Scientific Program
III Scientific-Technological Symposium
CATALYTIC HYDROPROCESSING IN OIL REFINING

Lyon, France, April 16-20, 2018

Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia

Institute of Research on Catalysis and Environment in Lyon, France

IFP Energies Nouvelles, Lyon, France

Institute of Hydrocarbons Processing SB RAS, Omsk, Russia

PJSC Gazprom Neft, St. Petersburg, Russia

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Boreskov Institute of Catalysis SB RAS
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Belgium

Symposium Proceedings:
CATALYSIS TODAY Journal (Elsevier)

GENERAL SYMPOSIUM SPONSOR

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Dr. Jan Verstraete	IFP Energies nouvelles, Lyon, France
Professor Andrey Zagoruiko	Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia

April 16, Monday

AMPHITHEATER St. IRENEE Hall

9.45 Symposium Opening

PLENARY LECTURES

Chairperson – Professor Oleg Martyanov, Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia

10.00
PL-1
Professor Jean-Pierre Gilson
ENSICAEN, Laboratory for Catalysis & Spectrochemistry, Caen, France
DESIGNER ZEOLITES FOR HYDROPROCESSING: BETTER, SMALLER, MORE ACCESSIBLE & AFFORDABLE

10.45
PL-2
Dr. Benoit Celse, Costa V., Dallerit V., Becker J., Bertier L., Guillaume D.
IFP Energies nouvelles, Solaize, France
KINETIC MODELING OF HYDROCRACKING PROCESSES

11.30 Coffee-break

KEYNOTE LECTURES

Chairperson – Professor Jorge Ancheyta, Mexican Petroleum Institute, Mexico City, Mexico

11.45
KL-1
Kovtunov K.V., Zhivonitko V.V., Salnikov O.G., Burueva D.B., **Professor Igor Koptyug**
International Tomography Centre SB RAS, Novosibirsk, Russia
NMR SPECTROSCOPY AND IMAGING OF HYDROCARBON CONVERSION PROCESSES

12.15
KL-2
Professor Kake Zhu, Xing-Gui Zhou
East China University of Science and Technology, Shanghai, China
ZEOLITES WITH HIERARCHICAL PORE STRUCTURE FOR HYDROCARBON FEEDSTOCK PRODUCTION

12.45 Lunch

ORAL PRESENTATIONS
Session 1

Chairperson – Professor Carole Lamonier, Unité de Catalyse et Chimie du Solide, Villeneuve d'Ascq, France

Chairperson – Professor Andrey Zagoruiko, Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia

14.00
OP-1
Maximov A.L.[1,3], Onishchenko M.I.[1], Panyukova D.I.[1,2], Sizova I.A.[1]
CATALYSTS FOR HYDROPROCESSING SYNTHESIZED USING SULFONIUM SALTS
[1]*A.V. Topchiev Institute of Petrochemical Synthesis RAS, Moscow, Russia*
[2]*D. Mendeleyev University of Chemical Technology of Russia, Moscow, Russia*
[3]*M.V. Lomonosow Moscow State University, Moscow, Russia*

14.15
OP-2
Nguyen M.T.[1], **Pirngruber G.D.[1]**, Chainet F.[1], Albrieux F.[1], Tayakout-Fayolle M.[2], Geantet C.[3]
MOLECULAR LEVEL INSIGHTS IN HEAVY GAS OIL HYDRODENITROGENATION BY FOURIER TRANSFORM ION CYCLOTRON RESONANCE MASS SPECTROMETRY
[1]*IFP Energies nouvelles, Solaize, France*
[2]*Université Claude Bernard Lyon 1, Villeurbanne, France*
[3]*Institute of Research on Catalysis and Environment in Lyon, France*

14.30
OP-3
Nadeina K.A.[1], Kazakov M.O.[1], Kovalskaya A.A.[1], Stolyarova E.A.[1], Prosvirin I.P.[1], Danilova I.G.[1], Gerasimov E.Y.[1], Klimov O.V.[1], Kondrashev D.O.[2], Kleimenov A.V.[2], Noskov A.S.[1]
THE INFLUENCE OF B and P ON THE PROPERTIES of NiMo/γ-δ-Al_2O_3 VGO HYDROTREATING CATALYSTS
[1]*Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia*
[2]*PJSC «Gazprom Neft», St. Petersburg, Russia*

14.45
OP-4
Lee Y.
ACTIVE PHASE OF DISPERSED MoS_2 CATALYST IN HYDROCRACKING OF VACUUM RESIDUE
Dankook University, Yongin, South Korea

15.00
OP-5
Nikulshina M.[1,2], Mozhaev A.[2], Lancelot C.[2], Blanchard P.[2], Fournier M.[2], Payen E.[2], Briois V.[3], Nikulshin P.[2,4], Marinova M.[5], Lamonier C.[2]
INVESTIGATION OF Mo_xW_{1-x}/Al_2O_3 CATALYSTS BASED on $SiMo_xW_{12-x}$ HETEROPOLYACID IN HYDRODESULFURIZATION OF DIBENZOTHIOPHENE AND 4,6-DIMETHYLDIBENZOTHIOPHENE
[1]*Samara State Technical University, Samara, Russia*
[2]*University Lille 1, Lille, France*
[3]*Synchrotron SOLEIL, Gif sur Yvette, France*
[4]*All-Russian Research Institute of Oil Refining, Moscow, Russia*
[5]*Institut Chevreul, University of Lille & CNRS, Villeneuve d'Ascq, France*

15.15
OP-6
Diaz de Leon J.[1], Alonso-Nuñez G.[1], Zepeda T.[1], Geantet C.[2], de los Reyes J.A.[3], Fuentes S.[1]
UV-vis INSIGHT ON THE SUPPORT EFFECTS FOR THE DISPERSION OF SUPPORTED WO_X AS HDS CATALYSTS
[1]*National Autonomous University of Mexico, Center for Nanoscience and Nanotechnology, Ensenada, Mexico*
[2]*Institute of Research on Catalysis and Environment in Lyon, Lyon, France*
[3]*UAM-Iztapalapa, Mexico City, Mexico*

15.30
OP-7
Kazakov M.[1], Nadeina K., Dik P.[1], Pereyma V.[1], Klimov O.[1], Danilova I.[1], Gerasimov E.[1], Prosvirin I.[1], Dobryakova I.[2], Knyazeva E.[2,3], Ivanova I.[2,3], Kondrashev D.[4], Kleimenov A.[4], Noskov A.[1]
NiMo/USY-Al_2O_3 HYDROCRACKING CATALYSTS WITH HIERARCHICAL ZEOLITES OBTAINED BY RECRYSTALLIZATION
[1]*Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia*
[2]*M.V. Lomonosow Moscow State University, Moscow, Russia*
[3]*A.V. Topchiev Institute of Petrochemical Synthesis RAS, Moscow, Russia*
[4]*PJSC «Gazprom Neft», St. Petersburg, Russia*

15.45
OP-8
Afanasiev P.[1], Saturnino D.[1], Geantet C.[1], Minoux D.[2], Grasso G.[2]
UNDERSTANDING OF THE RELATIONSHIP BETWEEN THE PHYSIC-CHEMICAL STRUCTURE AND ACTIVITY OF AGED INDUSTRIAL HDS CATALYSTS
[1]*Institute of Research on Catalysis and Environment in Lyon, Lyon, France*
[2]*Total Research & Technology, Feluy, Belgium*

16.00
OP-9
Pimerzin Al.A., Roganov A.A., Pimerzin A.A.
COMPARISON OF Pt-BASED AND TMS CATALYSTS FOR N-HEXADECANE HYDROISOMERIZATION
Samara State Technical University, Samara, Russia

16.15 Coffee-break

16.30
Round Table
MAJOR TRENDS AND LONG-TERM PROSPECTS FOR DEVELOPMENT OF HYDROPROCESSING CATALYSTS AND TECHNOLOGIES

Chair and moderator:
Professor Gilbert Froment, Belgium

18.30 Exhibition Opening

19.00 Welcome Reception

April 17, Tuesday

PLENARY LECTURES

Chairperson – Professor Jean-Pierre Gilson, University of Caen, Laboratoire Catalyse & Spectrochimie, Caen, France

9.00
PL-3
Professor Pedro Pereira-Almao
University of Calgary, Canada
IN THE PATH FOR [CATALYTIC] FIELD UPGRADING: WHAT WORKS AND WHAT DOESN'T

9.45
PL-4
Professor Oleg Martyanov
Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia
THE STABILITY AND EVOLUTION OF HEAVY OIL SYSTEMS STUDIED VIA ADVANCED METHODS IN SITU

10.30 Coffee-break

ORAL PRESENTATIONS
Session 2

Chairperson – Dr. Michael Brodeur-Campbell, Honeywell UOP, Chicago, USA

10.45
OP-10
Marafi A., Al-Bazzaz H.A., Rana M.S.
HYDROPROCESSING OF HEAVY RESIDUAL OIL: OPPORTUNITIES AND CHALLENGES
Kuwait Institute for Scientific Research, Kuwait City, Kuwait

11.00
OP-11
Shkurenok V.A.[1], Smolikov M.D.[1,2], Yablokova S.S.[1], Kir'yanov D.I.[1], Belyi A.S.[1,2]
Pt(Pd)/WO_3/ZrO_2 CATALYSTS FOR NOVEL HYDROPROCESS OF C_7-FRACTION ISOMERIZATION
[1]*Institute of Hydrocarbons Processing SB RAS, Omsk, Russia*
[2]*Omsk State Technical University, Omsk, Russia*

11.15
OP-12
Munirathinam R., Uzio D., G. Pirngruber, Devers E., **Laurenti D.**
HYDROTREATING CATALYST SUPPORTED ON ALUMINA COATED WITH BIO-INSPIRED POLYMERS
Institute of Research on Catalysis and Environment in Lyon, Lyon, France

11.30
OP-13
Vatutina Y.V., Stolyarova E.A., Nadeina K.A., Danilova I.G., Gerasimov E.Y., Prosvirin I.P., Klimov O.V.
INFLUENCE OF THE WAY OF THE PHOSPHORUS ADDITION ON PROPERTIES OF CoMo-CATALYSTS FOR HYDROTREATING
Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia

11.45
OP-14
Arancon R.[1], Bonduelle- Skrzypczak A.[1], Legens C.[1], Searles K.[2], Fedorov A.[2], Briois V.[3], Copéret C.[2], Raybaud P.[1]
A CONTROLLED SURFACE CHEMISTRY APPROACH TO THE SYNTHESIS OF HIGHLY ACTIVE Mo HYDROTREATING CATALYSTS
[1]*IFP Energies nouvelles, Solaize, France*
[2]*ETH Zurich, Zurich, Switzerland*
[3]*Synchrotron SOLEIL, Gif sur Yvette, France*

12.00
OP-15
Pereyma V.Y., Dik P.P.
THE EFFECT OF THERMAL PRETREATMENT ON THE PERFORMANCE OF NiW HYDROCRACKING CATALYSTS
*Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russi*a

12.15
OP-16
Al-Dalama K., Al-Sheeha H., Rajasekaran N.
EFFECT OF THE HYDROTHERMAL TREATMENT ON THE PROPERTIES OF ALUMINA SUPPORTS AND HYDROPROCESSING CATALYSTS
Kuwait Institute for Scientific Research, Adan, Kuwait

12.30
OP-17
Glotov A.[1], Stavitskaya A.[1], Levshakov N.[1], Anikushin B.[1], Ivanov E.[1], Vinokurov V.[1], Lvov Y.[1,2]
MESOPOROUS SILICA ARMED WITH HALLOYSITE NANOTUBES: SYNTHESIS, THERMAL AND MECHANICAL STABILITY, CATALYTIC APPLICATION
[1]*Gubkin Russian State University of Oil and Gas, Moscow, Russia*
[2]*Institute for Micromanufacturing, Louisiana Tech University, Ruston, USA*

12.45 Lunch

KEYNOTE LECTURES

Chairperson – Professor Pedro Castaño, University of the Basque Country, Bilbao, Spain

14.00
KL-3
Dr. Leon C.A. van den Oetelaar, Eijsbouts S.
Albemarle Catalysts Company BV, Amsterdam, The Netherlands
STEM-EDX CHARACTERIZATION OF SULFIDIC HYDROPROCESSING CATALYSTS

14.30
KL-4
Chen J., Alvarez-Majmutov A., **Dr. Cécile Siewe**
Natural Resources Canada, CanmetENERGY, Devon, Alberta, Canada
UPGRADING AND REFINING OF CANADIAN OIL SANDS BITUMEN – RESEARCH AT CanmetENERGY, NATURAL RESOURCES CANADA

ORAL PRESENTATIONS
Session 2

Chairperson – Dr. Abdulazim Marafi, Kuwait Institute for Scientific Research, Kuwait City, Kuwait

15.00
OP-18
Oliviero L.[1], Pedraza Parra C.[1,2], Chouaref N.[2], Maugé F.[1], Geantet C.[2], Afanasiev P.[2]
Re-ACTIVATION OF AGED AND REGENERATED HDS CATALYSTS: INFRA-RED CHARACTERIZATIONS OF ACTIVE SITES
[1]*Normandy University, ENSICAEN, UNICAEN, CNRS, Laboratory for Catalysis & Spectrochemistry, Caen, France*
[2]*Institute of Research on Catalysis and Environment in Lyon, Lyon, France*

15.15
OP-19
Kovalskaya A.A.[1], Kazakov M.O.[1], Nadeina K.A.[1], Danilevich V.V.[1], Klimov O.V.[1], Fedotov K.V.[2], Kondrashev D.O.[2], Kleimenov A.V.[2], Noskov A.S.[1]
DEVELOPMENT OF GUARD-BED CATALYST FOR SILICON REMOVAL FROM MIDDLE DISTILLATES
[1]*Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia*
[2]*PJSC «Gazprom Neft», St. Petersburg, Russia*

15.30
OP-20
Stolyarova E.A., Budukva S.V., Klimov O.V., Chesalov Yu.A., Larina T.V., Gerasimov E.Y., Noskov A.S.
CoMoP/Al_2O_3 HYDROTREATING CATALYSTS: EFFECT OF THE METHOD OF PHOSPHORUS ADDITION TO THE IMPREGNATION SOLUTION
Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia

15.45
ADVERTISING PRESENTATION

Dr. Liana Socaciu-Siebert, Alekseeva Yu., Meyer M., Dietrich P., Stephan Bahr S., Thissen A.
EnviroESCA – ROUTINE SURFACE ANALYSIS UNDER ENVIRONMENTAL CONDITIONS
SPECS Surface Nano Analysis GmbH, Berlin, Germany

Flash presentations

Chairperson – Dr. Maxim Kazakov, Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia

16.15 Coffee-break

PART-DIEU FOURIER Hall

Poster session

18.00 Lyon city tour

April 18, Wednesday

PLENARY LECTURES

Chairperson – Professor Pedro Pereira-Almao, University of Calgary, Canada

9.00
PL-5
Dr. Pascal Raybaud
IFP Energies nouvelles, Lyon, France
A MOLECULAR VIEW OF THE KEY COMPONENTS AND FUNCTIONS OF HYDROPROCESSING CATALYSTS

9.45
PL-6
Professor Dr. Ir. Emiel J.M. Hensen
Eindhoven University of Technology, The Netherlands
HIERARCHICAL ZEOLITES FOR HYDROCARBON CONVERSION

10.30 Coffee-break

ORAL PRESENTATIONS
Session 3

Chairperson – Professor Sergio Fuentes, National Autonomous University of Mexico, Center for Nanoscience and Nanotechnology, Ensenada, Mexico

10.45
OP-21
Lysikov A.I.[1,2], Semeykina V.S.[1,2], Polukhin A.V.[1,2], Parkhomchuk E.V.[1,2], Kleimenov A.V.[3], Fedotov K.V.[3]
THREE-STAGE HEAVY OIL HYDROPROCESSING OVER MACROPOROUS CATALYSTS
[1]*Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia*
[2]*Novosibirsk State University, Novosibirsk, Russia*
[3]*PJSC «Gazprom Neft», St. Petersburg, Russia*

11.00
OP-22
Shaverina A.V., Dik P.P., Pereyma V.Y., Kazakov M.O.
HYDROCONVERSION OF OIL SHALES: EFFECT OF MINERAL MATRIX ON KEROGEN CONVERSION AND PRODUCT YIELD
Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia

11.15
OP-23
Sosnin G.A.[1,2]**,** Yeletsky P.M.[1], Zaikina O.O.[1,2], Yakovlev V.A.[1]
HEAVY OIL UPGRADING VIA CATALYTIC STEAM CRACKING IN THE PRESENCE OF Ni- and Mo-BASED DISPERSED CATALYSTS
[1]*Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia*
[2]*Novosibirsk State University, Novosibirsk*, *Russia*

11.30
OP-24
Yeletsky P.M.[1], Ramírez Reina T.[2], Bermúdez Menendez J.[3], Arcelus-Arrillaga P.[3], Millan M.[3], Yakovlev V.A.[1]
CATALYTIC CRACKING OF ANTHRACENE AND PHENANTHRENE IN SUPERCRITICAL WATER ENVIRONMENT
[1]*Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia*
[2]*University of Surrey, Guildford, United Kingdom*
[3]*Department of Chemical Engineering, Imperial College London, London, United Kingdom*

11.45
OP-25
Tavizon-Pozos J.A., **de los Reyes J.A.**
EFFECT of Co AMOUNT in CoMo/Al_2O_3-TiO_2 FOR HYDRODEOXYGENATION OF PHENOL
Metropolitan Autonomous University-Iztapalapa, Mexico City, Mexico

12.00
OP-26
Varakin A.N.[1], Fosler A.V.[1], Pimerzin A.A.[1], Nikulshin P.A.[1,2]
PREPARATION OF UNSUPPORTED CARBON-CONTAINING MoS_2 CATALYSTS FOR HYDRODEOXYGENATION OF OLEIC ACID
[1]*Samara State Technical University, Samara, Russia*
[2]*All-Russian Research Institute of Oil Refining, Moscow, Russia*

12.15
OP-27
Valdés-Martínez O.U.[1], Suárez-Toriello V.A.**[1,2],** de los Reyes J.[1], Pawelec B.[3], Fierro J.L.G.[3]
CHARACTERIZATION AND HYDRODEOXYGENATION ACTIVITY FOR Ni-Ru/TiO_2 CATALYSTS
[1]*Autonomous Metropolitan University-Iztapalapa, Iztapalapa, Mexico*
[2]*CONACyT-CIATEC AC, León, Mexico*
[3]*ICP-CSIC, Madrid, Spain*

12.30
OP-28
Smolikov M.D.[1,2], Kir'yanov D.I.[1], Shkurenok V.A.[1], **Bikmetova L.I.[1],** Belyi A.S.[1,2], Kondrashev D.O.[3], Kleimenov A.V.[3]
CATALYSTS AND PROCESSES FOR PRODUCTION OF ECOLOGICAL FUELS
[1]*Institute of Hydrocarbons Processing SB RAS, Omsk, Russia*
[2]*Omsk State Technical University, Omsk, Russia*
[3]*PJSC «Gazprom Neft», St. Petersburg, Russia*

12.45 Lunch

KEYNOTE LECTURES

Chairperson – Dr. Cecile Siewe, Natural Resources Canada, Devon, Alberta, Canada

14.00
KL-5
Palos R.[1], Gutiérrez A.[1], Kekäläinen T.[2], Arandes J.M.[1], Janis J.[2], **Dr. Pedro Castaño[1]**
[1]*University of the Basque Country, Bilbao, Spain*
[2]*University of Eastern Finland, Joensuu, Finland*
ASSESSING THE CATALYTIC PERFORMANCE DURING HEAVY-OIL HYDROPROCESSING BY FT-ICR

14.30
KL-6
Rai A.[1,2], **Dr. Anil Kumar Sinha[1,2]**
[1]*CSIR - Indian Institute of Petroleum, Dehradun, India*
[2]*AcSIR-Academy of Scientific and Innovative Research, Chennai, India*
SELECTIVE POLYAROMATICS SATURATION AND RING OPENING DURING HYDROPROCESSING OF LIGHT CYCLE OIL OVER SULFIDED Ni-Mo/SiO_2-Al_2O_3 CATALYST

ORAL PRESENTATIONS
Session 4

Chairperson – Dr. Gerhard Pirngruber, IFP Energies Nouvelles, Solaize, France

15.00
OP-29
Brodeur-Campbell M., McCall M., Barnette T., Andersen J.
RENEWABLE JET FROM ALGAL OIL
Honeywell UOP, Chicago, USA

15.15
OP-30
Stepacheva A.[1]**,** Matveeva V.[1,2], Simanova A.[1], Sulman M.[1], Gavrilenko A.[1], Bykov A.[1], Sidorov A.[1], Sulman E.[1]
OIL-CROP BIOMASS HYDROCONVERSION FOR BIODIESEL PRODUCTION
[1]*Tver State Technical University, Tver, Russia*
[2]*Tver State University, Tver, Russia*

15.30
OP-31
Sharma P., Sharma R.K.
HETEROGENEOUS CATALYSTS FOR BIO-FUEL
Indian Institute of Technology, Rajasthan, India

15.45
OP-32
Salnikova K.[1,2], Strigina V.[1], **Matveeva V.**[1,2]**,** Mikhailov S.[1,2], Doluda V.[1], Sulman M.[1], Demidenko G.[1], Sulman E.[1]
LIQUID PHASE CATALYTIC HYDROGENATION OF FURFURAL TO FURFURYL ALCOHOL
[1]*Tver State Technical University, Tver, Russia*
[2]*Tver State University, Tver, Russia*

16.00
OP-33
Dimitriadis A., Bezergianni S., Chrysikou L.
RESIDUAL LIPIDS INTEGRATION IN A PETROLEUM REFINERY
Centre for Research & Technology Hellas (CERTH), Thessaloniki, Greece

16.15 Coffee-break

ORAL PRESENTATIONS
Session 4

Chairperson – Dr. Anil Kumar Sinha, CSIR - Indian Institute of Petroleum, Dehradun, India

16.30
OP-34
Shimanskaya E.[1], **Molchanov V.**[1]**,** Lugovoy Y.[1], Matveeva V.[1,2], Sulman E.[1]
CATALYTIC HYDROGENOLYSIS OF DIFFERENT TYPES OF LIGNIN WITH BIOFUELS OBTAINING
[1]*Tver State Technical University, Tver, Russia*
[2]*Tver State University, Tver, Russia*

16.45
OP-35
Brunet S.[1], Silva dos Santos A.[1], Girard E.[2], Leflaive P.[2]
TRANSFORMATION OF REFRACTORY MODEL SULPHUR COMPOUNDS REPRESENTATIVE OF FCC GASOLINE: A THEORETICAL AND EXPERIMENTAL COMBINED APPROACH
[1]*University of Poitiers, Poitiers Institute of Chemistry of Materials and Materials, France*
[2]*IFP Energies nouvelles, Solaize, France*

17.00
OP-36
Tregubenko V.Y.[1,2], Veretelnikov K.V.[2], Gulyaeva T.I.[1], Belyi A.S.[1,2]
EFFECT OF THE INDIUM CONTENT AND PRECURSOR NATURE ON Pt/Al_2O_3In-Cl REFORMING CATALYSTS
[1]*Institute of Hydrocarbons Processing SB RAS, Omsk, Russia*
[2]*Omsk State Technical University, Omsk, Russia*

17.15
OP-37
Belskaya O.B.[1,2], Stepanova L.N.[1], Likholobov V.A.[1,2]
PLATINUM CATALYSTS Pt/MgAl(M)O_x FOR LIGHT AND HIGHER ALKANES DEHYDROGENATION OBTAINED USING THE LAYERED HYDROXIDE
[1]*Institute of Hydrocarbons Processing SB RAS, Omsk, Russia*
[2]*Omsk State Technical University, Omsk, Russia*

19.00 Banquet

April 19, Thursday

PLENARY LECTURE

***Chairperson – Professor Kake Zhu,** East China University of Science and Technology, Shanghai, China*

9.00
PL-7
Professor Dr. Ir. Bert Weckhuysen
Utrecht University, the Netherlands
OPERANDO SPECTROSCOPY OF ZEOLITE-BASED CATALYSIS: FROM REACTOR TO ACTIVE SITE

ORAL PRESENTATIONS
Session 4

9.45
OP-38
Chandak N., George A., Hamadi A., Dakhan M., Choudhry A., Singaravel G., Morin S.
IMPACT OF PROCESSING HEAVY AND LIGHT CYCLE GAS OIL IN MILD HYDROCRACKER UNIT FOR 100% CONVERSION
ADNOC Refining Research Center, Abu Dhabi, United Arab Emirates

10.00
OP-39
Evdokimenko N.D.[1,2], Kustov A.L.[1,2,3], Kim K.O.[2]
CATALYTIC PROPERTIES OF IRON-CONTAINING CATALYSTS IN THE REACTION OF DIRECT CO_2 HYDROGENATION AT SUPERCRITICAL CONDITIONS
[1]*National Research Techaxaximovnological University "MISiS", Moscow, Russia*
[2]*N.D. Zelinsky Institute of Organic Chemistry RAS, Moscow, Russia*
[3]*M.V. Lomonosov Moscow State University, Moscow, Russia*

10.15
OP-40
Zagoruiko A.
LOW-TEMPERATURE SORPTION-ENHANCED DECOMPOSITION OF HYDROGEN SULFIDE: PROCESS CONCEPT
Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia

10.30 Coffee-break

ORAL PRESENTATIONS
Session 4

Chairperson – Dr. Leon Van den Oetelaar, Albemarle Catalysts, Amsterdam, The Netherlands

10.45
OP-41
Calderon C.J.[1], Ancheyta J.[2]
DYNAMIC MODELING AND SIMULATION OF EXPERIMENTAL CSTR AND SPR FOR HEAVY OIL HYDROCRACKING AND HYDROTREATING
[1]National Autonomous University of Mexico, Mexico city, Mexico
[2]Mexican Petroleum Institute, Mexico City, Mexico

11.00
OP-42
Belinskaya N.S., Frantsina E.V., Lutsenko A.S., Ivanchina E.D.
UNSTEADY-STATE MATHEMATICAL MODEL OF DIESEL FUEL CATALYTIC DEWAXING PROCESS
National Research Tomsk Polytechnic University, Tomsk, Russia

11.15
OP-43
Méndez García C.I.[1], Ancheyta J.[2], Trejo F.[1]
MODELING OF ONE AND TWO-STAGE REACTORS FOR FISCHER-TROPSCH SYNTHESIS
[1]National Polytechnic Institute, Mexico city, Mexico
[2]Mexican Petroleum Institute, Mexico City, Mexico

11.30
OP-44
Frantsina E.V., Belinskaya N.S., Ivanchina E.D.
INTENSIFICATION OF THE PROCESSES OF DEHYDROGENATION AND DEWAXING OF MIDDLE DISTILLATE FRACTIONS BY REDISTRIBUTION OF HYDROGEN BETWEEN THE UNITS
National Research Tomsk Polytechnic University, Tomsk, Russia

11.45
OP-45
Romero Vazquez M., Prieto Velasco C., Frontela Delgado J.
FEEDBACK AND FEED-FORWARD R&D SYSTEMS FOR THE OPTIMIZATION OF INDUSTRIAL HYDROPROCESSING CATALYTIC SYSTEMS
Cepsa Research Center (Alcala de Henares (Madrid)), Madrid, Spain

12.00
OP-46
Aleksandrova T.N., Kondrasheva N.K., Nikolaeva N.V.
DETERMINATION OF THE POTENTIAL PLATINUM-BEARING CAPACITY OF OILS AND REFINED PRODUCTS
St. Petersburg Mining University, St. Petersburg, Russia

12.15 Symposium Closing

12.45 Lunch

15.00 Excursion

POSTER PRESENTATIONS

PP-1. Aleksandrova T.N., **Nikolaeva N.V.**
RESEARCH OF HEAVY OIL PROCESSING
St. Petersburg Mining University, St. Petersburg, Russia

PP-2. **Belinskaya N.S.,** Ivanchina E.D., Frantsina E.V., Nazarova G.Y., Zyryanova I.V., Glik P.A.
STUDYING THE PROCESS OF HYDROCRACKING OF VACUUM GAS OIL
National Research Tomsk Polytechnic University, Tomsk, Russia

PP-3. **Boldushevskii R.E.[1],** Alekseenko L.N.[1], Guseva A.I.[1], Barsukov O.V.[1], Nikulshin P.A.[1], Alyabyev A.S.[2], Spaschenko A.Yu.[2]
USAGE OF DIALKYL DISULFIDES MIXTURE (DADS) AS A SULFIDING AGENT FOR INDUSTRIAL HYDROTREATING CATALYST
[1]All-Russian Research Institute of Oil Refining, Moscow, Russia
[2]«STC Salavatnefteorgsintez» Ltd Co., Salavat, Russia

PP-4. **Boronoev M.[1],** Shakirov I.[1], Ignateva V.I.[1], Terenina M.[1], Kardasheva Y.[1], Maximov A.[1,2], Karakhanov E.[1]
HYDROPROCESSING OF LIGHT CYCLE OIL OVER NiMoS CATALYSTS SUPPORTED ON ORDERED MESOPOROUS POLYMERS
[1]M.V. Lomonosov Moscow State University, Moscow, Russia
[2]A.V. Topchiev Institute of Petrochemical Synthesis RAS, Moscow, Russia

PP-5. **Budukva S.V.[1]**, Andreeva A.V.[2], Kleimenov A.V.[2]
EFFECT OF CITRIC ACID AND TRIETHYLENE GLYCOL ADDITION ON THE REACTIVATION OF HYDROTREATING CATALYSTS
[1]Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia
[2]PJSC «Gazprom Neft», St. Petersburg, Russia

PP-6. **Dimitriadis A.[1]**, Bezergianni S.[1], Faussone G.[2], Karonis D.[3]
ALTERNATIVE DIESEL FROM WASTE PLASTICS
[1]Centre for Research & Technology Hellas (CERTH), Thessaloniki, Greece
[2]INSER SpA, Turin, Italy
[3]National Technical University of Athens, Athens, Greece

PP-7. Dolganova I., Dolganov I., Ivashkina E., **Buryhina E.,** Bekker A.
UNSTEADY MATHEMATICAL MODEL OF H_2SO_4-CATALYZED ISOBUTANE WITH OLEFINES ALKYLATION
National Research Tomsk Polytechnic University, Tomsk, Russia

PP-8. Dolganova I., Dolganov I., Ivanchina E., Ivashkina E., **Belinskaya N.**
STUDYING THE CORRELATION BETWEEN MODES OF TECHNOLOGICAL STAGES OF SYNTHETIC DETERGENTS SYNTHESIS USING THE MATHEMATICAL MODEL
National Research Tomsk Polytechnic University, Tomsk, Russia

PP-9. Glotov A.[1], **Levshakov N.[1]**, Vutolkina A.[2], Lysenko S.[2]
BIMETALLIC SULFUR REMOVAL ADDITIVIES La-Mg-Al-MCM-41/Al_2O_3 for FCC CATALYSTS
[1]Gubkin Russian State University of Oil and Gas, Moscow, Russia
[2]M.V. Lomonosov Moscow State University, Moscow, Russia

PP-10. **Golubev O.[1],** Maximov A.[1,2], Karakhanov E.[1]
MESO-MACROPOROUS CATALYSTS FOR REMOVAL OF HETEROATOMIC COMPOUNDS FROM MIDDLE DISTILLATES
[1]M.V. Lomonosov Moscow State University, Moscow, Russia
[2]A.V. Topchiev Institute of Petrochemical Synthesis RAS, Moscow, Russia

PP-11. **Gumerov F.[1],** Mazanov S.[1], Usmanov R.[1], Gabitova A.[1], Le Neindre B.[2]
BIODIESEL OBTAINING UNDER SUPERCRITICAL FLUID CONDITIONS: NON-CATALYTIC AND CATALYTIC REACTION, THE REACTION KINETICS AND THE PROCESS SIMULATION
[1]Kazan National Research Technological University, Kazan, Russia
[2]LSPM, CNRS Université Paris 13, Villetaneuse, France

PP-12. Guseva A.I., Vinogradova N.Ya., **Alekseenko L.N.,** Boldushevskii R.E., Vishnevskaya E.E., Nikulshin P.A.
DEVELOPMENT SYSTEM OF GUARD CATALYSTS AND MATERIALS FOR COMPLEX HYDROTREATING OF DISTILLATE FEED
All-Russian Research Institute of Oil Refining, Moscow, Russia

PP-13. **Ivanchina E.D.,** Belinskaya N.
INTELLECTUAL TECHNOLOGY OF LOW-HARDENING HYDROCARBON FUEL PRODUCTION
National Research Tomsk Polytechnic University, Tomsk, Russia

PP-14. **Kazakova M.A.[1,2],** Kazakov M.O.[1], Vatutina Yu.V.[1,2], Klimov O.V.[1], Kuznetsov V.L.[1], Gerasimov E.Yu.[1], Prosvirin I.P.[1], Noskov A.S.[1]
SUPPORT EFFECTS ON THE PROPERTIES AND CATALYTIC ACTIVITY OF Co-Mo-S HYDROTREATING CATALYST
[1]Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia
[2]Novosibirsk State University, Novosibirsk, Russia

PP-15. **Kim K.,** Lee Y.
CHARACTERIZATION AND ACTIVITY OF DISPERSED MoS_2 CATALYSTS FOR HYDROCRACKING OF VACUUM RESIDUE
Dankook University, Yongin, South Korea

PP-16. Kondrashev D.[1], **Kondrasheva N.[2],** Rudko V.[2]
APPLICATION OF MODERN HYDROPROCESSES FOR LOW-VISCOSITY MARINE FUELS PRODUCTION
[1]PJSC «Gazprom Neft», St. Petersburg, Russia
[2]St. Petersburg Mining University, St. Petersburg, Russia

PP-17. **Mehrabi-Kalajahi S.,** Varfolomeev M.A., Abaas M., Al-Muntaser A., Suwaid M.A., Rodinov A.
APPLICATION OF NOVEL AND EASILY SYNTHESIZED NANOCATALYST FOR UPGRADING OF HEAVY CRUDE OIL
Kazan Federal University, Kazan, Russia

PP-18. **Minaev P.[1]**, Nikulshina M.[1], Pimerzin A.A.[1], Nikulshin P.[1,2]
DEEP HYDROTREATING OF VACUUM GAS OIL OVER NiW CATALYST SUPPORTED ON MODIFIED MESOPOROUS ALUMINA
[1]Samara State Technical University, Samara, Russia
[2]All-Russian Research Institute of Oil Refining, Moscow, Russia

PP-19. **Mukhin V.M.,** Guryanov v.v.
NOVEL CARBON CARRIERS FOR CATALYSTS
JSC "Electrostal Science and Production Association "Neorganica", Electrostal, Russia

PP-20. Nemudry A.P.[1], Gulyaev I.P.[2], Gainutdinov I.I.[1], Popov M.P.[1], **Zagoruiko A.N.[3]**
MICROTUBULAR SOLID OXIDE ELECTROLYZER CELL FOR HYDROGEN PRODUCTION
[1]Institute of Solid State Chemistry and Mechanochemistry, Novosibirsk, Russia
[2]Institute of Theoretical and Applied Mechanics, Novosibirsk, Russia
[3]Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia

PP-21. Naranov E.[1,2], Maximov A.[1,2], Karakhanov E.[2]
INVESTIGATION OF MICRO-MESOPOROUS MATERIALS WITH LAMELLAR STRUCTURE AS THE SUPPORT OF HYDROTREATING CATALYSTS
[1]A.V. Topchiev Institute of Petrochemical Synthesis RAS, Moscow, Russia
[2]M.V. Lomonosov Moscow State University, Moscow, Russia

PP-22. Odintsova M., Markova E.
FEATURES OF THE CONVERSION OF PROPANE ON THE STRUCTURALLY LABILE FORM OF CATALYTIC SYSTEMS
Peoples' Friendship University of Russia, Moscow, Russia

PP-23. Plais L.[1,2], **Lancelot C.[1],** Briois V.[2], Lamonier C.[1]
Co PROMOTED HYDROTREATING CATALYSTS: GENESIS OF THE ACTIVE PHASE FOLLOWED BY IN-SITU XAS ANALYSIS
[1]UCCS, Villeneuve d'Ascq, France
[2]Synchrotron SOLEIL, Saint-Aubin, France

PP-24. Pletneva I., Gavrilov Y., Silkina E.
PROCESSES OF NON-EXTRACTIONAL DEMERCAPTANIZATION OF OIL AND OIL PRODUCTS
Semenov Institute of Chemical Physics RAS, Moscow, Russia

PP-25. Roldugina E.A., Shayakhmetov N., Karakhanov E.
AQUEOUS-PHASE HYDRODEOXYGENATION OF LIGNIN MONOMER GUAIACOL OVER Ru CATALYSTS SUPPORTED ON MESOPOROUS MATERIALS
M.V. Lomonosov Moscow State University, Moscow, Russia

PP-26. Santolalla Vargas C.E.[1], Santes V.[1], Sanchez-Minero F.[2], Lartundo-Rojas L.[3], Diaz L.[4], Luna-Ramirez R.[4]
IN SITU REACTIVATION OF SPENT NiMoP/γ-Al_2O_3 FOR HYDRODESULFURIZATION OF STRAIGHT RUN GAS OIL
[1]CIIEMAD- National Polytechnic Institute, Mexico city, Mexico
[2]ESIQIE- National Polytechnic Institute, Mexico city, Mexico
[3]Center of Nanosciences and Micro and Nanotechnologies-National Polytechnic Institute, Mexico city, Mexico
[4]Mexican Petroleum Institute, Mexico city, Mexico

PP-27. Sotelo-Boyas R., Arroyo-Hernandez J.D., Macías-Hernández M., Manzo-Robledo A.
THERMODYNAMIC EQUILIBRIUM OF LIGHT NAPHTHA HYDROISOMERIZATION REACTIONS
National Polytechnic Institute -ESIQIE, Mexico City, Mexico

PP-28. Macías-Hernández M., Guzmán-Vargas A., Zacahua-Tlacualt G., Manzo-Robledo A., **Sotelo-Boyas R.**
UPGRADING OF CRUDE OIL ASSISTED WITH ANIONIC SURFACTANT AND CARBON PARTICLE CATALYST IN STABLE EMULSION
National Polytechnic Institute -ESIQIE, Mexico City, Mexico

PP-29. Suwaid M.A., Al-Muntaser A., Varfolomeev M.A.
EXPERIMENTAL STUDY OF IN-SITU UPGRADING FOR HEAVY CRUDE OIL USING COPPER-BASED CATALYST UNDER STEAM INJECTION CONDITION
Kazan Federal University, Kazan, Russia

PP-30. Vinnikova M.[1], Maximov A.[1,2]
DEVELOPMENT OF NANOSTRUCTURED NICKEL PHOSPHIDE FOR HYDROTREATING OF OXYGEN-CONTAINING FEEDSTOCKS
[1]A.V. Topchiev Institute of Petrochemical Synthesis RAS, Moscow, Russia
[2]M.V. Lomonosov Moscow State University, Moscow, Russia

PP-31. **Vutolkina A.[1],** Makhmutov D.[1], Zanina A.[1], Glotov A.[2], Akopyan A.[1], Maximov A.[1,3], Karakhanov E.[1]

HYDROGENATION AND SULFUR REMOVAL VIA WATER GAS SHIFT USING DISPERSED UNSUPPORTED CATALYSTS

[1]M.V. Lomonosov Moscow State University, Moscow, Russia
[2]Gubkin Russian State University of Oil and Gas, Moscow, Russia
[3]A.V. Topchiev Institute of Petrochemical Synthesis RAS, Moscow, Russia

PP-32. **Yuan C.**, Varfolomeev M.A., Suwaid M.A., Emelianov D.A., Khachatrian A.A., Starshinova V.L., Al-Muntaser A.A.

IMPROVED COMBUSTION BEHAVIOR OF HEAVY OILS USING OIL-SOLUBLE METAL-BASED CATALYST IN IN-SITU COMBUSTION PROCESS

Kazan Federal University, Kazan, Russia

PP-33. **Zazhigalov S.V.**, Zagoruiko A.N.

HYDROGEN PRODUCTION BY SORPTION-ENHANCED STEAM REFORMING OF HYDROCARBONS WITH AUTOTHERMAL SORBENT REGENERATION IN A SUPER-ADIABATIC HEAT FRONT OF CATALYTIC COMBUSTION REACTION

Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia

PP-34. Zimina V.[1], Kryuchkova T.[1], Sheshko T.[1], **Cherednichenko A.G.[1],** Serov Y.[1], Chislova I.[2], Yafarova L.[2], Zvereva I.[2]

INVESTIGATION OF $GdCo_xFe_{1-x}O_3$ (x=0; 0,5; 1) PEROVSKITES AS CATALYSTS FOR SYNGAS PRODUCTION VIA DRY REFORMING OF METHANE

[1]Peoples' Friendship University of Russia (RUDN University), Moscow, Russia
[2]St. Petersburg State University, St. Petersburg, Russia

PP-35. **Escobar J.[1],** Barrera M.C.[2], Gutiérrez A.W.[1], Angeles-Chávez C.[1], Toledo J.A.[1], Solís-Casados D.A.[3]

$NiMo/Al_2O_3$ HDS CATALYSTS FROM Mo-BLUE PRECURSOR

[1]Mexican Petroleum Institute, Mexico City, Mexico
[2]Veracruz University, Veracruz, Mexico
[3]Autonomous Mexico State University, Toluca, State of Mexico, Mexico

VIRTUAL PRESENTATIONS

VP-1. **Dobrynkin N.M.,** Batygina M., Noskov A.S.
MICROEMULSION CATALYSTS: HYDROTHERMAL SYNTHESIS AND ACTIVITY IN THE REACTION OF HYDROCRACKING OF HEAVY HYDROCARBONS
Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia

VP-2. **Kadieva M.Kh.,** Kadiev Kh.M., Erman E.S., Dandaev A.U., Khadzhiev S.N.
SLURRY CATALYST SYSTEMS FOR HYDROCONVERSION OF HEAVY PETROLEUM FEEDSTOCKS
A.V. Topchiev Institute of Petrochemical Synthesis RAS, Moscow, Russia

VP-3. Tagiev D.B., Abasov S.I., Agaeva S.B., **Mamedova M.T.,** Alieva A.E., Isaeva Y.S., Iskenderova A.A., Imanova A.A.
THE EFFECT OF HYDROGEN ON THE CONVERSION OF A MIXTURE OF C_7H_{16}: C_4H_{10} ON THE MOR / WO_4^{2-}- ZrO_2 CATALYTIC SYSTEM
Institute of Petrochemical Processes of ANAS, Baku, Azerbaijan

VP-4. **Mukhamed'yarova A.N.[1]**, Egorova S.[1], Zhang Y.[1,2], Skibina J.[1,2], Lamberov A.[1]
INFLUENCE OF HYDROTHERMAL TREATMENT OF THE AMORPHOUS ALUMINUM HYDROXIDE ON CATALYTIC PROPERTIES IN ACID TYPE REACTIONS
[1]Kazan Federal University, Kazan, Russia
[2]Heilongjiang University, Harbin, China

VP-5. **Mukhamatdinov I.,** Salih I., Vakhin A., Sitnov S.
CHANGE OF ASPHALTENE FRACTIONAL COMPOSITION IN HYDROTHERMAL CATATYTIC PROCESS
Kazan Federal University, Kazan, Russia

VP-6. **Nasullaev Kh.[1,2],** Yunusov M.[2], Mamatkulov Sh.[2], Teshabaev Z.[2], Hudayberganov A.[3]
SYNTHESIS OF HYDROGENING CATALYSTS ON ALUMINUM OXIDE PREPARED BY ELECTRO-CHEMICAL ANODIZATION
[1]M.Ulugbek National University of Uzbekistan, Tashkent, Uzbekistan
[2]A.Sultanov Uzbek Chemical-Pharmaceutical Research Institute, Tashkent, Uzbekistan
[3]JSC «Uzneftmahsulot», Tashkent, Uzbekistan

VP-7. **Obukhova A.V.**[1], Kuznetsova L.I.[1], Kaskevich E.S.[2], Kuznetsov P.N.[1]
INFLUENCE OF THE ACTIVATION PROCEDURES ON PHYSICAL-CHEMICAL AND CATALYTIC PROPERTIES OF Pt/WO_x-ZrO_2 CATALYSTS
[1]Institute of Chemistry and Chemical Technology SB RAS, Krasnoyarsk, Russia
[2]Siberian Federal University, Krasnoyarsk, Russia

VP-8. **Onishchenko M.[1],** Panyukova D.[1,2], Sizova I.[1], Maximov A.[1,3]
Ni-W and Co-Mo SULPHIDE CATALYSTS SUNTHESIZED *IN SITY* IN A HYDROCARBON MEDIUM FOR AROMATIC HYDROCARBONS HYDROGENATION
[1]A.V. Topchiev Institute of Petrochemical Synthesis RAS, Moscow, Russia
[2]D. Mendeleyev University of Chemical Technology of Russia, Moscow, Russia
[3]M.V. Lomonosov Moscow State University, Moscow, Russia

VP-9. **Petrukhina N.[1],** Maximov A.[1,2]
HYDROCARBON RESINS HYDROGENATION OVER UNSUPPORTED SULFIDE CATALYSTS FORMED FROM OIL-SOLUBLE AND WATER-SOLUBLE PRECURSORS
[1]A.V. Topchiev Institute of Petrochemical Synthesis RAS, Moscow, Russia
[2]M.V. Lomonosov State University, Moscow, Russia

VP-10. Rogacheva A.O.[1], Shamsutdinova A.N.[1], Brichkov A.S.[1], Larina T.V.[2], Paukshtis E.A.[1,2], Kozik V.V.[1]
SPHERICAL CATALYSTS:TiO_2-SiO_2/NiO, TiO_2-SiO_2/Co_3O_4, TiO_2-SiO_2/Cr_2O_3 FOR OXIDATION OF N-HEPTANE
[1]National Research Tomsk State University, Tomsk, Russia
[2]Boreskov Institute of Catalysis SB RAS, Novosibirsk, Russia

VP-11. Sosnin I.M.[1], Ulesova D.A.[1], Romanov A.E.[1,2], Vikarchuk A.A.[1]
PHOTOCATALYTIC DEGRADATION OF PHENOL UNDER SOLAR LIGHT IN THE PRESENCE OF ZINC OXIDE NANOSHEETS, ANNEALED AT DIFFERENT TEMPERATURES
[1]Togliatti State University, Togliatti, Russia
[2]University ITMO, St. Petersburg, Russia

VP-12. Tataurshchikov A.A., Krivtcova N.I., Ivanchina E.D.
NON-STATIONARY MODELLING OF DIESEL FUEL HYDROTREATMENT PROCESS WITH THE CATALYST DEACTIVATION
National Research Tomsk Polytechnic University, Tomsk, Russia

VP-13. Vitkovskaya R., **Bykova L.**, Petrov A.
GLASS-FIBRE CATALYSTS FOR HYDROCRACKING OF HYDROCARBONS
*St. Petersburg State of Industrial Technology and Design, St. Petersburg, Russ*ia

VP-14. Yunusov M., Nasullaev Kh., Sayidov U., Gulomov Sh., Vedrov N.
SYNTHESIS AND PHYSICO-CHEMICAL PROPERTIES OF ADSORBENTS OF THE ABSORPTION OF CHLORIDE HYDROGEN
[1]A.Sultanov Uzbek Chemical-Pharmaceutical Research Institute, Tashkent, Uzbekistan
[1]M.Ulugbek National University of Uzbekistan, Tashkent, Uzbekistan
[3]LLC «NKZ», Novomichurinsk, Russia

VP-15. Ziyadullaev O.E.[1], Abdurakhmanova S.S.[2], Samatov S.K.[1], Otamukhamedova G.Q.[3], Narbayev U.G.[3]
THE ROLE OF CATALYSTS IN THE SYNTHESIS OF ACETYLEN ALCOHOLS AND THEIR VINYL ESTERS BY CATALYTIC METHODS OF PETROLEUM PRODUCTS
[1]Chirchik State Pedagogical Institute of Tashkent region, Uzbekistan
[2]Tashkent Chemical Technological Institute, Tashkent, Uzbekistan
[3]National University of Uzbekistan, Tashkent, Uzbekistan