this case the polymer macromolecules play the role of argac for the composition of bitumen and increase their abrasion resistance from various influences, it is effective to use the obtained composite material for waterproofing purposes.

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**PP-27**

# INVESTIGATION OF THE DESTRUCTIVE STABILITY OF CO-POLYMERS, SYNTHESIZED BASED ON ALLYL ESTERS OF CARBOXYLIC ACIDS

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Obtaining base oils with a high viscosity index is one of the urgent tasks of modern petrochemicals. Among the various ways of obtaining such oils, it is considered simpler, more reliable and economical to use insignificant amounts of polymer compounds in the composition of petroleum oils, the so-called viscous additives, for example, polyisobutylene, polyalkyl methacrylates, etc. However, these additives for resistance to destructive effects do not satisfy the requirements of modern technology for one reason or another [1, 2].

Studies were conducted at the Institute of Additive Chemistry of the National Academy of Sciences of Azerbaijan in the direction of obtaining more advanced viscosity additives, which are resistant to destructive influences that meet the increased requirements of machines and mechanisms. In order to expand the raw material resources of monomers used in the synthesis of viscous additives, allyl monomers were first used. As is known, allyl monomers separately practically do not polymerize, but enter into a copolymerization reaction. Therefore, styrene, which is one of the cheapest petrochemical monomers, was chosen as a comonomer of the synthesized allyl carboxylic acid esters and its involvement in copolymerization with allyl carboxylic acid esters makes it possible to increase the thermal stability of the synthesized compounds.

The copolymerization was carried out in the presence of an azo(bis)isobutyric acid dinitrile initiator (DINIZ) in a solvent medium (hexane or heptane) [2]. The effect of copolymerization conditions on the properties of the copolymers was studied.

The synthesized copolymers are investigated as viscosity additives for lubricating oils.

The thermal stability of the synthesized copolymers was evaluated in comparison with the known viscosity additives polyisobutylene and polyalkylmethacrylate. The determination was carried out according to the known method, by heating them with 5% solutions in turbine oil “L” for 12 hours at 200°C. The results of the studies showed that the new samples are superior to the known ones in terms of a determined indicator - the viscosity reduction of oils thickened with polyisobutylene and polyalkyl methacrylate is 11.4 and 13.7, respectively; and for copolymers, this indicator is 6.5-7.7%.

Thus, by copolymerization allyl esters of caprylate with styrene, new samples of viscosity additives were obtained which, at improving the viscosity-temperature properties of oils, are at the level of polyalkyl methacrylates and surpass known viscosity additives in terms of resistance to destructive effects, which is due to the stabilizing effect of styrene units.

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**PP-28**

# SYNTHESIS OF ETHERS BASED ON CHLORANHYDRIDE OF LOW-MOLECULAR PETROLEUM ACIDS OF BAKI OILS OF MARINE FIELDS AND CHIRAL ALCOHOLS

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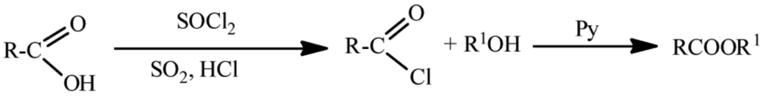
Esters based on low molecular weight natural petroleum acid chlorides of Baku marine oils and chiral unsaturated alcohols have been synthesized. The physicochemical properties of the obtained esters of naphthenic acids have been determined, and the possibilities of their use as plasticizers for high-molecular compounds and as antioxidants for fuels are shown. Naphthenic acids isolated from various oils and petroleum products are very different from each other. Baku oils are the richest in naphthenic acids. Petrochemical products based on petroleum naphthenic acids have special properties. The introduction of various radicals into the hydrocarbon molecules of these products gives them special properties: they reduce the pour point, improve thermo-oxidative and hydro-oxidative stability, improve the dissolving ability, temperature-viscosity, plasticizing, mechanical, anticorrosive and other characteristics. Esters of unsaturated C3-alcohols (propynolic, allylic) naphthenic acids were used in the composition of multifunctional additives for motor oils, and additionally including barium and zinc salts of petroleum naphthenic acids, are distinguished by high inhibiting properties and are used for steel corrosion in an acidic environment.Halides obtained on the basis of petroleum acids have a high reactivity, which makes it possible to obtain organic compounds in a higher yield. Moreover, in all cases, the properties of the final products largely depend on the nature and structure of the naphthenic radical.



where R is a naphthenic radical

R1 = radicals of monohydric unsaturated chiral alcohols

The resulting esters were tested as plasticizers for polymer materials, and also as antioxidants for fuels.

**PP-29**

# MODIFIED EPOXIDE OLIGOMER-BASED COMPOSITE

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One of the current problems is the preparation of composites for various purposes on the basis of oligomers of different compositions. However, existing oligomers have certain imperfections, and to overcome these weak points, they are modified with functional group organic compounds. [1, 2]

In the study, the epoxy oligomer was first modified by benzoquanamine by telomeration. [3] The main physicochemical, physico-mechanical and spectral analyzes of the obtained sooligomer were studied. The epoxy ologomer was also studied in parallel for comparison. Sooligomer, the product of telomerization, is a yellow solid, soluble in toluene, alcohol, acetone, dioxane, tetrahydrofuran and dimethylformamide.

In the next stage of the research, composites filled with natural and waste fillers (wood flour, chestnut, walnut, almond and hazelnut husk powder) were prepared using telomere-modified epoxy oligomer modified with benzoquanamine as a binder.

The optimal variant of the ratio of binder and fillers used in the preparation of environmentally friendly composites has been specified. The amount of filler was taken in the range of 1-10 k.h. and it was found that when the amount of filler is taken in the range of 5-7.5 k.h., it is possible to obtain a composite with higher performance.

It is known that composite materials are heterogeneous systems, and when choosing two or more components, special attention should be paid to their composition (polarity or non-polarity), which leads to their compatibility with each other. In the matrix + filler system, the ability to adhere at the interfacial boundary affects the strength of the composite, so that the adhesion energy of the oligomer and the filler is much more active than the cohesive energy of the oligomer.

The dimensions of the fillers used in the preparation of the composite belonged to the new generation of equipment group "MASTERSIZER-3000", the size of particles in the range of 10 nm to 3.5 mm was determined, and in our study used particles with dimensions of 100 ÷ 1000 nm. The density of the filler and the size of the particles are factors that directly affect the strength of the composite. When the particle size in the filler is large, the surface energy weakens, and as a result, as mentioned above, the cohesive energy decreases, and the strength of the composite weakens.

Comparing the results of the analysis of the density of natural fillers, it was found that high-density fillers have a higher resistance, this means, the use of high-dispersion fillers is not advisable. It is recommended to use modified epoxy oligomer-based composites filled with natural waste in the bonding of materials of various natures.

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**PP-30**

# ORGANİC SYNTHESİS PRODUCTS BASED ON PETROCHEMİCAL İNDUSTRY WASTES

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The level of development of the petrochemical industry is increasing annually.An increase in the production of lower olefins leads to an increase in the yield of cyclopentadiene and its dimeric form, dicyclopentadiene. These hydrocarbons are produced as by-products during the pyrolysis of petrochemical feedstocks. Based on them, a number of valuable products can be produced, such as petroleum resins, adamantane, polyester oligomers, diene rubbers, as well as pesticides and insecticides.

Great interest in the production of dicyclopentadiene begins in 2008, when the possibility of the polymerization of the dimeric form was studied. Dicyclopentadiene is highly reactive and polymerizes. One of the rational methods of using dicyclopentadiene is its polymerization, on the basis of which polydicyclopentadiene is obtained.

Polydicyclopentadiene is a thermosetting polymer compounds and has the following features: high resistance to various chemicals; reduced density; increased resistance to various temperatures. These materials have no natural analogues. They can be used in free and in the form of modifications. For this purpose, a dimeric monomer with a purity of about 95-97% is used. Pyrocondensate, which consists of the following fractions, is taken as a raw material from petrochemical products: $C_5$ fraction (with a boiling point of 20-25$^0$C) containing the following valuable hydrocarbons: n-pentane, isopentane, isoprene, cyclopentane, cyclopentadiene; $C_6$-$C_7$ fraction (boiling point 60-120$^0$C), containing mainly aromatic hydrocarbons and a small amount of dienes; and $C_8$-$C_9$ fraction (boiling point 100-210$^0$C), containing mainly hydrocarbon alkyl substituted arenes and monomeric forms, and dicyclopentadiene about 15-25%.

Diene hydrocarbons easily form dimers based on polymerization (dimerization), and also easily decompose with the formation of monomers. This makes it possible to separate these dienes from hydrocarbons, which have close boiling points [1].

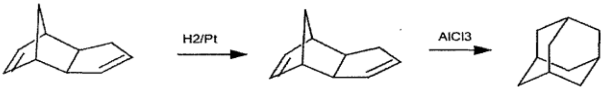
There are two methods for producing dicyclopentadiene: the first method is the preparation of a dimeric form together with other hydrocarbons (mainly with isoprene); the second way is to obtain dicyclopentadiene in its pure form.

The unique conditions for the implementation of the dimerization of cyclopentadiene monomer, which is contained in the feedstock: time 3.5 hours; under pressure of 0.6-0.8 MPa; temperature condition of the stage 80-120$^0$C. Under such conditions, the degree of conversion increases and represents 87%, and the selectivity is 95%.

It was determined that on the basis of a two-stage distillation for dicyclopentadiene concentration, it includes the following: separation of lower hydrocarbons with a boiling point of 25-400C and azeotropic distillation for separation of carbon disulfide and dienes together with methanol, as an agent, in a ratio of 0.5: 1. This makes it possible to isolate dicyclopentadiene with the main component 95%.

The monomeric and dimeric forms of cyclopentadiene are acyclic hydrocarbons. In their structure there are double bonds (unsaturated), so they have an increased reaction feature. In this way, various valuable products are produced that find various industrial applications [2].

The main target product is adamantane, which is obtained on the basis of dicyclopentadiene by hydrogenation in the presence of various catalysts. Various compounds are used as catalysts, and the following can be presented as an example: catalysts for the hydrogenation process (Pt), Lewis catalysts ($AlCl_3$, $SbF_5$).



Adamantan has widespread use: it produces polymers of various properties that are widely used for the production of optical glasses; various solutions, which are used as a thickener for various oils, are also used to obtain various medical preparations (in the form of tablets) that have antiviral and nerve-irritating properties.

The metal compounds of the dimeric form have the following general formula ($C_5H_5$) 2Me, which are called metallocene and are used as a catalyst. Catalysts based on them are used in polymerization reactions. They are also taken as additives to oils [3].

The polymer compounds based on the dimeric form are obtained by polymerization of dicyclopentadiene and the endo configuration of the dimeric form is adopted. Polydicyclopentadiene has inherently special properties: increased resistance to various chemical compounds, specific gravity not high, low density, increased resistance under low and high temperature conditions.

Indicators of the polymer form (polydicyclopentadiene) are presented in table. 1.1.

Table 1.1

The main indicators of polydicyclopentadiene

| The name | Value |
|---|---|
| Heat capacity, 0C | 110 |
| Density, g / cm3 | 1,15 |
| Elasticity in bending, MPa | 1850 |
| Impact strength | 5-30 kJ /$m^2$ |
| Tensile strength, MPa | 50-80 |
| Water-absorbing ability (in 12 hours at 200C), in% | 2 |

The dimeric form is also involved in the reaction of joint polymerization (copolymerisation) with various lower olefins, such as ethylene and propylene. Based on the latter reaction, copolymers are obtained which are widely accepted as rubber. Such rubbers of SKIPT brands.

Polyester resins are produced on the basis of epoxy dimer forms, which are widely used. Based on these resins, various rubbers and rubbers are produced, and some of them are also taken as additives [4].

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PP-31

# COMPOSITE COMPOSITIONS BASED ON PETROLEUM POLYMER PITCH OF GAS OIL FRACTION OF CATALYTIC CRACKING

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The rapid development of the chemical industry constantly requires new sources of raw materials, as well as the rational, waste-free use of natural resources, including by-products of secondary oil refining. In this aspect, the use of light phlegm, from the catalytic cracking process, rich with valuable aromatic hydrocarbons as a raw material for the production of thermosetting and thermoplastic petroleum polymer pitchs - phenoformolites, is of great practical interest.

We carried out the reactions of polycondensation of phenol with formaldehyde with the participation of aromatic hydrocarbons contained in the composition of light gas oil as a raw material component to obtain a petroleum polymer pitch. The synthesis process of the modified petroleum polymer pitch was carried out using ionic liquid as a catalyst, in particular morpholinohydrosulfate or N-methylpyrrolidonhydrosulfate [1].

This report presents the results of studies on the use of the specified petroleum polymer pitch as a binder in various composite materials. As a binder, the synthesized petroleum polymer pitch is used individually and in a composition with epoxy resin (ED-20) with the implementation of the curing process thermally and with the participation of crosslinking agents. In our studies, urotropine and polyethylene polyamine (PEPA) as crosslinking agents were used. The effect of the ratio of components, temperature and reaction duration on the curing process was investigated. It was found that during thermal curing of phenoformalite with epoxy resin, the formation of a crosslinked structure is observed only at a temperature of 160 ° C and the maximum degree of crosslinking is achieved with a curing time of 5 hours and is 97.5%.

The process of curing the synthesized petroleum polymer pitch, with the participation of a crosslinking agent - urotropin, was carried out at a temperature of 100-120$^0$C, and with the participation of PEPA at 20-90$^0$C. It should be noted that when PEPA is used as a crosslinking agent for all the studied mass ratios of the components, a rather high degree of curing (90.4-98.5% by weight) of the oil-polymer pitch is observed.

The obtained results indicate the possibility of modifying the phenoformolite pitch by introducing into the composition of aromatic hydrocarbons contained in the gas oil fraction from the catalytic cracking process.

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PP-32

# MONOMER SYNTHESİS BASED ON ALLEN AND METHYLACETYLENE, BY-PRODUCTS OF THE PYROLYSİS PROSES

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Allen and methylacetylene are highly reactive, which allows them to be used in petrochemistry. The use of allen and methylacetylene will lead to a satisfactory increase in the efficiency of the production of monomers for polymeric materials.

Petrochemicals are developing more and more every year. By pyrolysis of petroleum products lower alkenes are obtained, which include allen and methylacetylene. These hydrocarbons are obtained from the $C_3$ fraction from the pyrolysis of petrochemical feedstocks.

The implementation of the method of producing $\alpha$-methylstyrene by alkylation of benzene with allen and methylacetylene in one stage is considered relevant due to the presence of their source. Of particular interest are dimers of methylacetylene and allene, namely cyclic - dimethylene cyclobutanes (DMLC) obtained in the process. This is because of their special ability. There is no achievable method for producing DMLC, which speaks of the limitation of their use [1].

The possibility of synthesizing alkyl derivatives of $\alpha$-methylstyrene is shown on the basis of a thorough study of the reaction of allene and methylacetylene with aromatic hydrocarbons on aluminosilicate catalysts.

Thus, using chlorine derivatives, we obtained chloroaromatic hydrocarbons. As a result of the dimerization of allene and methylacetylene in the vapor state with the participation of aluminosilicate catalysts, 1,3- and 1,2-dimethylene cyclobutanes were obtained

Using diluted industrial fractions, including allen and methylacetylene, a method for producing $\alpha$-methylstyrene has been developed. The best conditions for the passage of the alkylation reaction and the factors affecting the selectivity for $\alpha$-methylstyrene have been developed [2].

The main mechanisms of the alkylation reactions, as well as the dimerization of methylacetylene and allene, benzene with $C_3H_4$ hydrocarbons on zeolite were studied, the effect of various factors was studied, and the inhibitory effect of propylene on the synthesis of $\alpha$-methylstyrene was clarified.

On acid-base catalysts, benzene alkylation and the formation of MAF oligomers occur. If they do not have acidic properties, then they do not activate the reaction. If zeolite does not have Brandsted, Lewis acidity, then it cannot be used as a catalyst for alkylation and dimerization. To increase the activity of the silica gel catalyst, it is necessary to process it with acid, namely with the help of $H_3PO_4$, ($H_0$ is greater than -1.2 and less than -3.4). In this case, it is activated for the dimerization reaction.

The activity of the catalysts increases the number of acid sites. This is seen in the increased conversion of allen (methylacetylene).

For magnesium oxide ($H_0$ greater than 6.9), the conversion of MAP reaches 6.2%, for alumina with 11% phosphoric acid, whose acidity is greater than -2 less than -3.4, the degree of conversion of MAP acquires 47.9% [3].

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**PP-33**

# EFFECT OF CRYSTALLINITY OF Cu-W-O CATALYSTS ON THEIR ACTIVITY IN THE REACTION OF ETHANOL CONVERSION

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We have previously shown that copper-tungsten oxide catalysts exhibit high activity in the ethanol conversion reaction. As was established, the yield of the reaction products strongly depended on the composition of the catalyst. Therefore, this paper presents the results of study of influence of phase properties of copper-tungsten oxide catalysts on its activity.

Synthesis of binary copper-tungsten oxide catalysts of different composition was carried out by the method of coprecipitation from aqueous solutions of copper nitrate and ammonium tungsten. Thus, 9 catalysts were synthesized with an atomic ratio of elements from Cu–W=1:9 to Cu–W=9:1. X-ray studies of binary copper-tungsten oxide catalysts were carried out on a Bruker D2 Phaser automatic powder diffractometer (CuKα radiation, Ni filter, $3 \leq 2\theta \geq 80$ °). The activity of the synthesized catalysts was studied on a flow-through installation unit with a quartz reactor in the temperature range of 150-500°C.

From results of X-ray studies, it can be seen that in the Cu-W-O catalytic system, three phases are formed: copper oxide, tungsten oxide and copper tungstate. The percentage ratio of the components is preserved, as evidenced by a regular change in the intensities of the reflections in the diffraction pictures. We also calculated the degree of crystallinity of the studied samples. It is found that the degree of crystallinity of the Cu-W-O catalytic system with an increase in the copper content in the catalyst composition first increases slightly to 85.7% for the sample Cu-W = 3-7 and then decreases to 41.3% for the sample Cu-W = 9-1.

Influence of the degree of crystallinity of binary copper-tungsten oxide catalysts on its activity in ethanol conversion reaction is shown in Figure 1. As can be seen from Figure 1, with increasing degree of crystallinity of the catalyst, the outputs of acetic aldehyde and conversion of ethanol increase, while the yield of carbon dioxide decreases.

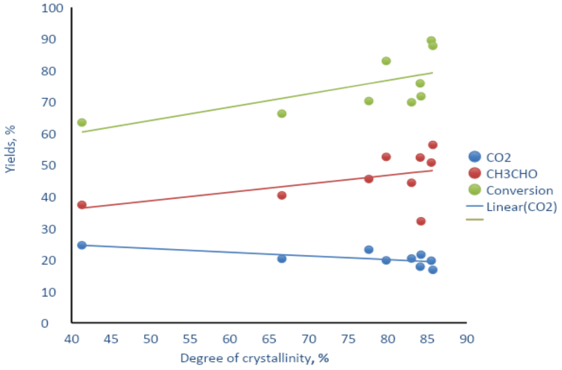

Figure 1. Dependence of the yields of the reaction products of ethanol conversion on the degree of crystallinity of binary copper-tungsten oxide catalysts.

**PP-34**

# NITROGEN AND BOR-NITROGEN STORING ALKYLPHENOLYATE ADDITIVESEFFECT ON THE PROPERTIES OF LUBRICANTS

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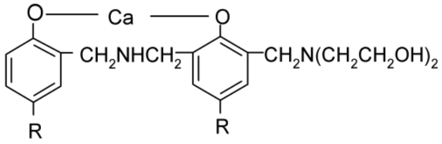
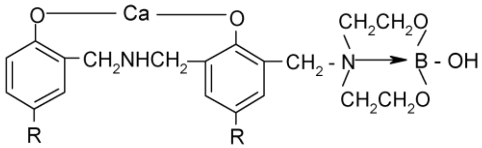
The boron atom in boron-containing additives adsorbs on the metal surface, passivating its surface and preventing it from becoming an oxidation catalyst, so they are used as antioxidants and corrosion inhibitors. The formation of protective layers, such as B2O3, BN, Fe3B2, formed with increasing temperature, also provides an improvement in tribological properties. BN is a layered structure, the coating protects the metal from both friction (antifriction) and corrosion. In most cases, the use of boron atoms in nitrogen-fixing organic compounds is more convenient, mainly due to the fact that the N → B coordination bond differs from other such bonds in strength. In addition to the anti-oxidation and corrosion properties of boron-containing compounds, this feature also improves the detergent-dispersant properties. The nitrogen atom also increases the water resistance of boron-containing compounds. The inclusion of a boron atom in the additive molecules also reduces the amount of sulfur atoms, which increases the number of ash by giving aggressive acids (sulfates, etc.).With this in mind, we have synthesized nitrogen and boron-nitrogen-containing alkylphenolate additives based on the derivative of dodecylphenol dialkyldihydroxydibenzylamine in order to obtain alkylphenolates whose quality indicators are more promising, especially for corrosion and anti-corrosion properties.The formulas of additives can be shown as follows:AKI-233 additive − calcium salt of the product of condensation of dialkyldihydroxydibenzylamine with formaldehyde and diethanolamine;



AKI-233B additive − Calcium salt of the product of condensation of dialkyldihydroxydibenzylamine with formaldehyde, diethanolamine and boric acid.



The IR-spectral structures, physicochemical and functional properties of the obtained nitrogen and boron-nitrogen-containing additives in M-8 oil were studied by standard methods.

Used IR spectrometer Fourier Nicolet-IS-10 (spectral range 7800-400cm-1), made in America.

Advantages of AKI-233B additive over borscht and industrial analogues from the results of the effect of additives on the functional properties of motor oil in the individual case; 5 times more corrosive than AKI-233, 27-29 times more than industrial analogues containing sulfur and carboxylate, 5-6 times more than nitrogen-containing analogue in oxidation stability, 7.3-23 times more than industrial analogues, 0.33mm against 0.55mm of anti-corrosive nitrogen, in washing properties it was determined to have a very high value of 0-0.5 points.

M-8B motor oil was prepared and tested with the application of AKI-233B additive. It is clear from the test performance indicators that this oil composition fully meets the requirements of GOST and does not lag behind Shell brand oil.

AKI-233B additive can be used in oils used in industrial and transport equipment.

**PP-35**

# ACETAMIDE-PHENOL-FORMALDEHID OLIGOMER-BASED SULFOCATIONITISK

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Currently, one of the important issues in the chemistry of high-molecular compounds is the acquisition of new materials with certain valuable properties. Among such materials sulfocationites have a special place. Sulfocationites are biologically active, surfactants. One of the important features of the synthesis of ion-exchange materials is that this process does not produce additional products that pollute the environment [1-2].Ion exchange materials are especially important in the technology of obtaining biopreparations and medicines. Purification of antibiotics, vitamins and sugar juices by ion-exchange oligomers is of great importance in the food and pharmaceutical industries. At present, glucose, gelatin, glycerin, etc. are used in the production of iodine and bromine in the technology of organic and inorganic substances from ion exchangers, as well as in the food industry. widely used in cleaning.The aim of the study is to include a sulfogroup in each phenol ring. Initially, the phenol-formaldehyde oligomer in an alkaline medium was modified with acetamide. The obtained phenol-formaldehyde oligomer was then sulfonated with solid sulfuric acid to obtain an ion-exchange cationite [3-4].Sulfonation is carried out in a reactor equipped with a counter-cooler. To do this, acetamide-modified resol-type phenol-formaldehyde oligomer and solid sulfuric acid are introduced into the reactor and the mixture is heated to 1400C. Once the oligomer is completely dissolved, the mixture is cooled to room temperature. A 37% solution of formaldehyde (formalin) is added to the cooled mixture. The reaction mass is placed in an oil bath at a temperature of 1100C and cured for 2 hours. After the solidification process, the reaction mass is washed with distilled water until a neutral reaction. The washed sulfocationite grains are filtered and first dried in air at 50-600C and then dried in a vacuum-drying cabinet at 400C to a constant weight.For comparison, the unmodified phenol-formaldehyde oligomer was sulfonated by the same method.The obtained sulfocationite is a black, powdery substance, insoluble in water and hydrocarbons. Physico-chemical, physico-mechanical properties of sulfocationite were studied.

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**PP-36**

# NEW QUATERNARY COMPOUND IN THE $Cu_2S$-SbSi SYSTEM

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A number of copper-based chalcogenides and chalco-halides display mixed ionic and electronic conduction in their superionic phase and therefore form a unique class of semiconductors. Complex chalcogenides of copper are of great potential in a wide range of applications such as in lighting, displaying and biological imaging, thin film solar cells, optical devices, etc. due to their unique electronic, thermodynamic, optical, and other physico-chemical properties [1-5]. Antimony sulfoiodide SbSI exhibits high photoconductivity, ferroelectricity, piezoelectricity and can be applied in the preparation of solar cells, radiation detectors, etc. [6-8].

In this paper, we report on the receipt and identification of a new antimony sulfoiodide of copper with the general formula $Cu_2SbS_2I$ on the section $Cu_2S$-SbSI. Alloys of the system each weighing 0.3 g, were obtained by fusing stoichiometric amounts of preliminary synthesized and identified initial compounds in evacuated quartz ampoules at ~1000 $^0$C with subsequent thermal treatment at 600K for 700h.

Powder X-ray diffraction (PXRD) was performed in a Bruker D2 PHASER diffractometer with CuKα radiation at room temperature. Analysis of the powder XRD pattern of alloys showed that the sample with 50 mol% $Cu_2S$+50 mol% SbSI composition ($Cu_2SbS_2I$) has radically different diffraction image and does not contain diffraction lines of the constituent components. Lattice parameters of the latter were refined by indication of the PXRD pattern using Topas V4.2 computer software. It was defined that, $Cu_2SbS_2I$ crystallizes in a monoclinic system with the following cell parameters: $a$=8.2226; $b$=4.7820; $c$=7.4600 Å ; $\beta$= 102.64$^{0.}$

Obtained new compound is of interest as a potential environmentally friendly functional material, given the recent intensive research on synthetic analogs of sulfide minerals of copper with antimony and phases based on them as thermoelectric materials and mixed ion-electronic conductors.

Acknowledgement

The work has been carried out within the framework of the international joint research laboratory "Advanced Materials for Spintronics and Quantum Computing" (AMSQC) established between the Institute of Catalysis and Inorganic Chemistry of ANAS (Azerbaijan) and Donostia International Physics Center (Basque Country, Spain) and partially supported by the Science Development Foundation under the President of the Republic of Azerbaijan, Grant № EİF-BGM-4-RFTF-1/2017-21/11/4-M-12

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**PP-37**

# SORBSION PHOTOMETRIC DETERMINATION OF VANADIUM (V) ION WITH SORBENT SYNTHESIZED ON THE BASIS OF SOPOLYMER OF MALEIN ANHYDRIDE- METAACYRYL ACID

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The use of refractory materials in modern times has a positive impact on the development of technology. In the production of refractory materials, including high-quality steel in the metallurgical industry, vanadium is mainly used in the production of iron, aluminum, titanium and other metal-based alloys. Large amounts of vanadium and its compounds are used as catalysts in the chemical industry and in the preparation of reagents. In addition to high technical properties, the high concentration of vanadium ions has toxic properties. The toxicity of vanadium depends on its oxidation state. The oxidation state of vanadium varies between +2 and +5. Vanadium (V) is more toxic than vanadium (IV). Thus, the use of oil and mineral fuels and unfavorable working conditions in mechanical engineering, transport, metallurgy and other sectors of the economy lead to air and soil pollution with vanadium. Environmental pollution has a negative impact on public health. Once vanadium enters the body, it is rapidly distributed in all organs and tissues and excreted in the urine. Environmental pollution requires increased control of the smallest concentrations of various metal ions. Several analytical methods for the determination of vanadium in various environmental samples are known. Recently, combined methods have been used for this purpose, especially the sorption-photometric method with the participation of polymer chelate sorbents[1].

In the presented work, a sorbent was synthesized on the basis of copolymer of maleic anhydride metaacrylic acid by means of fragmented amine N, N'-diphenyl-quanidine and the sorption capacity of vanadium (V) ion was studied with this sorbent. 10-2M V (V) metal solution during sorption, 2,2 ', 3,4-tetrahydroxy-3'-sulfo-5'-chlorazobenzene with 10-3M concentration to determine the concentration of metal ions in the solution after sorption and desorption (R) A reactive solution was prepared. Pure NH4VO3 salt was used to prepare the metal solution. The experiments were performed under static conditions, and various parameters affecting sorption under all conditions: dependence on the acidity of the medium, time, ionic strength, initial concentration of the metal ion, etc. studied. Based on the results of sorption experiments, the sorption capacity of the sorbent (253-mg / g) and the sorption rate (95%) were calculated. In addition, the desorption of the adsorbed metal from the sorbent was studied. For this purpose, different mineral and organic acids of the same concentration (HClO4, H2SO4, HNO3, CH3COOH) were used. The results showed that 2 ml, 2M HNO3 acid fully ensures the desorption of absorbed metal ions from the sorbent. Thus, it can be concluded that the sorbent used to determine the minimum concentration of vanadium (V) has higher sorption properties than those known in the literature (sorption capacity, analysis time, the effect of ionic strength)

The proposed sorbent can be reused for 7-8 cycles.

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**PP-38**

# TECHNOLOGICAL FEATURES OF THE PROCESS OF APPROPRIATION OF LAYO-ORIGINAL ALUMOSILICATES BY ORGANOSILICON COMPOUNDS

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In the literature, there are practically no studies on the development and study of technological features of the finishing of natural alumino-silicate layered mineral fillers of plastics. This is especially true of nanoparticles of aluminosilicates, the interest in which is growing every year. In this regard, in this work, we considered the technological features of the process of obtaining silane-finished aluminosilicate fillers. Naturally, in order to systematize research in this area, it became necessary to use various types of apparatuses, differing in composition and molecular weight. As an object of research, we used 13 organosilicon compounds (dressing agents) and mineral natural substances - kaolin, bentonite, talc, clinoptilolite, vesuvian. A technological scheme of the finishing process is presented, which consists of a reactor block, where the process of finishing finely dispersed natural minerals is directly carried out. The reactor block includes 3 batch reactors. As the emptying progresses, all reactors are sequentially connected to the finishing process: after finishing and emptying the first reactor, the second and then the third reactor are connected. At the beginning, from the container (C-1), distilled water is introduced into the reactor with the help of a pump (P), which is heated to 80 ° C, acidified with hydrochloric acid to pH = 3. At the rate of 50 kg of natural mineral per 100 kg of water, a mixture is prepared. Fine-dispersed powder of natural aluminosilicate with silanol is added through the second inlet of the reactor with constant stirring of the solution. The mixing process is carried out at a relatively high speed of rotation of the mixer 400-500 rpm. within 2 hours. Thus, according to the given technological scheme, the finishing process consists of 4 main stages: 1) hydrolysis in the reactor block; 2) extruder - dehydration at 100oC; 3) desiccant - the last stage of dehydration; 4) bag packing unit. In the reactor block at a temperature of 70-80 ° C, the first stage of the process occurs - hydrolysis, as a result of which the ethoxy and metoxy groups of the dressing are replaced by hydroxyl groups. The emergence of hydroxyl groups contributes to the first stage of the dehydration reaction with the formation of covalent bonds between the molecules of the dressing and the particles of the natural mineral. After the first stage of the sizing process in the reactor, the solution enters the extruder (E), where a preliminary stage of water evaporation takes place at 110 ° C. The extruder evaporates about 30-45% of the mass. water. Further, the aqueous mixture of the mineral enters the reaction dryer (DD-1), which is a horizontal rotating heated container. The dehumidifier is heated by hot air. In the dehumidifier within 2 hours the completion of the 2nd stage of the finishing process takes place, accompanied by dehydration and complete drying of the finished mineral.

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**PP-39**

# COMPOSITION ADDITIONS TO LUBRICANTS

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The main components of the package of additives to motor oil, responding to modern and promising requirements, are metal-containing washable-dispersing additives of salicylate and sulfonate type, which are disposed of in the form of shrimp. For a number of years, leading foreign companies in the development of motor oil successfully use high-alkaline alkylarylsulfonate and alkylsalicylate in the composition of additives for various purposes.Considering the urgency of the problem, the study of the development of a new generation of ecologically safe washable dispersants of the specified type, which in small concentrations have improved simultaneously, the problem has not improved. multifunctional. Significant interest is the development of a composition of additives, the basis of which are two or more components of the active substance.We carried out the synthesis of composite multifunctional additives containing salicylate and sulfonate fragments.Technical products - alkyl (C14-C18) salicylic acid and condensation product of alkyl (C8-C12) phenol with formaldehyde are used as raw materials. Sulfomethylation of these products was carried out with sodium hydroxymethane sulfonate, which is used to form acid tar. The resulting components - sodium salts of sulfo-methylated alkylsalicylic acid and methylene-bis-alkylphenol were mixed in a mass ratio of 1: 1 and subjected to an exchange reaction with calcium hydroxide (30% -800 p. hours, then the temperature was raised to 125-1300C to remove the reaction water. . Carbonation of the main mixed salt of carbon dioxide in the presence of an excess of calcium hydroxide, promoter - acetic acid, solvent - toluene, oil-diluent at a temperature of 82-85 0C received 150 g of medium-alkaline-type.Developed compositional main and medium additives are characterized by physical and chemical properties and functional properties. Applying additives of multifunctional purpose, they significantly improve the washing, dispersing, anti-corrosion properties and stability against oxidation of smazochny masel, as well as the prescription Thus, when introducing the developed salicylate-sulfonate additives OSKK and SS-150K in butter M-11 at a concentration of 5% corrosion on the pig is 28 and 20 g / m2, respectively, during the time as a result of 60 per cent 50 and 85 g / m2. The SS-150K additive has a higher stability of colloidal dispersion to the action of water (83%) than the additions of MASK and Heitek 6060M (77 and 75% respectively). The observed multifunctionality and the best functional properties of the developed composite additives by comparison are explained by their presence in the structure of the salicylate and sulfonate fragment and their inclination.The high efficiency of the developed salicylate-sulfonate additives allows them to be used in modern motor oil.

**PP-40**

# PHASE COMPOSITION AND ACTIVITY OF Mg-Zn-O CATALYSTS IN THE REACTION OF CONVERSION ETHANOL TO ACETONE

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In the previous article, we explained that the magnesium zinc oxide catalytic system shows high activity in the reaction of conversion of ethanol to acetone. In this connection this work is devoted to studying the influence of phase composition of binary magnesium-zinc oxide catalysts on its activity in the reaction of the conversion of ethanol to acetone.

Binary magnesium-zinc oxide catalysts of different compositions were prepared by co-precipitation method from aqueous solution of nickel magnesium nitrate and zinc nitrate. The activity of the synthesized catalysts was studied on a flow-through installation unit with a quartz reactor in the temperature range of 250-700°C. X-ray study of the phase composition of the prepared catalysts was carried out on an automated powder diffractometer «D2 Phaser» of the «Bruker» company (CuKα radiation, Ni filter, $3 \leq 2\theta \geq 80°$).

Based on the X-ray studies, it was found that in the Mg-Zn-O catalyst system, the formation of two phases is observed, namely magnesium oxide and zinc oxide. We also found that the formation of chemical compounds between magnesium and zinc oxides is not observed. İt is found that calculated degree of crystallinity of the Mg-Zn-O catalytic system slightly depend on the catalyst composition.

We have compared the degree of crystallinity and activity of binary magnesium-zinc oxide catalysts in the reaction of converting ethanol into acetone. Results of this research is shown in Figure 1. As can be seen from Figure 1, with increasing degree of crystallinity of the catalyst, the outputs of acetone slightly increase while the conversion of ethanol practically does not change.

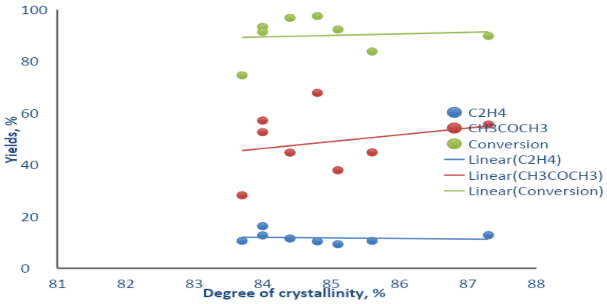

**Figure 2**. Dependence activity of binary magnesium-zinc oxide catalysts in the reaction of converting ethanol into acetone on the degree of crystallinity

Based on obtained results it can be say that binary magnesium zinc oxide catalysts have high activity in the reaction of the conversion of ethanol to acetone. Catalyst with the composition Mg-Zn =4-6 is most active in the reaction of acetone formation. Increasing degree of crystallinity of the catalyst leads to the rising of acetone yields and selectivity of conversion ethanol to acetone.

**PP-41**

# SYNTHESIS OF UNSATURATED SPIROACETALS AND LACTONES BASED ON 2-HEXYLIDENE (HEPTYLIDINE) CYCLOPENTANONES

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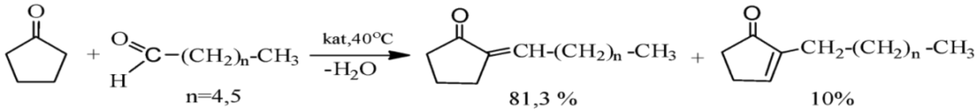
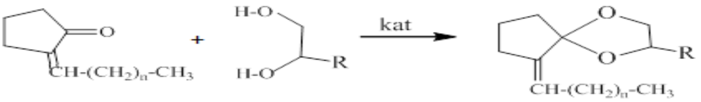
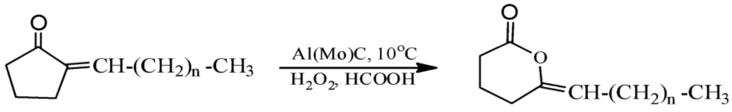
The results of research on the study of the structure and organoleptic properties of unsaturated alkyl derivatives of cyclopentanone C6-C7 and unsaturated spiroacetals by catalytic condensation with diodes on their basis are presented in this paper. Unsaturated alkyl derivatives of cyclopentanone C6-C7 were synthesized by aldol-croton condensation with cyclopentanone capron or enant aldehydes [1,2].The effect of factors influencing the catalytic condensation reaction of cyclopentanone with aldehydes was determined that the mole ratio of ketone to aldehyde was 3: 1, temperature 40 ° C and reaction time was 2.5 hours, the amount of catalyst was up to 7% by weight of reagents and unsaturated ketone yield 82.4%, tqay = 97-99 / 2; The yield of n_0 ^ 20 -1.4205, d_4 ^ 20 - 0.9245, and 2-heptilidentcyclopentanone was 81.3%. Aqueous solution of 20% KOH was used in the condensation reaction of aldehydes with cyclopentanone. The reaction is carried out according to the following scheme:



The 2-hexylidenticyclopentanone or 2-heptilidentcyclopentanone obtained by the reaction was catalyzed by catalytic condensation. Natural perlite modified with zirconium sulfate was used as a catalyst. The reaction was carried out in an azeotropic solvent medium for 4 hours at a temperature of 110 ° C:



Cyclopentanones from the synthesized 2-hexylidine (or heptylidine) were also subjected to a catalytic oxidation reaction and a new series of unsaturated valerolactones were obtained. Oxidation was carried out in the liquid phase in the presence of Al-Mo-C catalyst.



The composition and physicochemical and organoleptic properties of the obtained compounds were studied. It has been found that the aromas of synthesized unsaturated spiroacetals and lactones are more intense than those of their saturated analogues.

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**PP-42**

# PHASE EQUILIBRIUM IN THE GeTe-$Bi_2Te_3$ SYSTEM AND SOME PROPERTIES OF INTERMEDIATE PHASES

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Ternary tetradymite-like compounds formed in systems $A^{IV}$-$B^{V}$-Te ($A^{IV}$-Ge, Sn, Pb; $B^{V}$-Sb, Bi) have high thermoelectric parameters [1]. In recent years, interest in these compounds has sharply increased in connection with the discovery of the properties of a topological insulator in them [2-5].

This paper presents the results of studying phase equilibria in the GeTe-$Bi_2Te_3$ system by DTA (NETZSCH 404 F1 Pegasus differential scanning calorimeter), XRF (Bruker D8 ADVANCE powder diffractometer) and CEM (Field Emission Scanning Electron Microscope JEOLJSM-7600F).

The alloys of the system, each weighing 0.3 g, were prepared from the pre-synthesized and identified initial binary compounds by the following procedure: stoichiometric amounts of the initial compounds were fused in an evacuated quartz ampoule at $750^0$C. Then, the alloys were quenched by dropping them into cold water, followed by annealing at various temperatures for 800-100 h at $450^0$C. In addition, a series of alloys from the composition range of 75-100 mol% GeTe were also annealed at $550^0$C.

The experimental results showed the formation in the system of a number of ternary compounds belonging to the homologous series $mBi_2Te_3 \cdot nGeBi_2Te_4$ and $GeBi_2Te_4 \cdot nGeTe$. Representatives of the first row are mixed-layer van der Waals compounds with different alternation of 7 and 5-layer packages. Representatives of the second row are also van der Waals compounds, in which GeTe bilayers are inserted into the $GeBi_2Te_4$ seven-layer and form packets consisting of 9, 11, 13, etc. layers. In the range of compositions > 90 mol% GeTe alloys annealed at 450 $^0$C are solid solutions based on the low-temperature rhombic modification of GeTe, and alloys annealed at 550 $^0$C are solid solutions based on the high-temperature cubic modification of GeTe.

The types and parameters of the crystal lattices of the identified ternary compounds and solid solutions were determined on the basis of powder diffraction patterns.

The work was carried out within the framework of the scientific program of the international laboratory "Promising materials for spintronics and quantum computing", created on the basis of the Institute of Catalysis and Inorganic Chemistry of ANAS (Azerbaijan) and the International Physics Center Donostia (Spain) and partially funded by the EİF / MQM / Elm-Tehsil-1-2016-1 (26) -71 / 01/4-M-33.

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**PP-43**

# THERMODYNAMIC FUNCTIONS OF MELTING AND PHASE TRANSITIONS OF JOINTS $A_8GeX_6$ (A = Ag, Cu; X = S, Se)

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Compounds of the argyrodite family with the general formula $A_8B^{IV}X_6$ (where A-Cu, Ag; $B^{IV}$-Si, Ge, Sn; X-S, Se, Te) have a number of valuable functional properties and are the subject of research by many research groups. A number of representatives of this class have mixed ion-electronic conductivity, which makes them very promising for use in the development of photoelectrode materials, electrochemical solar energy converters, ion-selective sensors, etc. [1-3]. Most of these compounds have phase transitions at relatively low temperatures (40-250 $^0$C). The thermodynamic properties of the phase transitions of these compounds have not been studied.

The aim of this work was to determine the thermodynamic functions of melting and phase transitions of $Ag_8GeS_6$, $Ag_8GeSe_6$, $Cu_8GeS_6$ and $Cu_8GeSe_6$ by DSC.

For the studies, ternary compounds $Ag_8GeS_6$, $Ag_8GeSe_6$, $Cu_8GeS_6$ and $Cu_8GeSe_6$ were synthesized by direct fusion of stoichiometric amounts of the corresponding elementary components of high purity (99.999%) under vacuum in a two-zone mode. Further, the samples were annealed at 500 °C (100 h) and a temperature below the temperature of transitions of phase transitions of compounds (10 h). The synthesized compounds were identified by DTA and XRD. The temperatures and heats of phase transitions in the compounds $Ag_8GeS_6$, $Ag_8GeSe_6$, $Cu_8GeS_6$ and $Cu_8GeSe_6$ were determined by DSC. The studies were carried out on a Linseis DSC400 differential scanning calorimeter using the Linseis TA V 2.3.1 software, and the evaluation processing of the results was carried out using the Linseis TA Evaluation V 2.3.1 software. From the values of the molar enthalpy of phase transitions, the molar entropies of these transitions were calculated. It was found that the entropies of phase transitions of the studied compounds have anomalously high values, which is probably due to the delocalization of silver and copper cations during the transition to the high-temperature ion-conducting cubic modification.

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**PP-44**

# ALKOXYHALOGENATION OF DICHLOROSTYRENES IN UNSATURATED $C_3$-ALCOHOLS AND INVESTIGATION ON LIFE ACTIVITY OF SULPHATEREDUCTION BACTERIA

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One of the effective methods of obtaining β-halo ethers is alkylehalogenation of alkenes with halogen-carrying reagents - N-bromoxukinimide and cystic iodine in alcohol medium. Alkoxyhalogenation of dihalostyrenes with allyl or propargyl alcohol and *N*-bromosuccinimide or crystalline iodine in the presence of clinoptilolite $[(NaK)_4CaAl_6Ci_{30}O_{72}]$ afforded the corresponding unsaturated β-halo ethers with high yields. The reaction of alkoxyhalogenation of allylmethaacrylate with saturated alcohols with the participation of crystalline iodine proceeds chemo- and regioselectively at low temperature. The composition and structure of the synthesized compounds were determined by elemental analysis, IR, $^1H$ and $^{13}C$ NMR spectroscopy. The synthesized compounds have high antimicrobial activity against sulfate-reducing bacteria (SRB) at low concentrations. It has been shown that they are more effective antimicrobial substances and at low concentrations they completely stop the activity of SRB. It was determined that the minimum bactericidal concentration of the obtained compounds. So that, 0.025 and 0.05 ppm.

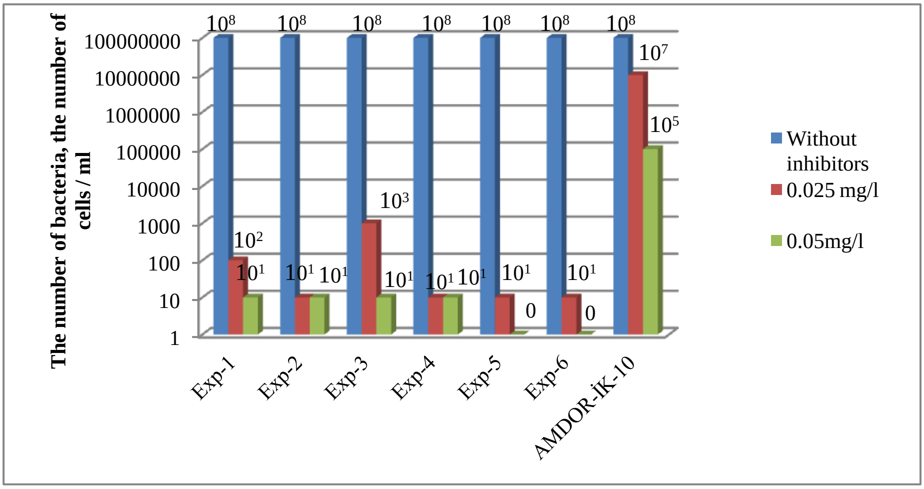

**Fig. 1** Diagram of the influence of samples E-7, E-8 and E-9 on the amount of SRB. 0.05 ppm

As can be seen from the diagram, in the medium without inhibitor the number of bacteria is $n = 1 \times 10^8$, and in an inhibitory medium for 1,3-Dichloro-2-{2-iodo-1-[(prop-2-en-1-yl)oxy]ethyl}benzene (Exp-1) the number of bacteria at a concentration of 0.025 ppm decreases from 1 × $10^8$ to $10^2$ and 0.05 ppm $10^1$. 2,4-Dichloro-1-{2-iodo-1-[(prop-2-en-1-yl)oxy]ethyl}benzene (Exp 2) at all concentration the number of bacteria decreases from 1 × $10^8$ to $10^1$. 1,2-Dichloro-4-{2-iodo-1-[(prop-2-en-1-yl)oxy] ethyl}benzene (Exp 3) at a concentration of 0.025 ppm decreases from 1 × $10^8$ to $10^3$, at a 0.05 ppm$10^1$. 2-{2-Bromo-1-[(prop-2-en-1-yl)oxy]ethyl}-1,3-dichlorobenzene (Exp 4) at a concentrations of 0.025 and 0.05 ppm decreases from 1 × $10^8$ to $10^1$. 1-{2-Bromo-1-[(prop-2-en-1-yl)oxy]ethyl}-2,4-dichlorobenzene (5) the number of bacteria at a concentrations of 0.025 ppm decreases from 1 × $10^8$ to $10^1$ at a 0.05 ppm to 0. 4-{2-Bromo-1-[(prop-2-en-1-yl)oxy]ethyl}-1,2-dichlorobenzene (Exp 6) at a concentrations of 0.025 ppm decreases from 1 × $10^8$ to $10^1$ at a 0.05 ppm to 0.

So that the synthesized β-halo ethers exhibit high bactericidal effect at low concentrations.

**PP-45**

# COMPOUNDS OF $Tl_4LnTe_3$ TYPE - NEW STRUCTURAL ANALOGUES OF $Tl_5Te_3$

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One of the rational ways to develop new functional materials is to search for complex structural analogues of compounds with the same properties.

According to the available literature data [1], the $Tl_5Te_3$ compound crystallizes in the tetragonal system and forms a separate structural type. The unit cell contains 4 formula units. The main elements of the $Tl_5Te_3$ structural type are tellurium octahedra, with thallium -Tl (I) atoms located at their centers. These octahedra, when bonding to the vertices, form a framework of the composition $Tl_4Te_{12}$ or $(TlTe_3)_4$. The remaining 16 thallium atoms, Tl (II), are located in the voids of this framework, link the octahedra along the c axis and form a unit cell with the chemical composition $Tl_{16}$ $(TlTe_3)_4$. When half of the Tl (I) atoms located in the centers of the octahedra are replaced by $B^3$ + cations, compounds of the $Tl_9BTe_6$ type are formed, and when all Tl (I) atoms are replaced by $B^2$ + atoms, $Tl_4BTe_3$. Typical representatives of these types of compounds are $Tl_9$BiTe6, $Tl_9SbTe_6$, $Tl_4SnTe_3$, and $Tl_4PbTe_3$ [2].
Earlier we synthesized thallium telluride - REE of the $Tl_9LnTe_6$ type with the $Tl_5Te_3$ structure [2].

In this work, we report on the preparation and identification of a new class of thallium tellurides - REE with the general formula $Tl_4LnTe_3$ (Ln-Sm, Gd, Dy, Er, Tm)

The syntheses were carried out by direct interaction of stoichiometric amounts of previously synthesized and identified compounds of $Tl_2Te$ and LnTe in evacuated (~ $10^{-2}$ Pa) quartz ampoules at 1000-1100 K, followed by prolonged annealing at 700 K for 1000 h.

Analysis of the powder X-ray diffraction patterns of the obtained samples showed that they have diffraction patterns qualitatively similar to the $Tl_5Te_3$ compound. By indicating them with the help of the Topas V3.0 computer program, their belonging to the tetragonal system was confirmed and the parameters of the unit cells were determined.

Thus, we have established for the first time that both possible types ($Tl_9LnTe_6$ and $Tl_4LnTe_3$) of structural analogs of $Tl_5Te_3$, in which the REE atoms have oxidation states of $^{3+}$ and $^{2+}$, respectively, are realized in the Tl-Ln-Te systems.

The resulting new class of compounds is of interest as potential magnetic and thermoelectric materials with low thermal conductivity.

The work was carried out within the framework of the scientific program of the international laboratory "Advanced materials for spintronics and quantum computing", created on the basis of the Institute of Catalysis and Inorganic Chemistry of ANAS (Azerbaijan) and the Donostia International Physical Center (Spain) and partially funded by the grant EİF / MQM / Elm-Tehsil- 1-2016-1 (26) -71 / 01/4-M-33.

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PP-46

# LUBRICANT COMPOSITION RESISTANT TO BIOLOGICAL DAMAGE

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It is known that motor oils are subject to microbiological damage during operation. In this case, their physical and chemical properties change due to environmental influences (humidity, temperature, etc.) and become unusable. To protect lubricating oils from biodegradation, it is necessary to add biocides to them. According to the literature, there are various ways to protect all living and non-living things around us from biotransformation. These methods are the simplest in terms of economic biocide protection. Although biocides are simple in composition, they are difficult to obtain and have complex structures.

Compounds used in research, which are to some extent significant and soluble in oils, are various derivatives of ethenes. Nitroetenes and their derivatives have been studied and applied in various fields such as biocides. However, there is almost no literature on their study in lubricants. Based on the information in the literature about simple types of nitroethenes, the possibility of using ⟨-phenyl-®-nitroethene and ⟨-furyl-®-nitroethene as antimicrobial additives was investigated. The resulting compounds were first applied to lubricants as antimicrobial additives.

When creating lubricating compositions, various functional additives are used in their composition. The effect of these additives on the development of microorganisms was studied by preparing samples with 0.25% ⟨-phenyl-®-nitroethene biocide in M-10 oil. Based on the results obtained, a biodegradable M-14$B_2$ lubricant for diesel locomotives and industrial diesel engines was developed (table).

**Table.** Results of microbiological tests of lubricant composition

| Composition M-14$B_2$ | Without biocides | | ⟨-phenyl-®-nitroethene biocide 0,25% | |
|---|---|---|---|---|
| | Bacteria | Mushrooms | Bacteria | Mushrooms |
| M-10<br>3,7% AKİ-150<br>1,3% C-150<br>0,7% Viscoplex 2-670<br>1,2% ДФ-11<br>0,7% Viscoplex 5-309<br>0,003% ПМС-200А | +* | + | 1,6-1,8 | 2,3-2,5 |

* (+) Full development of the microorganisms

The effectiveness of the new lubricant composition can be explained by the high effect of the multifunctional detergent, anti-oxidation and anti-corrosion additive AKI-150 with a large number of active elements, especially the synergism of the free electrons of the nitrogen atom with hydroxyl groups. On the other hand, the mobility of sulfur atoms in different conditions of zinc salt of dialkyldithiophosphate can be explained by the fact that its absorption layer on metal surfaces improves the corrosion and oxidation properties of the oil, increases the washing potential, and the addition of biocide has the effect of preventing biodegradation.

**PP-47**

# NANOPARTICLES IN THE PRODUCTION OF ROAD OIL BITUMENSA

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One of the priority areas of economic and social development is the creation of a modern transport infrastructure and, first of all, the road network [1]. For this purpose, it is necessary to increase the production volume and quality of road bitumen.The author [2] shows the possibility of producing bitumen with high quality indicators using various heavy residues. The work [3] summarizes the methods of analysis and application, the technology for the production of road bitumen.At present, research with the use of nanoparticles is of increasing interest. Nanostructuring modifier for asphalt concrete based on carbon nanoparticles can be used in the construction industry for the production of road surfaces. For this purpose, it is of great interest to use the possibility of using nanoparticles in the production of road oil bitumen.As a modifier for organic-based asphalt concrete, there can be bi-tum, carbon nanotubes or carbon black uniformly dispersed in it (in our case, coke breeze calcined at 13500C was taken - a waste of the delayed coking process, which has not yet found qualified application), organoclay in the following ratio of components, wt. %: carbon nanotubes 0.5-1.0, technical carbon, in particular, coke breeze 10-20, organoclay 1-20 or pyrolysis process waste - heavy resin, the rest - bitumen.Achievement of high wear resistance, i.e. the technical result was achieved with the following composition.

The composition of the bitumen composition modifier

| № | taken: Components of raw material | concentration, % mass. |
|---|---|---|
| | Bitumen based modifier: | |
| 1 | Bitumen | 50,00 |
| 2 | Carbon black | 20,00 |
| 3 | Organoclay | 20,00 |
| 4 | Carbon nanotubes (length 0.2-1.0 µm, diameter 1-7.0 nm) | 10,00 |

The decrease in the modifying ability for the modifier, where all nanostructures were replaced by carbon nanotubes, amounted to 32.0-46% of the mass. compared to the optimal composition. The modifying ability means the increase in the compressive strength of the modifying asphalt concrete in comparison with the non-modifying sample. To confirm the results obtained, asphalt concrete mixtures were manufactured and tested. Parameters characterizing the effectiveness of the modifier: compressive strength and safety of this parameter after 50 freeze-thaw cycles, imitating the natural cycle, showed the effectiveness of the study: an increase in the durability of asphalt concrete, a high economic effect due to a reduction in repair work.

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**PP-48**

# SYNTHESIS OF AMINOMETHYL DERIVATIVES OF BUTYL ETHER OF p-OXIBENZOIC ACID AND STUDY OF THEIR ANTIMICROBIAL PROPERTIES

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Esters of para-hydroxybenzoic acid, due to their antiseptic and antimicrobial properties called "parabens", are widely used as preservatives in pharmaceutical, cosmetic and food industries. The content of the most common of them under the code E-218 - methyl paraben, E-214 - ethylparaben, E-216 - propylparaben can be seen in the last place in the chain of ingredients of these products. The ancestor of all parabens is benzoic acid, which has been used as a preservative for over 400 years [1].

Information on the antiseptic activity of parabens served as the basis for the synthesis of their aminomethyl derivatives in order to study the effect of the alkoxymethyl group on the antimicrobial activity of the derivatives obtained. Butylparaben was used as a starting material, i.e. para-hydroxybenzoic acid butyl ester. Aminomethylation was carried out with methylene-bis-amines (or Boehme amines), which are effective aminomethylating agents at a temperature of 60-70 ° C in the presence of catalytic amounts of trifluoroacetic acid with a 1: 1 ratio of starting reagents.

The structure of the synthesized derivatives was confirmed by 1H– NMR and IR– spectroscopy. In 1H NMR spectra of the obtained aminomethyl derivatives in the region of 3.8 ppm. in the form of a singlet, a signal corresponding to the integral curve of two protons in the PhCH2N group is observed, and the chemical shift is at 2.58 or 2.65 ppm. corresponds to 4H in the N (CH2) 2 group. In the IR spectra in the region of 1050, 1045, 1120 cm-1, stretching vibrations of the C-N bond are observed, in the region of 1285 cm-1, stretching vibrations of the group, which indicates the aminomethylation of the initial ester.

The study of the antimicrobial properties of the synthesized aminomethyl derivatives was carried out against microorganisms affecting diesel fuel in accordance with GOST 9.023-74. The tests used the most aggressive strains of pure cultures of the bacterium Pseudomonas aeruginosa and the fungus Cladosporium resinae.

As a result of microbiological tests, it was found that the synthesized series of derivatives of p-hydroxybenzoic acid butyl ester possesses antimicrobial properties and, at a concentration of 0.5%, provides complete protection of diesel fuel from bacterial attack. Parallel studies of the original butylparaben showed that it is absolutely ineffective against either the specified bacteria or the fungal strain.

The observed bactericidal activity of aminomethyl derivatives, in contrast to the ineffective initial butylparaben, can apparently be explained by the alkylating (aminomethylating) effect on the proteins of the microbial cell of the aminomethyl group of the synthesized compounds, leading to the death of the microorganism.

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**PP-49**

# STUDY OF PROCESSED GEAR OILS

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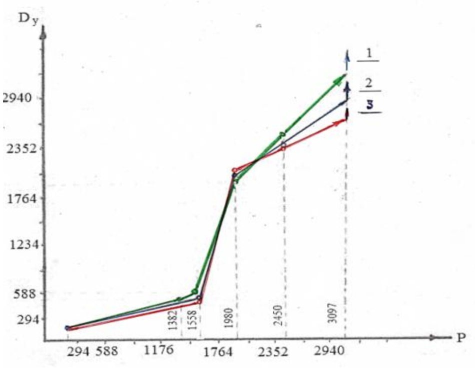
The rational and economical use of petroleum products and the aggravated problems of environmental protection pose challenges for the recycling of waste products of the oil industry. In the course of long-term operation, oils under the influence of working conditions undergo strong changes, including chemical transformations. In this regard, there is a need to improve technological processes for the regeneration of materials to the level of commercial ones.

Gear oils taken at the Karadag Cement Plant of Holcim-Azerbaijan OJSC were selected as the object of regeneration. Evaluation of extreme pressure and anti-wear properties of commercial and used oil samples is carried out according to GOST 9490-75 on a four-ball friction machine ChMT-1.



1. Energol GR-XP 680
2. Energol GR-XP 680 (after work 24 months)
3. Energol GR-XP 680 (after work 48 months)

The study of the obtained data showed that both samples of oils have high extreme pressure and moderate antiwear properties, and slightly improved lubricating properties. Comparison of the tribological properties of the oils showed that they differ insignificantly in the critical load Pk and the wear diameter Di.

Thus, it was revealed that the Energol GR-XP 680 oil, used for different periods of time (24 months and 48 months), retains the basic physicochemical indicators, while an increase in the service life and duration of the gear oil is observed during operation, which helps to save valuable resources.

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**PP-50**

# SORPTION OF OIL AND OIL PRODUCTS FROM AQUATIC ENVIRONMENT BY SWELLING HYDROPHOBIC POLYMER GELS

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Oil spills in accidents of tankers and piping pose serious threat to the environment, leads to a loss of energy and heavily pollute the sea water. Currently, pollution of surface water bodies with oil hydrocarbons occurs not only during emergency oil spills, but also during routine maintenance, which increases the technogenic load on the ecosystem. Therefore, the process of the rapid removal of oil pollution from the surface of the water becomes especially important.

Research and development on the elimination of the consequences of oil accidents include a large number of experiments to evaluate the effectiveness and efficiency of various methods of protection and purification of sea water. The urgent way to solve this problem is the search for materials suitable both for collecting oil from the water surface and for treating industrial wastewater. Cleaning the surface of water bodies from contamination involves removing the oil film by mechanical and (or) physico-chemical methods.

One of the effective tools that are successfully used to solve the problem associated with the elimination of the consequences of pollution is its mechanical extraction by the sorption mechanism. The advantages of the sorption method include the ability to remove contaminants of any nature to almost any residual concentration, as well as process control.

The quality of oil sorbents is determined mainly by oil absorption, water absorption and buoyancy, and the effectiveness of sorbents for skimming oil is estimated by the value of oil sorption capacity, oil sorption (absorption) rate, oil retention, recovery of sorbed oil and reuse of the sorbent.

Liquidation of oil films is carried out using various sorption materials, such as natural organic, inorganic and synthetic sorbents (for example: polypropylene, polystyrene, styrene copolymers, polyurethane, melamine-formaldehyde resin, polyalkoxysilanes, chitosan, petrogels, polyacrylamide). Due to its biodegradability, environmental friendliness and accessibility, sorbents from organic products have greater potential than commercial synthetic sorbents.

Particular attention is paid to the aminopolysaccharide chitosan, which is very popular today, it is especially widely used in medicine and cosmetics. A crosslinked chitosan airgel was obtained as an environmentally friendly absorbent by crosslinking and freeze drying. Compared with conventional sorbents, porous chitosan airgel has unique properties - low density, high porosity and high adsorption.

Chitosan airgel is also reusable and flexible with maximum recovery of thickness after unloading. It showed a high adsorption capacity for crude oil and diesel fuel. Airgel can absorb a wide range of organic solvents and oils depending on their density and viscosity.

The aim of our further research work is to study the properties of oil sorption from aqueous media by swelling polymer gels, and in particular, sorbents based on chitosan and its derivatives.

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**PP-51**

# SYNTHESIS OF ORGANYLTIOMETYL-1,3-DIOXOLANES AND RESEARCH AS A PROTECTIVE ADDITION TO LUBRICATION OILS

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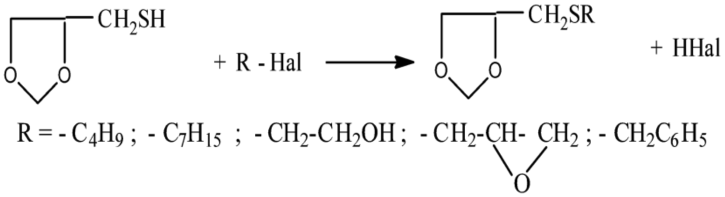
Tractors, aircraft and other types of equipment are interrupted during operation, and during this period, unless special protective measures are taken against electrochemical corrosion under the oil layer on the lubricated surfaces of metals, its development is inevitable. The main method of combating damage to the surface of metals are lubricants that contain an effective protective additive.

Preservative additives added to lubricants are usually some organic compounds that contain N- and S-. Thus, these compounds have a high absorption activity, giving them a passive property in contact with the metal. Therefore, these compounds show effective protective properties under harsh conditions of operation, ie under conditions of joint action, such as intensive friction regimes.

The report presents the results of research work on the search for new effective preservatives and studied the relationship between the structure of compounds and their preservative properties.

The raw material taken as the object of study was synthesized by the action of 4-chloromethyl-1,3-dioxolane with potassium hydrosulfide (KHS) according to the following scheme:

A number of 4-organylthiomethyl-1,3-dioxolanes were obtained from the interaction of 4-mercaptomethyl-1,3-dioxolan with organillogenides:



$R = -C_4H_9;\ -C_7H_{15};\ -CH_2\text{-}CH_2OH;\ -CH_2\text{-}CH\text{-}CH_2;\ -CH_2C_6H_5$

The composition and structure of 4-Mercaptomethyl-1,3-dioxolan and its organylsulfide derivatives were determined by elemental analysis and NMR-spectroscopy.

The synthesized 4-organylthiomethyl-1,3-dioxolanes were tested as a protective additive to lubricants. The tests were performed and evaluated in a humidity chamber (G-4), sea water and 0.1% solution of HBr acid, which is included in the complex research system in accordance with GOST 9.054-75.

It has been found that when these compounds are added to the oil in an amount of 1%, the protective effect of the oil increases. The effectiveness of the compounds is practically the same as, but in some cases superior to, that of industrial additives SIM (alkenylsuccinimylcarbamide).

Thus, studies show that some representatives of 4-organylthiomethyl-1,3-dioxolanes can be used as a preservative in the creation.

**PP-52**

# CORROSION PROTECTION OF STEEL SAMPLES IN SEAWATER

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For the first time, phenol-formaldehyde oligomers (MFFO), modified by organic compounds containing elements such as nitrogen, chlorine, bromine, sulfur, etc., were used as an inhibitor in the corrosion protection of equipment and facilities operated in two-phase systems and as a coordinator in the preparation of lacquer-paint coatings [1-4].

During the research work, analyses were carried out to protect steel samples from corrosion in water taken from different zones of the Caspian sea. It is known that the composition of sea water consists of salts of various metals and oxygen. Because of this, steel is corroded, water-soluble salts are exposed to the surface, and oxygen is depolarized. As a result, an increase in the concentration of chlorine and sulfate ions in the system destroys the protective coating of the metal. At this time, the corrosion rate increases, but increasing the salt concentration reduces the solubility of oxygen, which weakens the corrosion rate of steel. Since seawater contains about 8-10 mg/l of oxygen, it has a high electrical conductivity and electro-chemical corrosion is inevitable. This type of corrosion is the most common type of corrosion. When the temperature of sea water increases, the rate of corrosion increases, which is caused by an increase in the speed of the electro-chemical reaction. When the temperature rises from 10 ºC to 30 ºC, the corrosion rate increases by 2 times. Steel-3 samples were taken from Bayil port, Hovsan and Novkhani as research object and phenol-formaldehyde oligomer modified with seawater and carbamide. It was found that water samples taken from three zones of the Caspian Sea differ from each other in composition and are different in the form of corrosion occurring in steel samples. Modified with carbamide, it was used as a coordinating agent on the basis of three times decrease in the amount of free phenol and formaldehyde and twice increase of adhesive capacity in FFO. Industrial waste bauxite slurry was used as a filler in the preparation of FFO-based coating composition modified with carbamide. The effect of the amount of bauxite slurry on the physical-mechanical and operational parameters of the prepared coating composition has been studied. The amount of the filler in the composition was taken in the range of 2,5-10 parts of the mass, and the best indicators were obtained when 5 parts of the mass. The adhesive strength of the coating composition is 3,0 MPa, the hardness is 0.8 conventional unit, the elasticity is 5 mm. In sea water, steel samples (both coated and non-coated) were stored for 3 months, then (corrosion rate determined by gravimetric method) corrosion rate was 1.094 and 0.284 $g/m^2 \cdot$ hours.

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**PP-53**

# PHASE COMPOSITION OF NANOSTRUCTURED NICKEL-CONTAINING NAX ZEOLITE IN THE REACTION OF OXIDATIVE DEHYDROGENATION OF PROPANOL

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Phase composition of NiX (1-10 wt.%) NaX samples was tested in oxidative dehydrogenation of the propanol. It was shown that the oxidation- reduction processing conditions allow the optimizing the phase composition and size of active component, which makes it possible to regulate the yield of target products and reduce the temperature threshold of the reaction. XRD D2, Bruker diffractometer and EMX, Micro, Bruker spectrometer, Germany, were used to determine the phase composition of the catalysts and magnetic properties of the samples before and after catalytic cycle. The composition of the reaction products was controlled by means of LXM-80 chromatograph (Russia). The dependence of catalytic activity of created systems in oxidative dehydrogenation of the propanol on reaction temperature and amount of active component was studied. It was determined that nanostructured NiO particles with active oxygen are active phase in obtained systems. The approaches to the synthesis of nanostructured catalysts with mentioned properties and methods of the controlling size-dependent catalytic properties are discussed.At present, developed zeolite modifying methods, including ion exchange, changing the composition of crystal lattice, etc., provide wide opportunities for aimed regulation of their acid- base and oxidation- reduction properties. In addition, methods for obtaining effective catalysts are also developed; and these methods are based on the application into the structure of zeolites of guest particles with different nature. Within this approach the creation of zeolite- oxide systems, containing active components in highly dispersed state, is studied. Use of the nanomaterials based on the zeolites allows to regulate the placing of applied particles and control their properties at the micro level. The formation of clusters of oxides of different elements, ranging from alkali metals to platinum group, provides new opportunities for the creating active centres with unusual properties. The data gathered over the past two decades on the features of catalytic reactions in the systems containing nanometre-sized particles became the base for the formation of new prospective direction – catalysis by nanoparticles.

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**PP-54**

# THE IMPACT OF THE CORONAVIRUS (COVID – 19) PANDEMIC ON THE ECOLOGY OF AZERBAIJAN AND OTHER COUNTRIES

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The coronavirus crisis slowed down economic activity in many countries, which automatically led to a decrease in the ecogenic (technogenic) industrial load on the environment.

According to the analysis, in the first thirty days of quarantine, the level of pollution by nitrogen dioxide decreased in Europe by an average of 40%. Contaminants began to disappear in the air over Baku. In the city center, the average concentration of carbon monoxide decreased three times, and suspended particles PM10 - 5.8 times.

Earlier, such a trend was noted in China and a number of European cities, where due to coronavirus reduced car traffic and stopping industrial production.

In February, NASA and the European Space Agency satellites recorded that in China, air improved significantly: the cloud of pollution on these maps literally dispersed. In Europe, where the virus moved from China also began to notice positive changes associated with a decrease in the number of cars on the streets. For the first time in a long time in March 2020, the water in the canals of Venice became so clear that you can see the fish swimming under water, the swans returned, who had not been there for many years.

Satellite images that capture traces of human activity show a dramatic decrease in pollution levels in Azerbaijan, Russia, China, Italy and the United States since the outbreak of the corona virus.

Taken data from the Center for Energy and Clean Air Research (CREA) show that from February 3 to March 1, CO2 emissions in China fell by at least 25%. Seven of the 10 cities that were previously considered the most polluted in the world had significant improving air quality.

In particular, in New Delhi, which often leads in the ranking of the most polluted cities in the world, the air cleared by 23%, and in the capital of South Korea - Seoul - by 54%. One of the main conclusions of the study is that industry and energy occupy a significant place in environmental pollution. Based on these, we can conclude that the scientific direction “Research and development of methods to reduce the technogenic (ecogenic) loads of the oil refining and petrochemical production” remains relevant.

**PP-55**

# GEOCHEMICAL CONDITION OF THE LANDSCAPES AND THEIR IMPACT ON HUMAN HEALTH (on an example Kura lowland)

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Geochemistry of landscapes studies the migration patterns of chemical elements in the Earth's geographical envelope. It deals with the patterns of matter migration in the Earth's shell, which is the human habitat.

Geochemistry of the landscape, as well as geochemistry in general, uses three methodological approaches. The first is to study the migration of chemical elements in different landscapes. The second approach is a systematic study of the types of elemental and geochemical landscapes of the biosphere and the nonosphere as a whole, the behaviour of paragenic associations of elements in forest, steppe, tundra and other modern natural landscapes, as well as in landscapes of past geological eras.

The article is devoted to the study of the peculiarities of the geochemical transformation of landscapes of the Kura intermountain basin based on the patterns of concentration and migration of macro-compounds and trace elements found in samples of mountain rocks, soil, plants and water, for which a comparative method of research and the relationship of landscape components was used.

- In the landscapes of Kura lowland bruseliosis is very widespread, digestive system and nervous diseases are widespread diseases.

-In hyacinth, forest-desert, grass-bushes and bush landscapes of the accumulative plains, hypertension is very wide, malaria and respiratory diseases are common, dysentery, brucellosis and conjunctivitis.

- The most common diseases in the desert, desert and arid denidation landscapes of low mountains and slopes are not common. Dental caries, malaria and respiratory tract diseases are widely spread here, dysentery, bruseliosis, hypertension and conjunctivitis are less common.

- In the arid forest, forest bush and slopes-desert landscapes complex of the lowlands, the most common diseases of oncological diseases, cardiovascular and respiratory tract are malaria and hiportolic diseases. Dysentery, brucellosis, conjunctivitis, and digestive tract disorders are characterized by low-spread disease.

Because of the anthropogenic transformation of natural landscapes in the Kura mountainous basin, changes in natural geochemical conditions of the landscapes were assessed as weak, moderate and strong (3 levels). The analysis of the large-scale medical ecochemical landscape mapping on this basis revealed that the risk geography of a number of diseases (brucellosis, cardiovascular, hypotonia, etc.) has changed in accordance with ecogeochemical conditions.

**PP-56**

# NEURAL NETWORKS – BASED MUNICIPAL SOLID WASTE FORECASTING

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Starting in Azerbaijan in 2008 there is a steady growth of indicators of the formation of deviations, corresponding to the dynamics of the increase of the state of population. It is important to note that regardless of the classification of the World Bank of Azerbaijan relates to the countries with the average level of income, i.e. The specific growth potential of SHW in the country is significant, but has not been realized yet. It is possible to expect that the growth of individual indicators of waste formation will be preserved in the near future and will be stabilized in a few years. Growth will be able to increase the population's well-being and change consumer behavior. [1]

Within the framework of the forecast of growth of GDP for the near future in the course of 10 years it is possible to expect the achievement of saturation points at the level of up to 400 kg of SHW per person per year. Dependence on the volume of education deviations from the level of well-being has been confirmed by international comparisons. Average allocated volumes of SHW education in countries with a large income are characterized by a large specific volume of waste disposal . According to the data received, countries with a large income are characterized by a large share of expenditures. In addition, according to the size of revenues, the share of organ-Czech expenditures in the SHW is reduced, and the fractions that are suitable for processing are increased. [2]

The use of traditional methods of forecasting does not always allow to ensure a satisfactory result. In connection with this widespread distribution received information technology, allowing to receive the necessary analytical information. One of the most promising areas is the technology of artificial intelligence. The best results in forecasting show technologies based on the use of artificial neural networks.

The use of artificial neural networks is recognized as one of the most promising methods intended for the study of sociological, biological, ecological, financial, economic and other disciplines. Such systems represent the result of the influence of a multitude of factors, including the human, which is considered a practically impossible creation of a complete mathematical model, which would have taught all the existing things. [3]

Neural networks are used to predict the dependence of gross national income on solid household waste. The task was implemented in the MATLAB package. The results obtained allow to predict the nearest years.

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