3rd R. Agladze Conference

RAC-3

On Applied Chemistry

Dedicated to the 100 Anniversary of Academician

Rafael Agladze

October 18-19
2011
Tbilisi, Georgia

ABSTRACTS
PROGRAM
NOTEBOOK

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Georgian Technical University

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Association of professional Chemists of Georgia

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GEORGIAN TECHNICAL UNIVERSITY

The Jubilee Conference on Applied Chemistry

October 19, 2011
Tbilisi

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GEORGIAN NATIONAL ACADEMY OF SCIENCES


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PROGRAM

October 19, 2011
Georgian Technical University
77 Kostava Str., 0175 Tbilisi, Georgia

09:00 – 09:30 - Registration - Ground Hall, GTU

Hall A

09:30-09:45- Welcome address
Prof., Dr. A. Prangishvili,
Rector of the Georgian Technical University

PLENARY SESSION

#

Hall A

Chairman: A. Tvalchrelidze

10:45-10:15
The impact of the current financial crisis on Georgia and how to respond to it
U. Schramm
Management Consultant

10:20-10:45
The Contribution of Manganese Chemical Industry to Sustainable Development of the Economy
T. Agladze
Georgian Technical University

MORNING SESSION
SECTION 1 – ADVANCED MATERIALS, COATINGS AND COMPOUNDS
HALL A

Chairman: I. Krastev, D Jishiashvili

10:50-11:00

PREPARATION OF THE ACTIVATED MANGANESE DIOXIDE

J. Shengelia[1], T. Agladze[1], J. Gvelesiani[2]

[1]*Georgian Technical University*

[2]*I. Javakhishvili Tbilisi State University,* R.Agladze Institute of Inorganic Chemistry end Electrochemistry

11:05-11:15

LAYERS OF ANODICALLY PREPARED MANGANESE DIOXIDE FOR SUPERCAPACITORS

G.Tsagareli, Sh. Makhatadze., E. Kachibaia

Javakhishvili Tbilisi State University, R.Agladze Institute of Inorganic Chemistry end Electrochemistry

11:20-11:30

SIMULTANEOUS ELECTRODEPOSITION OF MANGANESE METAL AND ACTIVE MANGANESE DIOXIDE IN THE ELECTROCHEMICAL REACTOR, DIVIDED BY THERMALLY STABLE ANION-SELECTIVE MEMBRANE

G. Tsurtsumia[1,2], G. Agladze[1,2], N. Koiava[1], N. Gogishvili[1], L. Beriashvili[2], I. Zaridze[1]

[1]*I. Javakhishvili Tbilisi State University, R.Agladze Institute of Inorganic Chemistry and Electrochemistry*

[2]*Georgian Technical University*

11:35-11:45

NEW TETRACYCLIC HETEROCYCLIC SYSTEMS, CONTAINING BENZIMIDAZOLE/BENZOTRIAZOLE AND BENZOTHIOPHENE/BENZOFURANE AND THEIR DERIVATIVES

M. Maisuradze, N.Gaxokidze. S.Tskvitaia. G.Ugulava, E.Kalandia, V.Ananiashvili
Georgian Technical University

11: 55-12:10 Coffee break

12:10-12:30

ONE-POT SYNTHESIS OF SOME NOVEL TETRAKISAZO DISPERSE DYES

E. Elizbarashvili, I. Lagvilava, T. Matitaishvili
Georgian Technical University

12:35-12:45

PREPARATION OF INSULATING FILMS OF NEW CLASS ON THE BASIS OF POLYNAPHTOYLBENZIMIDAZOLES

N.Ormotsadze[1], D.Bibileishvili[2]
[1]*Akaki Tsereteli State University,*
[2]*Georgian Technical University*

12:50-13:00

EXPLOSIVE COMPACTION AND OPTIMIZATION OF GD AND B CONTAINING COMPOSITIONS FOR APPLICATION IN EXTREME CONDITIONS

N. Chikhradze[1,2], L. Kurdadze[2], G. Abashidze[1]
[1] G. Tsulukidze Mining Institute,
[2]Georgian Technical University

13:05-13:15

INSTALLATION OF CONCRETE HORIZONTAL CONSTRUCTIONS WITH SILICATE MATERIALS AND HIGH PERFORMANCE CONCRETE'S

INNOVATIVE TECHNOLOGIES ASSIMILATE-USE PRACTICE IN GEORGIA

R.Skhvitaridze, L.Gogichaishvili , B.Keshelava , I.Giorgadze , R.Vekua

[1]*Ltd „International Construction Holding "*

[2]*Kiriak Zavriev Institute of Structural Mechanics and Earthquake Engineering*

13:20-13:35

POLYMER COMPOSITES FILLED WITH BASALT MODIFIED WITH SILICON-ORGANIC COMPOUNDS ON THE BASIS OF EPOXY-RESINS

L.G.Shamanauri[1], E.G.Markarashvili[2], J.N.Aneli[1], O.V.Mukbaniani[2]

[1]*R.Dvali Institute of Machine Mechanics*

[2]*Iv.Javakhishvili Tbilisi State University, Faculty of Exact and Natural Sciences*

SECTION 2
CHEMISTRY FOR SAFE ENVIRONMENT
HALL B

Chairman: M. Oturan, G. Kvesitadze

10:50-11:15

ELECTROCHEMICAL ADVANCED OXIDATION PROCESSES FOR EFFICIENT REMOVAL OF PERSISTENT ORGANIC MICROPOLLUTANTS FROM WASTEWATERS. APPLICATION TO ELIMINATION OF PHARMACEUTICAL POLLUTANTS

M. A. Oturan

Université Paris-Est, Laboratoire Géomatériaux et Environnement (LGE)

11:20-11:40

TREATMENT OF WASTEWATERS FROM REFRACTORY ORGANICS BY

MEANS OF GREEN REAGENTS GENERATED IN ELECTROCHEMICAL REACTORS AND FUEL CELL SYSTEMS

G. Agladze
Georgian Technical University
Ivane Javakhishvili Tbilisi State University
Rafael Agladze Institute of Inorganic Chemistry & Electrochemistry

11:45-11:55

APPLICATION OF NANOFILTRATIVE MATERIALS FOR "SAFE" WATER PREPARATION

M. Donadze,T. Agladze, J. Shengelia
Georgian Technical University

11: 55-12:10 Coffee break

12:10-12:35

HIGHER PLANTS ECOLOGICAL POTENTIAL

E. Kvesitadze, G. Kvesitadze
Georgian Technical University,
Durmishidze Institute of Biochemistry and Biotechnology of Georgian Agrarian University

12:40-12:50

HEAVY METALS IN MEDICINAL, AROMATIC, SPICY PLANTS AND IN SOIL

T. Kacharava[1], I. Koiava[2]
[1] *Biotecnology Centre of Georgian Technical University*
[2] *Georgian Technical University of Chemical Technology and Metallurgy of Faculty doctorate*

12:55-13:05

STUDY OF ECOLOGICAL RISK FACTOR AREAS OF GEORGIA AND ELABORATION OF PHYTOREMEDIATION METHODS NEEDED FOR THEIR REHABILITATION

G.Jishkariani, M.Mikaberidze, G.Jandieri, D.Sakhvadze, G.Tavadze
LEPL Ferdinand Tavadze Institute of Metallurgy and Material Sciences

13:10-13:20

CHEMICAL PROCESSING OF MANGANESE-CONTAINING PRODUCTION RESIDUALS AND LOW-QUALITY ORES

T. Chakhunashvili, T. Rokva, Zh. Kebadze, M. Dadunashvili, G. Gobechia, T. Mestvirishvili, N. Butliashvili
Javakhishvili Tbilisi State University
R. Agladze Institute of Inorganic Chemistry and Electrochemistry

13:25-13:35

STUDY OF TOXICITY RATE AND ENVIRONMENTAL POLLUTION CAUSED WITH ARSENIC-CONTAINING WASTE ACCORDING TO TCLP AND WET STANDARDS

R. Gigauri, Sh. Japaridze, A. Chirakadze, T. Gogiberidze
Agladze Institute of Inorganic Chemistry and Electrochemistry Ivane Javakhishvili Tbilisi State University

13:35-13:50 Plenary session; Students awarding ceremony, Hall A
13:50-14:50 Lunch
14:50-15:35 Poster session

SECTION 3
INDUSTRY AND ECONOMY
HALL C

Chairman: V. Tsitsishvili

10:50-11:10

ECONOMICS OF COMMODITIES: GLOBAL ANALYSIS

A.G. Tvalchrelidze

11:10-11:25

PRIORITY TO UTILIZATION OF NATIONAL RESOURCES

A. Silagadze

Georgian National Academy of Sciences

11:25-11:40

ECONOMICAL AND ECOLOGICAL ASPECTS OF ZEOLITE APPLICATION

V.Tsitsishvili

Petre Melikishvili Insitute of Physical and Organic Chemistry at Ivane Javakhishvili Tbilisi State University

11:40-11:55

CAPITALIZATION OF MINERAL COMMODITIES: WORLD AND GEORGIAN EXPERIENCES

A. Tvalchrelidze

11: 55-12:10 Coffee break

EVENING SESION

SECTION 1
ADVANCED MATERIALS, COATINGS AND COMPOUNDS
HALL A

Chairman: N. Boshkov, E.Elizbarashvili

15:35-15:55

ELECTRODEPOSITION OF SELF-STRUCTURED SILVER ALLOY COATINGS

I. Krastev

Institute of Physical Chemistry, Bulgarian Academy of Sciences, Sofia, Bulgaria

16:00-16:10

GROWTH OF NITRIDE AND PHOSPHIDE NANOWIRES USING HYDRAZINE VAPOR

D. Jishiashvili, Z. Shiolashvili, N. Makhatadze, L.Kiria, A. Jishiashvili, D.Sukhanov

V.Chavchanidze Institute of Cybernetics. Georgian Technical University

16:15-16:35

CORROSION STUDIES OF NANOSTRUCTURED ZINC AND ZINC BASED COMPOSITE COATINGS

N. Boshkov[1], D. Koleva[2], P. Petrov[3], N. Tsv etkova[1], V. Bachvarov[1], M. Peshova[1]

[1]*Institute of Physical Chemistry, Bulgarian Academy of Sciences*

[2]*Delft University of Technology, Faculty of CiTG, Dep. Mater.& Environment*

[3] *Institute of Polymers, Bulgarian Academy of Sciences*

16:40-16:55 Coffee break

16:55-17:05

ELECTRON-BEAM TECHNOLOGIES IN GEORGIA AND PERSPECTIVES OF THEIR DEVELOPMENT

M. Okrosashvili

Georgian Technical University

17:10-17:20

HETEROMODULUS CERAMICS BASED ON NANOCRISTALLINE CARBIDE ABRASIVE

A. Gachechiladze[1], R. Chedia[2], O. Tsagareishvili[1], A. Mikeladze [1], M. Antadze[1], B.Margiev[1], D. Gabunia[1]

[1]*F. Tavadze Institute of Metallurgy and Materials Science, Tbilisi, Georgia*

[2] *Javakhishvili Tbilisi State University, P. Melikishvili Institute for Physical and Organic Chemistry*

17:25-17:35

SPECIAL SINGLE – LAYER COATINGS FOR PIPES

Berdzenishvili I.G. [1, 2], Shalygina O.V.[2]

[1] *Georgian Technical University,*

[2] *Ukrainian Enamellers Association*

17.40-17:50

ELECTROCHEMICAL SYNTHESIS OF METAL NANOPARTICLES

M. Gabrichidze, N. Donadze, T.Agladze

[1]*Georgian Technical University*

SECTION 2
CHEMISTRYFOR SAFE ENVIRONMENT
HALL B

Chairman: G. Agladze

15:35-15:45

ENVIRONMENTALLY FRIENDLY TECHNOLOGIES FOR MANUFACTURING PURE METALS

O. Mikadze, A. Kandelaki, J. Bagdavadze, L. Rukhadze
Georgian Technical University
Ferdinand Tavadze Institute of Metallurgy and Materials Science, Tbilisi, Georgia

15:50-16:00

APPLICATION OF ELECTRICAL CONDUCTING RUBBER FOR INDICATION OF DIFFERENT LIQUIDS LEAKING FROM CAPACITIES

Z.D.Kovsiridze[1], J.N.Aneli[2], G.G.Basilaia[2]
[1]*Georgian Technical University, Faculty of chemical technology*
[2]*R.Dvali Instituite of Machine Mechanics*

16:05-16:15

QUESTIONS OF AUTOMATION OF PROCESSES OF PREPARATION COAGULANT SOLUTIONS FOR THE REAGENT PURIFICATION OF NATURAL AND WASTE WATERS

T. Dzagania, V. Padiurashvil, R. Semionov, N. Iashvili, E. Butskhrikidze, Khutashvili, K. Makhashvili
Georgian Technical University

16:20-16:30

PROCESSING AND MANUFACTURING AUTOMATIC DEVICES FOR ENRICHING THE DRINKING WATER WITH SILVER

T. Dzagania, V. Padiurashvili, N. Iashvili, E. Butskhrikidze, Khutashvili,

K. Makhashvili; R. Semionov.
Georgian Technical University
16:40-16:55 coffee break

SECTION 4
BIOMEDICINE, BIOTECHNOLOGY AND FOOD INDUSTRY
HALL C

Chairman: R. Katsarava

15:35-16:00
BACTERIOPHAGE BASED TECHNOLOGY AGAINST PLANT BACTERIAL DISEASES
T. Sadunishvili, N. Sturua, L.Chokheli
Durmishidze Institute of Biochemistry and Biotechnolog of NLE Agrarian University of Georgia

16:00-16:20
PROLONGED ACTION ACARICIDE PREPARATIONS
O. Lomtadze, G. Chimakadze, K. Ebralidze, N. Lomtadze
TSU Petre Melikishvili Institute of Physical and Organic Chemistry

16:20-16:40
ANTIBACTERIAL ACTIVITY AND TOXICITY OF NANOSILVER CONTAINING CREAMS
I. Meskhi[1], M. Donadze[2], T. Agladze[2]
[1]*GPC*
[2]*Georgian Technical University*

16:40-16:55 coffee break

16:55-17:20

INNOVATIVE TECHNOLOGY AND FOOD SUPPLY

R.A. Gakhokidze
Iv. Javakhishvili Tbilisi State University

17:20-17:40

PROSPECTS OF BASIDIOMYCETES POTENTIAL APPLICATION IN WHITE BIOTECHNOLOGY

V. Elisashvili, M. Asatiani, I. Berikashvili, T. Jokharidze
Durmishidze Institute of Biochemistry and Biotechnology of N.L.E. Georgian Agrarian

17:40-18:00

NANOPEPTIDE BIOREGULATORS INDUCE REACTIVATION OF "AGED" CHROMATIN

Lezhava T.A., Jokhadze T.A., J.Monaselidze
Institute of Genetics Iv. Javakhishvili Tbilisi State University

18:00-18:20

NON-CONVENTIONAL MACROMOLECULAR SYSTEMS COMPOSED OF NATURALLY OCCURING A-AMINO ACIDS

R.Katsarava, D.Tugushi
Center for Medical Polymers and Biomaterials, Technical University of Georgia

19:00 Banquet

POSTER SESSION

Wednesday, 19 October, 2011
at GTU third floor hall way
13:35-14:20 pm

PP1. Organomineral admixtures for poultry feeding
I.Beshkenadze, S.Urotadze, N.Zhorzholiani, M.Gogaladze
Iv. Javakhashvili Tbilisi State Universitety
Peter Melikishvili Institute of Physical and Organic Chemistry

PP2. Effect of the additives of various metals and organic compounds on the quality of aluminum electroplating
N. Gasviani, G. Kipiani, L. Abazadze, S.Gasviani
I. Javakhishvili Tbilisi State University
R. Agladze Institute of Inorganic Chemistry and Electrochemistry

PP3 Electroplating and surface alloying of hardware by compositionsof molybdenum–cobalt–nickel
N.Gasviani, D. Supatashvili, G. Kipiani, L. Abazadze
I.Javakhishvili Tbilisi State University
R.Agladze Institute of Inorganic Chemistry and Electrochemistry

PP4. Leaching of Chalcopyrite Concentrates by of Nitric and Sulfuric Acids Mixture Solutions
G. Agladze[1,2], N. Kochiashvili[1], I. Kakhniashvili[1,2], G. Tsurtsumia[1,2]
[1]*Ivane Javakhishvili Tbilisi State University Rafael Agladze Institute of Inorganic Chemistry and Electrochemistry*
[2]*Georgian Technical University*

PP5. Coproduction of manganese dioxide and hydrogen by electrolysis
T. Chakhunashvili, T. Rokva, M. DadunaSvili, Zh. Kebadze, Ts. Gagnidze, V. Mosidze
I. Javakhishvili Tbilisi State University
R. Agladze Institute of Inorganic Chemistry and Electrochemistry

PP6. Forcasting of Localized Corrosion of New Metastable and Duplex Steels

E.Gozalishvili[1], N.Luarsabishvili[2], D.Ramazashvili[3], L.Akhvlediani[4], M.Mikaberidze[5]

[1-5] F.Tavadze Institute of metallurgy and Materials Science, [6] G.Tsulukidze Mining Institute

PP7. The new phosphate composition (antipyrine)- increasing the fire resistance of various materials

N.Jabishvili, N.Klarjeishvili, I.Karalashvili, S.Urotadze, I.javashvili

Tbilisi State University, Petre Meliqishvili Institute of physical and organic chemistry

PP8. Cathode materials based on modified lithium – manganese spinel – $LiMxNi_{0.5}$-$xMn_{1.5}O_4$, $0 \le x \le 0.3$, for lithium-ion accumulators

E. Kachibaia, R. Imnadze, T. Paikidze

R.Agladze Institute of Inorganic Chemistry and Electrochemistry of Ivane Javakhishvili Tbilisi State University

PP9. Regeneration of exhaust engine oils

T. Shakarashvili[1], M.Andguladze[2], N.Kutsiava[3], G.Zodelava[4]

Georgian Technical University

PP10. Economically alloyed duplex steel with increased corrosion resistance for construction operating in the oil and sea water containing hydrogen sulfide

N.Luarsabishvili[1], T.Purckhvanidze[2], D.Ramazashvili[3], E.Gozalishvili[4], G.Djaparidze[5]

[1-5]F.Tavadze Institute of Metallurgy and Material Science

PP11. Use of carbon materials of new generation in current sources of the system manganese dioxide-zinc

Zh.Kebadze, Ts.Gagnidze, T.Chakhunashvili, K.Ugrelidze,l.Kakuria

I.Javakhishvili Tbilisi State University
R.Agladze Institute of Inorganic Chemistry and Electrochemistry

PP12. Efficient technology for copper sulfide concentrates pyrometallurgical processing

J. Gvelesiani, T. Lezhava, M. Mamporia, J. Meskhi,Z. Khuztishvili, Sh. Kikabidze
R. Agladze Institute of Inorganic Chemistry and Electrochemistry of Iv. Javakhishvili Tbilisi State University

PP13. Preparation of efficient catalysts-adsorbents from concentraces of Georgian manganese natural ores for cleaning of hydrocarbon from sulfur compounds

V. Sh. Bakhtadze, V. P. Mosidze, R.V. Janjgava, D.G. Kartvelishvili, N.D. Kharabadze M.V. Pajishvili, N.M. Chochishvili
Iv. Javakhishvili Tbilisi State University, R. Agladze Institute of Inorganic Chemistry and Electrochemistry

PP14. Works of Academician Rafael Agladze on Generating Complex Ions in Water Solutions Containing Ammonium and Manganese Compounds

M. Tsintsadze, T. Tsivtsivadze, G. Tsintsadze, T. Edilashvili
Georgian Technical University

PP15. Adsorption Purification of Air from Nitrogen Oxides by Natural H-Mordenite

Pirtskhalava N.[1], Eprikashvili L[1]., Kordzakhia T.[1], Zautashvili M.[1], Dzagania M.[1], Rubashvili I.[1], Kordzakhia K.[2]
[1] *I.Javakhishvili Tbilisi State University; Petre Melikishvili Institute of Physical and Organic Chemistry*
[2]*St. Andrew's University of the Patriarchate of Georgia*

PP16. Bioethanol production from unedible plant raw materials

L.Tatiashvili, N. Tserodze, I. Mikadze

I. Javakhishvili Tbilisi State University, Petre Melikishvili Institute of Physical and Organic Chemistry

PP17. Hydrobiometallurgical Method for Commercial Utilization of the Manganese-containing Waste

L. Sakhvadze, D. Sakhvadze, G. Tavadze, G. Jandieri, A. Rapava
LEPL Ferdinand Tavadze Institute of Metallurgy and Materials Science

PP18. Mineralization of Atrazine and Cyanuric Acid by Electrochemical Advanced Oxidation Processes

N. Oturan[1], E. Brillas[2], M. A. Oturan[1]
[1] *Université Paris-Est, Laboratoire Géomatériaux et Environnement (LGE), 5 bd Descartes, 77454 Marne-la-Vallée Cedex 2, France*
[2]*Laboratori d'Electroquímica dels Materials i del Medi Ambient, Departament de Química Física,Universitat de Barcelona*

PP19. Treatment of Waters Contaminated by Aniline Brome –and Chlorine Containing Compounds by Electro-Fenton Method

G. Gorelishvili[1,2], D. Gogoli[1,2], A. Benashvili[1]
[1]*I. Javakhishvili Tbilisi State University R.Agladze Institute of Inorganic Chemistry and Electrochemistry*
[2]*Georgian Technical University*

PP20. Therapeutic and prophylactic functional food stuffs of new generation

T. Tsivtcivadze, N. Chigogidze, R. Skhiladze, G. Sulakvelidze, E.
ChigogidzeBiologically Active Substances Research Center of Georgian Technical University

PP21. Using local sorption materials to treat used motor < Castrol 15 W-40> oil

N. Mamulaishvili[1], T. Mamedova[2], T. khitarishvili[3]
[1] *Shota Rustaveli State University; The Faculty of Engineering technology*
[2] *Baku Scientific-Research Institute of oil Chemical Processes*

[3]*Georgian Technical University-Doctoral student*

PP22. Air-Al Fuel Cell with Hydrogen Peroxide Co-generation

P. Nikoleishvili[1], G. Agladze[1,2], G. Gorelishvili[1,2], V. Kveselava[1],
D. Gogoli[1,2], M. Avaliani[1], I. Kakhniashvili[1,2]
[1]*Ivane Javakhishvili Tbilisi State University*
Rafael Agladze Institute of Inorganic Chemistry and Electrochemistry
[2]*Georgian Technical University*

PP23. New Systems of Direct Methanol Fuel Cells with H_2O_2 Generation

G. Agladze[1,2], P. Nikoleishvili[1], G. Gorelishvili[1,2], V. Kveselava[1], N. Nioradze[1]
[1]*I. Djavakhishvili Tbilisi State University*
R. Agladze Institute of Inorganic Chemistry and Electrochemistry
[2]*Georgian Technical University*

PP24. Cogeneration of Alkali Metal Peroxides and/or Perborate in Borohydrate Fuel Cell System

G. Agladze[1,2], P. Nikoleishvili[1,2], G. Tsurtsumia[1,2], V. Kveselava[1],
G. Gorelishvili[1,2], R. Kurtanidze[1]
[1]*Ivane Javakhishvili Tbilisi State University*
Rafael Agladze Institute of Inorganic Chemistry and Electrochemistry
[2]*Georgian Technical University*

PP25. Thermodynamic Properties of the Ferrites of Spinel Type

T. Machaladze, V.Varazashvili, N. Lezhava, M. Tsarakhov, M. Khundadze,
T.Pavlenishvili,R. Jorbenadze, G. Japaridze
I.Javakhishvili Tbilisi State University
R. Agladze Institute of Inorganic Chemistry and Electrochemistry

PP26. The Treatment of Waters Contaminated by Pesticide B-58 Using Chemical and Electro-Fenton Methods

D. Gogoli,[1,2] G. Gorelishvili, [1,2] A. Benashvili[1]
[1]*Georgian Technical University*
[2]*Ivane Javakhishvili Tbilisi State University Rafael Aglasdze Institute of*

Inorganic Chemistry and Electrochemistry

PP27. The Treatment of Waters Contaminated by Nitro- and Amino Phenol Derivatives Using Electro-Fenton Methods

G. Gorelishvili, [1,2] D. Gogoli,[1,2] A. Benashvili[1]

[1]*Ivane Javakhishvili Tbilisi State University*

Rafael Agladze Institute of Inorganic Chemistry and Electrochemistry

[2]*Georgian Technical University*

PP28. Dependence of manganese hydroxide precipitation pH on temperature in manganese and ammonia sulfates solutions

L. Beriashvili, D. Gogoli

Georgian Technical University

I. Javakhishvili Tbilisi State University R.Agladze Institute of Inorganic Chemistry and Electrochemistry

ABSTRACTS

OP1. THE IMPACT OF THE CURRENT FINANCIAL CRISIS ON GEORGIA AND HOW TO RESPOND TO IT

J. Schramm
Management Consultant
D – 53340 Meckenheim / Germany
juergenschramm@gmx.net

Summary

Georgia is a small economy of slightly over USD 10bn. It was once a relatively affluent part of the Soviet Union but its resource endowment is not much more than a unique cultural heritage and traditional hospitality. Historically it has been positioned at the crossroads of Europe and Asia; earlier it has been called the "Silk Road" which now became a strategic gas and oil transit route to the Mediterranean, bypassing Russia. The key sectors of the economy are agriculture, some ores and a small industrial sector. The government's aim is to develop the country into an international transit corridor for gas, oil and other goods. Tourism is also an increasingly significant sector.

The August hostilities around South Ossetia in 2008 and the economic breakdown as a consequence of the financial in 2009 had severe consequences for the country. Prospects for the reintegration into Georgia of the breakaway provinces of Abkhazia and South Ossetia, which were already remote before the conflict with Russia in 2008, have vanished. Russia recognised the independence of Abkhazia and South Ossetia. There are only a very few other countries who have recognised the two provinces' independence. Russia's decision appears to be irrevocable. If and when the former situation with Georgia could be re-established is currently unpredictable. In this context the current negotiations of the Russian government with the World Trade Organisation (WTO) may play an important role. Georgia has indicated that it may not block Russia's accession to the World Trade Organisation, which is expected to occur in near future, as long as Russia lifts its blockade on Georgian goods, and customs control is established at the internationally recognized border, recognising South Ossetia and Abkhazia as sovereign states. Whether some kind of compromise can be found under those facts is nearly impossible to me to predict.

The Georgia government made enormous progress in the economic sector during the past eight years – it implemented major political, institutional and economic reforms and became a top economic reformer. It ranks the highest on institutional quality and ease of business in the CIS, and compares to top European reformers. Nevertheless, the Georgia economy has been significantly affected both by the conflict with Russia and the international financial crisis. The August conflict undermined investor and consumer confidence, put stress on public finances, damaged infrastructure and put serious pressure on the banking system because of large deposits withdrawal. The intensification of the international financial crisis has put further pressure on the currency and foreign investments, affected the quality of the loan portfolio while the international financial markets remain closed. Remittances from abroad, particularly from Russia, went down which accounts for two-thirds of the source of remittances. This negative impact has been partly offset by large-scale international financial support, amounting to about USD 4.55 billion over three years, pledged in October 2008. The international financial support continues and is one of the strongest pillars for the economy of the country.

What are the challenges for the country?

- The financial crisis revealed important weaknesses in the financial sector. Improvement in risk and portfolio management including though increase in local currency lending, as well as improvement in supervision and confidence in the banking sector, are important for financial sector stability.
- The rehabilitation of decaying physical infrastructure is a major challenge and part of the government's anti-crisis stimulus plan. Further investments, regulatory reforms and private sector participation in infrastructure and municipal utilities are important for improving efficiency, quality of services, and long-term sustainability.
- The economic base of the country needs to be broadened again beyond the financial services and the construction business. Developing the tradable sector, by supporting exports and improving competitiveness, especially in manufacturing, and developing import substitution, in particular in agribusiness, are important for long-term sustainable growth.

- Further improvements of the business climate are necessary to boost confidence and attract more foreign investments. These should include in property rights, independence of the judiciary, and a further reduction in corruption as one International Financial Institution said.

The government has developed a number of investment plans and is heavily trying to attract foreign investors, in particular for hydropower projects primarily targeted for exports, tourism and agriculture. Batumi will be developed to a international top tourism centre with a number of huge hotels. Names such Hilton, Radisson and Kempinski are being dropped. It looks like as if Georgia is going to compete with Turkey or Spain. Whether this will be a successful business model seems questionable to some experts.

Agribusiness will be certainly a very important sector again. More and more foreign investors have come to Georgia during the recent years, built up their business, have taught and trained their staff – apparently there are no such state organisations and will attract other investors.

To sum up one can certainly say that the Georgian government is fully aware of the challenges and is working on it. The international donor community will provide its support to the country.

OP2. THE OMPACT OF THE MANGANESE CHEMICAL INDUSTRY ON THE SUSTAINABLE DEVELOPMENT OF THE ECONOMY

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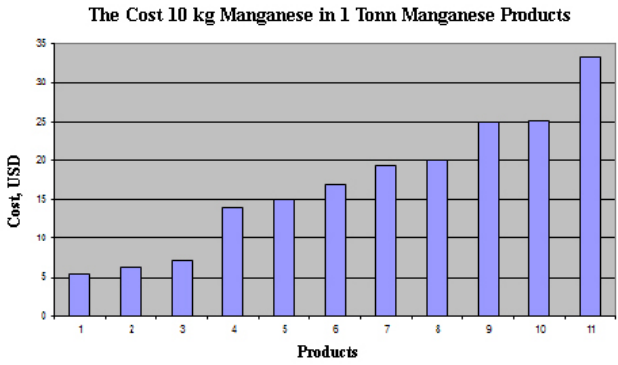
The analysis of the global manganese market leads to the following conclusions:

- Chemical Processing of manganese ores results in manufacturing of highly diverse added value products (fig.).
- In nearest decades there are no adequate substitutes for manganese compounds in the major applications sectors.

- The growth rate of manganese chemical production on global scale is about 8-12%. It is envisaged that in a number of applications (electro mobiles and hybrid autos, energy conversion and storage devices etc) demand for manganese compounds will be doubled in a nearest decade.
- A decrease of the export of row manganese materials and increase in export of added value products, manufactured by the chemical processing of the domestic ores as well as integration of mining and processing industries in vertical companies is a global trend in manganese industry.
- Manganese chemical industry contributes significantly to the sustainable development of the economics in transition (China, Gabon etc).

In the XX century strong chemical sector of Georgian industry was able to manufacture electrolytic manganese metal (4,000 t/y), battery grade manganese dioxide (16,000 t/y), potassium permanganate (5,000 t//y), animal food grade manganese (1,500 t/y) and fertilizer grade manganese sulphate monohydrate (800 t/y). The overall number of the employed was about 2000 person and export volume - about 50 mil US Dollars.

In the presentation current state of the manganese chemical sector as well as role of the new factors e.g. increase in electro energy generation capacities on rehabilitation perspectives of the chemical industry and its impact on the sustainable development of the economy of Georgia will be discussed.



1. Manganese Ore – 40% Mn
2. Manganese Ore – 45% Mn
3. Manganese Ore – 50% Mn
4. Natural Manganese dioxide
5. Manganese Oxide
6. Manganese Carbonate
7. High Carbon Ferro Manganese
8. Silico Manganese
9. Manganese Sulphte Monohidrete
10. Electrolytical Manganese Metal
11. Electrolytical Manganese Dioxide

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OP3. ELECTROCHEMICAL ADVANCED OXIDATION PROCESSES FOR EFFICIENT REMOVAL OF PERSISTENT ORGANIC MICROPOLLUTANTS FROM WASTEWATER. APPLICATION TO ELIMINATION OF PHARMACEUTICAL POLLUTANTS

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Traditional water treatment processes remain inefficient in the clean up of wastewater containing toxic and bio-recalcitrant organic pollutants. On the other hand, a large number of Advanced Oxidation Processes (AOPs) have been successfully applied to remove such pollutants from water. In AOPs, the in situ generated powerful oxidizing agent, hydroxyl radicals ($^{\bullet}OH$), react on the organic pollutants up to their mineralization trough several reaction modes including electron transfert, dehydrogenation or hydroxylation. Recently new AOPs based on the electrochemical technology are being developed. Electrochemical advanced oxidation processes (EAOPs) constitute emergent processes in decontamination of wastewater containing toxic and persistent organic pollutants such as pesticides, synthetic dyes, chloro- or nitrophenols, polychlorinated biphenyls, margins, landfill leachates, pharmaceuticals [1, 2], etc.

In this lecture, the principles of different EAOPs such as direct (anodic oxidation), indirect (electro-Fenton) and electro-Fenton coupled to anodic oxidation, as well as combined processes will be presented. In anodic $^{\bullet}OH$ are generated by oxidation of water on a high O_2-overvoltage:

$$M + H_2O \rightarrow M(^{\bullet}OH)_{ads} + H^+ + e^-$$

In the case of the electro-Fenton process, hydroxyl radicals are generated in the bulk of solution by electrochemically supported Fenton's reaction:

$$H_2O_2 + Fe^{2+} \rightarrow Fe(OH)^{2+} + {}^{\bullet}OH$$

in which the Fenton's reagent ($H_2O_2 + Fe^{2+}$) is electrocatalytically

generated through simultaneous electroreduction of O_2 (from compressed air) and Fe(III) (catalyst) on a carbon felt or gas diffusion cathode. This process can be coupled with photochemistry (photoelectro-Fenton) [3], sonochemistry (sonoelectro-Fenton) [4] or coagulation (peroxycoagulation) in order to enhance $^{\bullet}OH$ production rate and consequently the pollutant and/or solution TOC removal rate.

The effect of several experimental parameters that largely influence the degradation kinetics and mineralization efficiency of organic pollutants will be discussed. HPLC analyses and TOC measurements show a very quick disappearance of organic pollutants as well as their aromatic or aliphatic by-products in all cases. The great capacity of oxidation and/or mineralization of different AOPs for the destruction of toxic/persistent organics pollutants will be described. Treatments are monitored by the evolution of the solution toxicity using Microtox test. Obtained results evidenced that evolution of the toxicity could be explained by the evolution of oxidation reaction intermediates.

This presentation aims to present the availability and effectiveness of the EAOPs to application to removal of the emerging organic pollutants, i.e. the pharmaceutical pollutants from contaminated water, including their degradative oxidation kinetics with hydroxyl radicals, reaction mechanism, mineralization efficiency and toxicity evolution during treatment.

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OP4. TREATMENT OF WASTEWATERS FROM REFRACTORY ORGANICS BY MEANS OF GREEN REAGENTS GENERATED IN ELECTROCHEMICAL REACTORS AND FUEL CELL SYSTEMS

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Advanced oxidation processes (AOPs) of biologically non-degradable organics remediation is based on reaction with hydroxyl radicals (*OH), formed by catalytic destruction of H_2O_2. Products of H_2O_2 and OH* destruction are only green reagents, oxygen and water.

Original membrane electrochemical reactors, operated on commercially reasonable (500-1500 Am^{-2}) current densities with 80-100% current efficiency and average specific energy consumption of hydrogen peroxide electro-generation had been designed and successively used for treatment of solutions with phenol and its compounds, (4-chlorophenol, o- and p-nitrophenols, m-aminophenol and sodium p-nitrophenol), aniline and its compounds, (2,6- dichloraniline, p-bromaniline) to nearly complete mineralization. In comparison with conventional Fenton treatment process, 65% economy of treatment cost was achieved using Electro-Fenton method [1].

Running costs on H_2O_2 generation and overall purification cost was significantly lowered in tests where co-generation of hydrogen peroxide proceeded in the fuel cell (FC) systems. Metal free carbonic air-diffusion cathode, washed by the catholyte is separated by ion-exchange membrane or membrane-electrode assembly from the anode chamber, where oxidation of solid (Al), gasous (H_2), or liquid (alcohols, borohydryde etc) fuel is obtained with generation of electrons to the outer circuit. Number of original Al-air FC, Direct methanol fuel cells (DMFCs) and borohydride fuel cells (BFCs) systems were developed and successfully tested in wastewater treatment using “in-cell” or “ex-cell” mode of operation [1-5]. Utilization of sodium methaborate, continuously formed during BFC operation and wasted in the known DBFCs, has been obtained

with co-production of valuable detergent – sodium perborate due to mixing of anodic and cathodic products in the separated vessel [6]. Thus, the novel fuel cell systems were designed which can be used for effective treatment of water in remote regions by tourist, military or agrarian complexes as well as for insulated systems (spacecrafts, submarines, etc.) or for bleaching purposes in pulp and paper industry and washing machines.

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OP5. ECONOMICS OF COMMODITIES: GLOBAL ANALYSIS

A.G. Tvalchrelidze

Economic development of the world is synergistically followed by gradual increase of production and consumption of main primary commodities. By the beginning of the new Millennium production of metallic and food commodities reached its maximum values, and further expansion of commodity production without world-wide exploration campaigns and dramatic increase of harvested area will lead to exhaustion of commodity resource base.

Role of commodities in the modern world is extremely important. First, commodities are subject to world-wide inter-country and intercontinental flows, which, in turn, promotes development of other businesses. Second, trade of commodities is the basic imperative on which the

international commerce is based. Third, commodities provide excellent possibilities for private investments. Four, in a short-term run commodity prices are subject to distinct cycles and correspondingly predictable. Such environment creates room for speculations, which, in turn, ensure liquidity of commodity markets. Economic modeling have sown that the world, the commodity exporting and the commodity importing countries' GDP in great extent depends on volume of produced, consumed or exported commodities. In other words, periods of economic development are characterized by increasing commodity production and consumption whereas periods of recession are distinguished by diminishing volumes of produced and consumed commodities.

International commodity flows have huge impact on improvement of the modern world infrastructure. Development of crude oil and natural gas pipelines, tanker and LNG fleet, oil and LNG terminals, oil, gas and coal ports, etc. aim a sole target – efficiently and timely provide commodities to consumers.

Commodities play a significant role in the world geopolitics. In eighties of the recent century President Reagan persuaded Saudi Arabia to flood the world market with cheap oil at the same time providing inner market with petroleum from strategic reserves. These measures, known as "a new political economy of oil", ultimately lead to collapse of the USSR. Just oil and gas geopolitics is the basic reason for new international pipeline projects. Inadequate reinforcement of Russia, which had based economic development upon extensive exports of primary commodities, is a basic concern of free economies. Correspondingly, an idea of new pipeline projects was internationally discussed (INOGATE, NSABUCCO, Trans-Caspian Gas Pipeline Project, Trans-Africa Gas Pipeline Project, Algeria – Italy Gas Pipeline Project, and North Sea Gas Pipeline Project).

In the globalized world commodities are either subject to intergovernmental agreements or traded at commodity exchanges under spot and futures contracts. That is why commodity prices do not follow the basic economic rule – relation of supply versus demand but are fixed by basic commodity exchanges. In this process crude oil represents a world-

wide benchmark for world commodity pricing, and other commodities including even grains and other food are dully following the price course of crude oil.

Excessive commodity pricing in 2001-2008 and, then, their sharp decrease in autumn 2008 – winter 2009 lead to the global economic crisis. The main lesson of the crisis is very simple: the world has changed, and gambling with commodity prices is extremely dangerous; on the other hand, it became clear that extreme expansion of the finance sector on commodity market is destructive. Thus, a real equilibrium, a golden mean between the commodity chain and the world economic development should be urgently elaborated.

OP6. PRIORITY TO UTILIZATION OF NATIONAL RESORCES

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1. World financial crisis slowed the economic growth in Georgia and decreased amount of direct foreign investments, while inflation rate, foreign debts, negative trade balance, unemployment level, number of people living below poverty line sharply increased. Such situation was caused not only by world financial crisis and consequences of the war with Russia, but also by the inner state conditions. Afterwards, the situation was partially equilibrated, but we are still far away from the desired results: in 2010 the Gross Domestic Product (GDP) in current prices composed USD 11,663.4 million, and this figure is 8.3% more than GDP index for 2009 but 8.9% less than that of 2008. Share of production sector, composes 27.5% (32.9% in 2006) of GDP. This

sector includes agriculture, forestry, haunting and fishery – 7.3% (11.2% in 2006), industry – 14.7% (14.8% in 2006), construction – 5.5% (6.9 % in 2006).

2. Share of real sector in Georgian economics is not small but the product manufactured in this sector (agriculture, industry) cannot meet domestic country demand, which is greatly satisfied by imported goods. As a result, billions of Laris (GEL) earned in Georgia flow abroad, creating this way work places in foreign countries while in Georgia unemployment is increasing from year to year. Rich natural resources crucial for the development of these businesses are not used, and government declared tourism as the sole priority sphere. We believe that such development trend will make our country more dependent on imports, and economic integration with the European Union will become more difficult.

3. Government should support development of national resources-based industry and agriculture (not excluding, of course, tourism) but such actions require elaboration of the long-term state program, which still does not exist. Hence, a long-term program of social & economic development of Georgia is already worked out and published [1]. In case I if this program is implemented, GDP and state budget incomes will increase ten times, and this will result in reaching mid-European indices of GDP per capita, employment level and inflation rate.

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OP7. ECONOMICAL AND ECOLOGICAL ASPECTS OF ZEOLITE APPLICATION

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Zeolites are aluminosilicates ($Me_nSi_xAl_nO_{2(x+n)}\cdot mH_2O$, Me = Na, K,... ½Ca, ½Mg,...) with different three-dimensional framework structures that form pores and channels of molecular dimensions. Molecular-sieve effect, sorption and diffusion at the surface and in pores or channels, the ability to undergo the ion exchange and to play a role of catalyst are the most important properties of zeolites giving a basis for their application as sorbents, ion exchangers and catalysts in industry, agriculture, protection of environment, medicine, etc. Zeolite-containing rocks of different geological age and type (clinoptilolite-heulandite, phillipsite, analcime, laumontite, mordenite, etc.) are wide spread on the territory of Georgia. Estimation of application of natural and synthetic zeolites as sorbents and ion exchangers needs to take into account both economical and ecological aspects.

Zeolite catalysts significantly lower the Sheldon's E-factor (ratio of total mass of products involved in the process to the mass of target product) for procedures in organic synthesis, zeolite grains trap heavy metals in fresh water treanment, another example – change of organic softener complexons in detergents by LTA and other type synthetic zeolites.

Significants economic effects characterizes zeolite application in following branches of agriculture:

Stockfeeds – Zeolite additives providing weight increase (by 8/12%), and young animal's safety (over 99%) for poultry, cattle, etc. as well as decrease of E-factor by 15/25% not taking into consideration the possibility to utilize waste/sawage using natural zeolites.

Fertilizers – direct application giving possibility dispense with mi-

neral fertilizers, additives to mineral fertilizers decreasing usual NPK-doses, and "organic" fertilizers utilizing stock-breading wastes provide the lowering of E-factor 2/5 times, but such factor is not enough for correct comparizon of the Zeolite and NPK-fertilizers, especially in a case of possible pollution control and estimation, a multifactorial approach is necessary.

Aquaculture – Zeolite decreases ammonia levels in ponds and tanks and reduces fresh water consumption 5/20 times, significantly lowering E-factor.

Production of medical zeolite preparations is characterized by low material capacity, the E-factor is many times lower, than for organic synthesis of analogs.

OP8. CAPITALIZATION OF MINERAL COMMODITIES: WORLD AND GEORGIAN EXPERIENCES

A. Tvalchrelidze

Today, there is a single parameter, which determines capitalization of mineral commodities at international markets: Net Present Value (NPV) of eventual mining enterprises. However, discounting of NPV is possible only in course of feasibility study of mining projects. That is why early exploration of so-called "greenfields" is a venture business and its financial viability greatly depends on experience of the exploration team. Hence, there is a possibility to discount NPV even at the early stage of exploration, which could be based on a so-called Price Index, which I introduced in 1995:

$$I_p = P_S Q_O$$

Where: I_P = Price Index, P_S = specific price of 1 unit (1 t or 1 m^3) of the natural resource, Q_O = reserves of a resource. Then, $P_S = \sum_i P_i C_i k_{Ei} - K_O$, where P_i = specific price of *i* constituent, C_i = its grade in ores, k_{Ei} = extraction factor of *i* constituent, K_o = cost of

processing. In this case

$$NPV = \sum_{i}^{t} I_{p}^{\alpha t},$$

where t = time and α = discounting coefficient.

The report will deal with technologies of NPV discounting for Greenfield territories.

Taking into account the world practice of financial evaluation of greenfields, it may be concluded that the Georgian experience of issuing mining licenses is not acceptable for international mining companies: the starting price for greenfields is 500 GEL/ha in Georgia whereas it is US$ 20/ha in the USA and several cents in Australia, Canada and other countries with the developed mining infrastructure. Due to this sad realm, no exploration company is coming to Georgia, and the sole existing regional geological information has been accumulated in the Soviet era.

Our proposal is, first of all, to separate exploration and mining licenses from each other. Then, to dramatically decrease starting price for greenfields but if a discovery is made imply new prices for delivering mining license based on technologies discussed above.

Econometric modeling of possible income from such governmental measures has demonstrated that the annual cash flow to the state budget may reach US$ 2 billion.

OP9. PREPARATION OF THE ACTIVATED MANGANESE ORES

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The Possibility of preparation of electrochemicaly active γ-MnO_2 by means of processing of various types Chiatura manganese ores was propoesd and tested [1-3]. Contray to the traditional technology, which

involves two-stage processing of β-MnO_2 or $Mn_2O_3 \cdot 2H_2O$ ores by means of high-temperature (600-700°C) roasting of the ore and subsiquent treatment of the ash by mineral acids [4-6] or oxidizers [7,8], in our technology cinder material is by treated by chlorine which is *in-situ* generated in the electrolyzer, containing a mixter of hydrochloric acid and sodium chloride, as electrolyte.

The γ modification of the product was tested by means X-ray spectroscopy and performance characteristics of the dry battery, consisting target product as a cathode material was tested.

The specific capacity of the alkaline battery consisting from the cathode, which was prepared by treatment of the β-MnO_2 was 140-150 mA·h/g, which is close to the specific capacity of the battery, consisting from electrolytic manganese dioxide.

The specific capacity of the battery, consisting cathode material prepared by processing of the hydrited Mn_2O_3 was 120-130 mA·h/g. The yeld of the treated by clorine product was 100% for metal treated while nitric acid is only 50-55%.

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OP10. LAYERS OF ANODICALLY PREPARED MANGANESE DIOXIDE FOR ULTRACONDENSERS

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Manganese dioxide may be considered as a promising material for supercondensers. This is due to a relative cheapness of manganese dioxide, its environmental safety and an ability of repeated cycling. Its properties depend on a number of the factors: size of material grains, crystal structure (or its absence), foreign ions, introduced in a structure and etc. The use of various additives is one of the efficient means for preparation of the material with required properties.

In presented work the capacitive properties of thin layers, prepared by electrochemical method at flat platinum electrode, were studied. Fe^{2+} - ions, aniline and polyvinyl alcohol were used as the additives in the course of layers preparation in an electrolyte. X – ray crystallographic analysis has shown that the deposit, obtained at an anode, represents the amorphous hydrated manganese dioxide. The measurements were carried out in 0.5 mole/l solution of Na_2SO_4. The cycling was performed in the range from 0.1V to 0.9 V by the rate of potential sweep - 50mV/sec. Recording of 400 sequential cycles was carried out. All additives cause the sharp improvement of specific capacity of the layers, prepared in various conditions, which attained 400-450F/g in the presence of iron and polyvinyl alcohol.

The capacity was determined by the formula: $Cow = I\Delta t/\Delta Vm$ where I – current density at given potential, t – time, V – electrode potential, m – layer mass. In the case of all three additives the loss of capacity comprised up to 10% after 400 cycles.

OP11. SIMULTANEOUS ELECTRODEPOSITION OF MANGANESE METAL AND ACTIVE MANGANESE DIOXIDE IN THE ELECTROCHEMICAL REACTOR, DIVIDED BY THERMALLY STABLE ANION-SELECTIVE MEMBRANE

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Most valuable products of manganese ore treatment – electrolytic metal manganese (EMM) and electrolytic manganese dioxide (EMD), are produced worldwide in separated plants despite of the identical technological circuits of preparation of manganese sulfate electrolyte and of the fact that they are deposited at electrodes of opposite polarity that stimulates their combined production in the same electrolytic cell. Moreover, electric power is used effectively only at one electrode of these cells while it is consumed on production of the waist product – anodic oxygen evolution, in case of EMM winning process, and cathodic hydrogen evolution, in EMD production. Two main reasons of this dissipative matter manganese metal are: a) different required temperature regime of electrolytes: (>90°C) in the anolyte and (<35°C) in the catholyte; b) ammonia sulfate, the mandatory buffer additive into the electrolyte for EMM electrowining for maintaining of neutral medium, to avoid precipitation of manganese in hydroxide form, is absolutely inadmissible in EMD electrodeposition as it causes dramatic decrease of MnO_2 electrochemical activity in batteries which is the main field of application of this product. Principal possibility of simultaneous formation of EMM and EMD in the same membrane electrochemical reactor was shown in our previous works [1-3] but low selectivity of MA-40 type anion-exchange membranes used in these tests, towards cations became apparent in prolonged tests.

Possibility of AMI-7001S ion-selective membrane utilization (Membranes International Inc., USA) which was known previously as thermally stable in electrodialysis processes applications, for electrolysis of manganese solutions has been studied in the present work. Effects of electrolyte temperature, manganese and ammonia sulfates concentrations, selenium compound additives, solution flow rate and cathodic current densities variation on the current efficiency of manganese metal has been determined.

Current efficiency of manganese deposition at titanium cathodes dropped to zero level with increasing of temperature up to 70°C when solution with 30g/L Mn^{2+} and 160g/L $(NH_4)SO_4$ was used but at concentrations in a range of 40-50 g/L $Mn^{2+}$and of 126-70 g/L of $(NH_4)_2SO_4$, 40 % c.e was obtained at 70°C. Addition of Na_2SeO_4 resulted in increase of Mn current efficiency, but formation of colloidal selenium was observed in the catholyte. More than 90% of generated H_2SO_4 was accumulated in the anolyte. The membrane showed good mechanical stability at 92^{o}C in the anolyte and 70°C in the catholyte.

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OP12. PREPARATION OF "SAFE" DRINKING WATER BY THE USE OF NANOFILTERS

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Owing to the high surface to volume ratio nanoparticles displaying unique adsorption and catalytic properties. A number of advanced nanomaterials as nanosilver, manganese and titanium dioxides as well as various carbon nanotubes were intensively tested for utilization in the water purification systems [1-3]. Recently the high toxicity of the nanosilver particles synthesized by the novel electrochemical method toward both gram-positive and gram-negative bacteria was proved [4,5]. The high killing rates of E-coli were demonstrated (table).

Nanostructured manganese dioxide, prepared by the novel method [5] is characterized by the high sorption and catalytic activity toward iron, manganese, arsenic (table) and other toxic metal ions, as well as radionuclide and H_2S. High performance characteristics of the filters containing Ag-MnO_2 NPs were experimentally tested. The trial batch of the filters for preparation of the "safe" water is manufactured and distributed.

Table

№	Filtrated Material	E.coli index in the water		Mn^{2+} Contant, mg/l		$(As^{3+}+ As^{5+})$ Contant, mg/l	
		Before treat-ment	After treat-ment	Before treat-ment	After treat-ment	Before treat-ment	After treat-ment
1	Nanosilver	> 1100	< 3				
2	Nano-structured Manganese Dioxide			2,93	< 0,05	0,123	< 0,01

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OP13. NEW TETRACYCLIC HETEROCYCLIC SYSTEMS, CONTAINING BENZIMIDAZOLE/BENZOTRIAZOLE AND BENZOTHIOPHENE/BENZOFURANE AND THEIR DERIVATIVES

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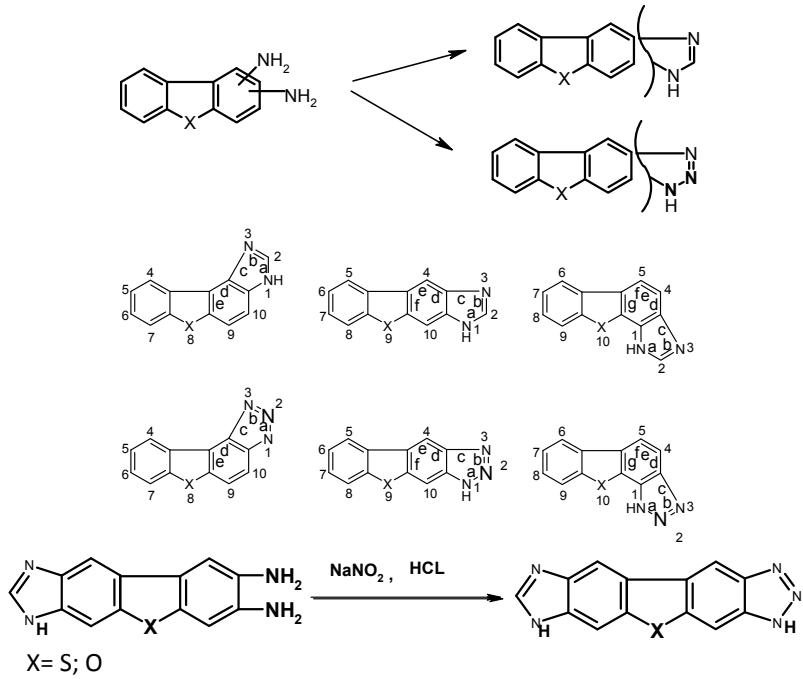
One of the most important goals of modern organic chemistry is synthesis of effective biologically active substances. We've created on the one hand benzimidazol/ Benzotriazole, and on the other hand tetracyclic systems, containing benzothiophene/benzofurane and their derivatives. Our choice was made, according to the high biological activity of the substances.

Initially, we had taken o-diamines of all possible constructions of dibenzothiophene and debenzophurane. By cyclisation of this substances we got responsive tetracyclic heterocyclic systems.



On the base of created benzimidazoles had been synthesised derivatives with possible biological activity.

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OP14. ONE-POT SYNTHESIS OF SOME NOVEL TETRAKISAZO DISPERSE DYES

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Multiple-chromophore-containing dyes have been synthesized by azo coupling of twentymembered poly(azomethine) dye and 3-nitro- or 2,4-dinitrobenzene-1-diazonium tetrafluoroborate in solvents of various polarity (water, chloroform) in the presence or absence of dibenzo-18-crown-6 as phase transfer catalyst. The obtained disperse dyes are suitable for dyeing Nylon and polyester fibers from light reddish brown to dark brown colors with good uniformity of dyeing as well as light, washing and sublimation fastness.

The main advantages of discovered azo partner compound and azo coupling reaction method in comparison to other known azo partners are as follows:

- Possibility to carry out one-pot azo coupling reaction to form tetrakisazo dyes
- Possibility to obtain azo dyes of deep color under one stage interaction
- Possibility to carry out azo coupling reaction rather middle conditions at 25-30 °C
- Possibility to obtain colored Nylon and polyester fibers from light reddish brown to dark brown colors with good uniformity of dyeing as well as light, washing and sublimation fastness.

The obtained disperse azo-poly(azomethine) dyes were applied for polyester and Nylon fibers. The results are listed in table below.

The main areas of application of prepared dyes are textile industry, namely dyeing of synthetic fibers such as Nylon or polyester. In addition, the dyes may be used in science as sufficient precursors for the synthesis of valuable metal complex compounds or multifunctional dyes of other types.

Dye	Hue	Fiber	Fastness						
			light	wash	Rubbing (dry)	rubbing (wet)	acid	alkaline	sublimation
1	brown	poly-ester	4-5	4-5	4-5	4-5	4-5	4	
1	dark brown	poly-ester	4-5	4-5	4-5	4-5	4-5	4	
2	brown	Nylon	4-5	4-5	4-5	4-5	4-5	4	
2	dark brown	Nylon	4-5	4-5	4-5	4-5	4-5	4	

The preparation of 20-membered polyazomehtine azo partner is developed as well as method of one-pot azo coupling between of 20-membered polyazomehtine and various diazo partners. The dyeing method of Nylon and polyester has also been developed.

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OP15. HIGHER PLANTS ECOLOGICAL POTENTIAL

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Elimination of contaminants from the environment by microorganisms of different taxonomic groups is a well-established, genetically determined property, which has already been widely discussed. Only recently, plants, still occupying above 40% of the world land, were considered as organisms having only a limited potential for contaminants conjugation and accumulation within the cell organelles.

Natural contaminations such as the emission of poisonous gases during a volcanic eruption and earthquakes, swamps poisoned evaporations, synthesis of toxic compounds by lower (microorganisms) and higher plants, etc., in comparison with the human contribution in the environmental contamination is much less impressive. As a result of urbanization, the unpredictable growth of industry and transport, production of chemicals for agriculture, military activities (explosives), etc. the concentration of anthropogenic toxicants spread in nature, especially in some regions, exceeds all permissible standards.

Analysis of experimental data of last two decades revealed the high ecological potential of plants. It allowed exposing the deep degradation processes proceeding in higher plants, in the majority of cases leading to the mineralization of contaminants. As a result of the enzymes action carrying out oxidation, reduction and conjugation processes these intracellular transformations have been revealed and characterised; formation of anthropogenic contaminants conjugates with endogenous compounds and enzymes participating in this process has been determined.

Finally, plants are considered as universal ecological remediators carrying out degradation of ecological contaminants in soil, water and air. Differing from microorganisms, by lower velocity of contaminant degradation, but extremely good for monitoring and long term protection of the nature.

OP16. PREPARATION OF INSULATING FILMS OF NEW CLASS ON THE BASIS OF POLYNAPHTOYLBENZIMIDAZOLES

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The development of modern radioelectronics is responsible for necessity of the creation of composite materials on the basis of light-sensitive polymers. Polynaphtoylbenzimidazoles (PNBI), whch are characterized by photosensitivity, attract a considerable interest. For their preparation the polymer of aminoimide type is used, differing from recently used silicon dioxide by elasticity and from polyimides – by good adhesion ability.

The investigations [1,2] have shown that for preparation of film – forming systems on the basis of PNBI, the step method of synthesis must be used. At first step the film-forming pre-polymer – poly[(o-amino)phenyl]naphtalimide (PANI) is produced at low-temperature poly-condensation; at second step – in macromolecules of PNBI an intramole-cular cyclodehydration by thermal polycondensation in solid phase takes place by formation of PNBI macromolecular chain. Polymer, prepared at second step, is characterized by chemical, radiation, mechanical and thermal stability. In accordance with dynamic thermogravimetric method, the mass loss in PNBI macromolecules at the air begins at ~ 500^{o}C and in inert media – at ~ 550^{o}C. The quantitative evaluation of the fragments of naphtalimide and naphtoylbenzimidazole allows the precise determination of the time of etching and thermal treatment of shadows in thecourse of photolithography or at the formation of definite relief by the nuclear magnetic resonance $^{13}C\{^{1}H\}$. In this case the polymer swelling and delamination takes place.

Blocking of terminal anhydride groups of a polymer by the use of aromatic diamines makes it stable and suitable for operation and

technology. Its properties satisfy the regnirements for the storage life of composite materials. Reagents, used for preparation of industrial polymer, aren 't explosive and fire hazard. Synthesis doesn't require a complicated apparaturs.The preparation of the films of desired thickness is possible by this polymer. Prepared films maintain a transparance at drying and thermal treatment (over 30 min at 350 ^{o}C) and have negligible loss in the weight and thickness, as well as maintain a good adhesion ability regarding to Si, SiO_2, Al. The creation of their thermally stabile composite combined with a negative photoresist will allow to prepare new electric insulating materials in microelectronics .

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OP17. HEAVY METALS IN MEDICINAL, AROMATIC, SPICY PLANTS AND IN SOIL

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Nowadays the contamination of ecosystem with heavy metals is one of the serious and nearly irreversible adverse ecological problem for any countries therefore its study is significant for the protection of living organisms, also the biodiversity of vegetative cover and the soil.

The toxicity of heavy metals is expressed by interfere with the grow-development of plants and microorganisms, their excessive quantity causes the damage of central nervous system of human and animals’ body, changes the composition of blood, negatively influences on the function of

internal organs, causes the severe physiological changes. The cadmium is one of the interesting element between them, which is involved in plant metabolic processes, causing the slow growth of root system, the injuries of internal and external structure, reducing the moving of food items and water that causes the disorder of accumulation of the balance of food and storage materials, the decrease of chlorophyll content and changes of photosynthesis processes and so on.

We have conducted a series of experiments that are aimed at the heavy metal content determination in soil, accumulation of medicinal, aromatic and Spicy in plants and their genetic resources study of the different ecosystem parameters, because the ecological safety tests in one - a factor in biodiversity conservation and phytogenetic resources during sustainable use [1 , 2].

The series of experiments conducted by us that have aimed the determination of heavy metal content in the soil, the accumulation in medicinal, aromatic and spicy plants in the period of their genetic resources study with the different parameters of ecosystem in the regions of country because the ecological safety test is one of the factor for the conservation of biodiversity and sustainable usage of phytogenetic resource.

The object of our research was the medical, aromatic and spicy plants: Valeriana officinalis, Valeriana alliariifolia, Origanium vulgare, Vaccinium myrtillus, Rhododendron Caucasicum and the soil cover of 10-30 cm depth. Fifteen heavy metals content were defined in the areas of Stepantsminda, Zugdidi, Mtskheta and Jamjamas. The pollution level of medical, aromatic and spicy plants and soil with the heavy metals were ascertained according to regions on a basis of comparison with the maximum allowable concentrations that will enable us to produce clean, high-quality phytomaterials that is demanded on the domestic market as well as has the high export potential.

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OP18. EXPLOSIVE COMPACTION AND OPTIMIZATION OF GD AND B CONTAINING COMPOSITIONS FOR APPLICATION IN EXTREME CONDITIONS

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The frequency of development contemporary technologies is strongly connected to the creation of new composite materials with multi-functional application. They should be characterised with all necessary complex properties for functioning in extreme conditions. The radiation materials science has one of the important segments among the huge spectrum in materials science. There is much interest in above mentioned materials in nuclear technologies. In particular, there are increased requirements in key-segments in nuclear reactors (under high-loading and high temperatures) working in extreme conditions. Accordingly, investigations for creating radiation-resistant and radioprotective materials (protecting from neutron and gamma radiation) are more active day after day.

The second main problem is a great quantity of accumulated nuclear waste as well as uncontrolled irradiation sources. They are a serious concern in environmental contamination. The efficiency of the measures for the protection from their effect essentially depends on the properties of the protective materials. Therefore, the production and characterization of such new composite materials with high characteristics of inactivated absorption and attenuation of neutral radiation, providing radiation protection, is actually. For the mentioned composite materials having the appropriate ratio mixtures of constituents can produce stable physical-chemical and radiation-resistant properties with universal abilities for absorption of various types of irradiation.

The third important problem is reliability and safety storage of radiation wastes. So, it is very actually to create new construction

materials for building of protective constructions reliable against industrial, scientific-research and other establishments or at various accidents (explosion and fire) and against expected terrorist acts.

The unique combination of radiation resistant and absorbing properties may be found in the composite of gadolinium, boron and tungsten containing Fe, Ni, W matrix. What has hindered the full utilization of such a composite has been the extreme difficulty in its fabrication. To produce such a composite to high enough density with sufficient neutron absorption constituents all the while possessing integral physical and corrosion resistant properties. Shock-wave compaction and consolidation (e.g. explosive compaction) technology has a high potential for success particularly with components having large differences in each of the component's physical properties.

Accordingly, the cited difficulties of consolidating ceramic like materials as well as the limited alloying of Gd with the alloying elements mentioned may be solved by the use of high temperature shock-wave consolidation technology.

In the paper the results of optimization of Me–Gd and Me-B containing composition for obtaining of materials with desired properties and results of explosive compaction are discussed.

OP19. STUDY OF ECOLOGICAL RISK FACTOR AREAS OF GEORGIA AND ELABORATION OF PHYTOREMEDIATION METHODS NEEDED FOR THEIR REHABILITATION

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One of the most urgent environmental problems become before mankind, is the problem of clearing of territories of military ranges and destruction of the chemical weapon. Contamination and pollution of soils and waters with heavy metals and radionuclids by number of industrial

objects in different regions of Georgia creates a threat to both: health conditions of Georgian population and eco-system in general. These metals and radionuclids are capable of accumulating in the organism and thus carry carcinogenic, mutagenic, teratogenic and embryotoxic qualities.

Existing methods and techniques to remove metal pollutants from soils and waters are inefficient, ecologically unsafe and expensive. Due to the above-mentioned facts, they are commonly applied only to the small sites.

Efficiency of biological cleaning technology of the soil that we suggest is also defined by the fact that plants used in phytoremediation process to remove metals and radionuclids are characterized with high accumulative abilities. They are to be selected based on preliminary study of local flora, because the factors such as pH of the soil and other biological peculiarities affect the accumulative capacities. It is recommended to use the mixture of rapid-growing plants with large biomass the ones that can be cropped several times a year.

The decrease of time needed for removal of heavy metals from the soil will be accomplished through achievement of optimal size of biomass of plants, through dissolving of phytoextraction effectors that significantly accelerate the metals' accumulation process on the surface and biomass. After cleaning of soils carrying out the heavy metals recuperation from the burnt plants will be possible. At the same time this biomass can be used for reception of ecologically pure bioenergy.

Results of researches are very important for protection of environment, a sustainable development and correct management of natural resources, and also for improvement of sanitary conditions.

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OP20. INSTALATION OF CONCRETE HORIZONTAL CONSTRUCTIONS WITH SILICATE MATERIALS AND HIGH PERFORMANCE CONCRETE'S INNOVATIVE TECHNOLOGIES ASSIMILATE-USE PRACTICE IN GEORGIA

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On Georgian Construction Market one of the innovative Project is ,,Forum Rakeen'' in Tbilisi, where first time was used modern technologies in Georgia, for example:

- With cements, Concrete aggregates and modification additives - produced in Georgia has been made C60 (M600) Class Concretes, which is High Performance Concrete.
- In horizontal Structures used 2-4kg/m^3 , 12-24mm basalt (silicate) fiber (made in Georgia).

  Reinforcement by basalt fibers, mechanical strength of Concrete on compression increased by

  2-10%, on bend increased by 20-50% after 7 days and 10-17% after 28 days, decreased anisotropy of Concrete Properties.

Refernces

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OP21. CHEMICAL PROCESSING OF MANGANESE-CONTAINING PRODUCTION RESIDUALS AND LOW-QUALITY ORES

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The issue of Georgian manganese-containing low-quality ores and production residuals processing on commercial scale and their utilization is a very important and at the same time not easily soluble problem.

In the current sources laboratory of the Institute of inorganic chemistry and electrochemistry in the course of the years have been carried out laboratory-scale and large scale tests of electrolytic manganese dioxide (EMD) receipt from Chiatura carbonate ores and concentrates that were accomplished with positive result. Over the last years (2008-2010) in the same laboratory has been implemented the work financed by Georgia National Science Foundation that refers to utilization of Rustavi EMD large-capacity production residual slugs, in particular receipt of EMD over again from them.

The representative batch (party) of Rustavi EMD production primary slugs consisted of 28,5% of total manganese and 18,0% of MnO_2. Tkibuli coal has been used as reductant (79,2% of C and 5,5 of bonded H). Large-scale reduction tests has been conducted in rotating drum electric furnace of continuous action constructed by us, that has a variety of advantages as distinct from furnace operating by natural gas heating. 100% ore reduction has been achieved under conditions of 1 hour exposure (temperature in the zone of reduction is 800-850°C). Reduced ore that contained 35-36% of Mn has been leached out by electrolyte worked out by electrolysis. The complete cycle of clarification from mixtures has been carried out with received solution. Quality of manganese extraction from solution comprised of 90-91%. Content of residual manganese in the

secondary slugs didn't exceed 6%. The possibility of this slug's application for cement production has been established. EMD received as a result of large-scale electrolysis met international demands by its content. On the basis of received information initial data have been processed for designing of pilot-plant equipment.

Especially important is the utilization of Chiatura manganese ore dressing residuals, so-called tailings, which quantity is increased by 100 thousand tons per year and makes ecological situation even worse.

On the basis of multiyear researches conducted by Georgian scientists we deem it possible to carry out large-scale implementation of ore dressing tailings' chemical treatment technology. Manufacturing and testing of small capacity (200-300 tons of high-priced production a year) pilot-plant equipment for mentioned residuals' processing is the necessary precondition of it, thereby optimal technology of manganese-containing residuals will be finally specified. This plant will become the interlink between scientific-research works and industrial production. At this moment we are working at drawing up of preliminary feasibility study for implementation of this project.

OP22. POLYMER COMPOSITES FILLED WITH BASALT MODIFIED WITH SILICON-ORGANIC COMPOUNDS ON THE BASIS OF EPOXY-RESINES

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In the process of elaboration of the polymer composites an application of different organic or inorganic addenda, by means of which the material physical and chemical properties may be regulated purposefully, attracts the growing attention at last time.

It is well known that by means of chemical modify of the carbon-chain polymers with some silicon-organic compounds it may be proofed the technical characteristics both polymers and composites based on them. In this work the polymer composites on the basis of epoxy-resins with thin (up to 100 mcm) dispersed natural basalt is used as filler. The purpose of investigation is the improvement of some properties of the composites based on epoxy resin filled with basalt powders modified by silicon-organic compound –ethyl silicate.

The basalt powder after 24 h exposition in the 3,5,7 mass.% water solution of ethyl silicate was dried in the normal atmospheric conditions, after which the powder was introduced to the epoxy resin of type ED-20 (filling 20-70 mass%) and cured by means of polyethylene-polyamine. The obtained composites underwent to heating 30 h in the thermostat during 30 h at temperatures 120-150^{o} C. Analogical composites but without unmodified filler were used as controlled samples.

Testifying of obtained samples were provided for definition of mechanical (strengthening at pressing, hardness, shock viscosity), thermal (softening temperature) properties and water absorption.

The analysis of the obtained results shown that all measured by us the technical parameters of the composites with modified fillers generally are improved in comparison with their unmodified analogues. For the composites with fillers modified by 5 mass% ethyl-silicate essentially (several times and in separate cases on the full order) the mechanical strengthening and thermo-strability increase at decreasing of water absorption.

The obtained results are described in terms of structural peculiarities of polymer composites.

OP23. STUDY OF TOXICITY RATE AND ENVIRONMENTAL POLLUTION CAUSED WITH ARSENIC-CONTAINING WASTE ACCORDING TO TCLP AND WET STANDARDS

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Currently in Georgia, particularly in Racha and Svaneti regions, where arsenic mining and processing was carried out, disposals 11 arsenic-containing compounds and soils e adjoining cropland areas.

We have also studied and determined the percentage of arsenic in arsenic-containing wastes by the Evans method. Table below presents the samples that contain greater amounts of arsenic.

Arsenic percentage in arsenic-containing wastes

#	Location of arsenic-containing waste	As,g	As,%
1	Burnt arsenopyrite, Tsana (Svaneti)	0.15	1.80
2	Around the repository (Racha)	0.10	2.40
3	Mepichala repository, Uravi	0.10	4.48
4	Acidic water sedimentation pond, Uravi	0.08	7.36
5	Preparations precipitator, Uravi	0.08	14.7

All wastes studied by us are the products of annealing. Therefore, they present oxides and mainly As (III), which indicates that they are redox-sensitive and much more toxic than As(V) compounds.

The arsenic-containing waste samples #3 and #5 listed above were investigated for toxicity by the standard test methods, including the Toxicity Characteristic Leaching Procedure (TCLP) and the Waste Extraction Test (WET).

It can be concluded that the both investigated samples are very toxic and that the appropriate technology needs to be developed to treat and process the appropriate wastes to a market product. Amount of arsenic with extremely high concentration wastes in two Georgian regions (Racha and Svaneti) equals to hundreds of tons.

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OP24. ELECTRODEPOSITION OF SELF-STRUCTURED SILVER ALLOY COATINGS

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The electrodeposition of silver alloys with less noble metals results at low current densities in pure silver coatings or solid solutions of these metals in silver. At high current densities, after saturation of the silver lattice with the alloying metal its surplus amount forms a new richer in this element phase and heterogeneous coatings are obtained. The spontaneous deposition of different phases is sometimes connected with electrochemical instabilities and oscillation phenomena leading to formation of periodically ordered spatio-temporal structures on the surface of the electrode. The spreading of waves of different metal composition over the electrode could result not only in wave, spiral or target structures on the surface, but also in the spontaneous formation of multilayered coatings, which combine the properties of the phases of the different sublayer.

The possibility of spontaneous formation of heterogeneous periodic self-structured coatings in micro- and nano-scale, based on silver alloys with antimony, bismuth, indium, tin, cadmium, as well as on some other alloys without applying external pulses is shown and some properties of the deposited alloy coatings are discussed.

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OP25. GROWTH OF NITRIDE AND PHOSPHIDE NANOWIRES USING HYDRAZINE VAPOR

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The objective of this work was development of a hydrazine (N_2H_4) based technology for the growth of nitride and phosphide nanowires. The growth of nanowires was performed by annealing different solid sources (Ge, In+Ge, InP, GaP) in hydrazine vapour diluted with 3 mol.% H_2O. The low water content helped to produce the volatile suboxide molecules. The mass transfer was accomplished through the sublimation of these molecules, which then were reacting with ambient gases and forming the nanowires on the Si and glass substrates located above the source materials. Hydrogen was one of the decomposition products of hydrazine, and the growth was performed in the simultaneous presence of oxidizing (H_2O) and reducing (hydrogen) gases. In our previous work [1] it was found that even in the presence of water molecules the pure, single crystalline germanium nitride nanowires may be produced using this technology. These nanowires have diameters in the range of 10-80 nm.

In the presented work we have studied the growth mechanisms of Ge nitride nanowires and the influence of process parameters on their composition and structure. The dependence of nanowire sizes on the growth temperature is presented in Fig.1.

When InP and GaP were used as solid sources the composition of grown nanowires were identical to source materials. However, the composition of produced nanowires strongly depended on the growth temperature when In+Ge was used as a solid source. In this case, by varying the temperature we were able to produce different nanowires including In_2O_3, $In_2Ge_2O_3$ and InN.

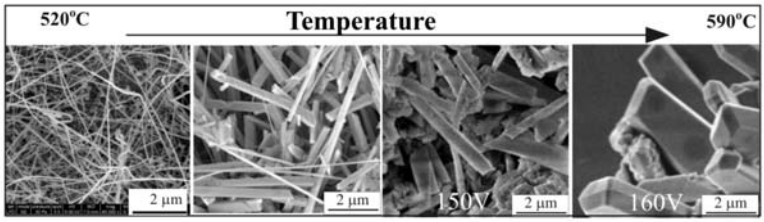

Fig. 1. The growth temperature dependence of germanium nitride nanowire sizes.

The results of this work clearly demonstrate that the nitride, phosphide and even oxide nanowires can be successfully produced using the developed hydrazine based technology.

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OP26. CORROSION STUDIES OF NANOSTRUCTURED ZINC AND ZINC BASED COMPOSITE COATINGS

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Novel composite materials based on zinc and some of its alloys with embedded polymeric nano-aggregates are developed and investigated. The main objective is to determine the corrosion

performance of these coatings in aggressive medium containing chloride ions as activators. Several types of nano-sized core-shell aggregates based on tri- or diblock amphiphilic copolymers have been investigated.

Following experimental methods and techniques are employed to determine the corrosion behavior of the hereby investigated metallic nano-composite coatings: Potentiodynamic polarization (PD), Linear polarization resistance (LPR), Cyclic Voltammetry CVA), Scanning vibrating electrode technique (SVET), Electrochemical impedance spectroscopy (EIS), Scanning (SEM) and Transmission (TEM) electron microscopy, X-ray diffraction (XRD) and X-ray photoelectron spectroscopy (XPS).

Further, the kinetics of the electrodeposition process itself is monitored in order to determine the relevant phenomena within the cathodic and anodic processes in the presence of nano-aggregates, embedded in the metallic matrix. It is established that the stability of the electrolytes for deposition of the composites is of great importance. The results reveal that the nano-aggregates containing electrolytic baths are with variable stability; some of them remaining sufficiently stable within prolonged time.

All above mentioned nano-aggregates were co-deposited (embedded) within the electrodeposition of zinc while some of them – for selected zinc based alloys. The incorporation of nano-aggregates in Zn alloys leads to partially contradictive results i.e. a well pronounced positive effect is observed only in definite cases.

Overall, it can be stated that the nano-composite zinc and Zn-based layers present better protective parameters compared to the galvanic Zn ones in neutral corrosion medium with Cl^- ions.

OP27. PAPPLICATION OF ELECTRICAL CONDUCTING RUBBER FOR INDICATION OF DIFFERENT LIQUIDES LEAKING FROM CAPACITIES

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The problem of indication of leakage of different liquids from big capacities has important meaning now. It is more essential when these capacities contain volatile and poisoning liquids (petrol and other oil products, active chemicals), which creates of danger after leakage because of ecological pollution of surrounding.

Two new simple methods based on application of conductive rubbers for indication of leakage of different liquids from capacities-containers made from any materials have been developed. First method is used for conducting liquids and second one for all liquids, which are capable to penetrate through the rubber.

The sensors present the made from conductive rubber developed by us a strip of films with wires connecting the sensor with the automatic monitoring. Rubber sensors are placed on the container surface through the cloth by which these surfaces are covered. In accordance with first method the liquid drops leaked through the capacities walls lead to contact of two neighboring strips. This contact is fixed by the automatic monitoring connected with these strips and is transformed to alarm signal. At using of second method signal about leakage of liquids is fixed by monitoring after diffusion of the liquid in the rubber and change the resistance of last.

The sensors were obtained on the basis of some silicon organic rubbers containing high dispersive (up to 50 mcm) powders of the conducting substances: graphite, carbon black and stainless steel. The concentration of the fillers were selected with the calculation of the optimal amount provided the specific volumetric electric resistance of the

rubber in the range 10-20 kOhm/cm. With the aim of increasing of some mechanical and thermal properties the sensor material contained high dispersive powders of the acid proof mineral andezite and basalt (up to 20 mass%). Here was used so called sinergist effect of fillers – non-additive change of physical properties of composites at selected ratio of fillers concentrations. This effect was used for selection of such ratio of filler content, which provides the production of material with high electrical conductivity and mechanical strength. Selection of the optimal ratio of the filler concentrations was occurred with using of methods of mathematical planning of experiments.

After testify of the rubber sensors at using of both first and second methods it was established that they are sensitive at contact with even one drop of petrol. Testify of the sensors on stability to different aggressive liquids (sulfur, nitrogen and hydrochloric acids) shown that all selected sensors satisfy to presented standard requirements.

OP28. **ENVIRONMENTALLY FRIENDLY TECHNOLOGIES FOR MANUFACTURING PURE METALS**

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The present report deals with an alternative way of producing pure metals by their reduction from the respective oxides. In contrast to the conventional methods of metallurgical treatment of ores the production of pure metals is realized using the methods of thermal dissociation of oxides in the atmosphere of ultra-low oxidation potential. The formation of such an environment is possible by using an oxygen

pump.

The process can be simplified and accelerated by suppression of the oxygen partial pressure in the useful capacity as a result of interaction of alcohol vapor with oxygen. For example, the introduction of 0.2 mg of alcohol in the atmosphere of l-capacity closed air container and its heating to 800^{o}C provides obtaining nitrogen with the oxygen partial pressure of 10^{-22}atm. Increase of the temperature up to 1500^{o}C causes ultra-deep evacuation of oxygen to 10^{-28}atm. Such conditions promote dissociation of oxides of almost any kind. A positive aspect is that the thermodynamic equilibrium of partial pressure at a given temperature is set during few seconds.

An installation for ultra-deep oxygen evacuation has been constructed and a methodology for conducting experiments was developed. The paper presents the results of complete thermodynamic analysis of the ethanol reduction processes of oxides (CuO, NiO, CoO, Fe_2O_3 and Cr_2O_3) in the temperature range 300-1500K.

OP29. QUESTIONS OF AUTOMATION OF PROCESSES OF PREPARATION COAGULANT SOLUTIONS FOR THE REAGENT PURIFICATION OF NATURAL AND WASTE WATERS

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Coagulation is one of the most spread processes in the technology

of purification of natural and waste water, which provides fast and reliable purification of water from the suspended and colloidal matters. Coagulation also reduces bacterial contamination and color of water.

The success of water purification with coagulant is depending on many physical and chemical factors, including the amount of injected coagulant and accuracy of its dosages. Therefore, it is a very important to prepare solutions of coagulant with required concentration for the water preparation plants.

According to the conventional technologies, the solution of the coagulant is used to be prepared in two stages. First, a highly concentrated solution is preparing in the mortar tanks. From the mortar tank, solution is pumped into the tank of the working solution, where it is diluted to the desired concentration. According to the recommendations, the strength of the working solution is 4-10%, but in practice there are used more concentrated 10-16% solutions of anhydrous aluminum sulfate $Al_2(SO_4)_3$.

When a non-automated preparation, solution concentration is controlled on density hydrometer. However appliances based on the measurement of density or use of ultrasound does not find application in practice due to the specific physical and chemical properties of the reagent solutions, which are corrosive, viscous suspensions, and connecting sediment with an inhomogeneous composition on the surface of the sensor devices. As a result, the measurement errors are increasing significantly, and there are technical problems during the exploitation.

OP30. PROCESSING AND MANUFACTURING AUTOMATIC DEVICES FOR ENRICHING THE DRINKING WATER WITH SILVER

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Contaminated drinking water is one of the sources of people's

poisoning and infection. In big cities and especially in the countryside, we face a big risk of microbes' invasion in human's organism with the spoon of water.

A portable series of device– ionatores called "Hope" will allow us to drink water without any fear from any source and vessels. In these devices there are used a centuries-old traditions and modern achievements of microelectronic.

The fact that drinkable water is taking medicinal properties in contact with silver, was known long ago, but it has been approved since the beginning of our century, that the water electrolysis with silver is a very simple and effective method of disinfection.

In 1942 Englishman Benton held a research between 30 000 road construction workers in State of Burma. He was able to stop the epidemic of Cholera and Dysentery. In 1940 in Iran, one of the largest water-pipe was equipped with ionatores. After many years of exploitation the quality of drinking water had significantly improved. Good results were obtained after processing the drinking water with silver on ships. At this time drinking water preserves its sanitary - hygienic properties for a long time. Also, the storage period of water increases greatly - from seven days up to one year. Antimicrobial properties of silver were widely used in medicine. As early as 1895, it had been used in surgery for treating wounded, suppressing purulent and inflammatory processes, treating wounds and skin diseases.

This kind of water is used as a remedy for gastritis, caries and many other diseases. Also for making compresses of treating purulent wounds. Enriched by silver, drinking water is desired for washing up vessels, vegetables and fruit, gargling through the mouth and throat against the flu, caning fruit and vegetable, processing fruits and alcohol.

Proposed series of devices are purposed as for the offices, restaurants, canteens, hospitals and families to use, also for individual usage in field conditions.

OP31. BACTERIOPHAGE BASED TECHNOLOGY AGAINST PLANT BACTERIAL DISEASES

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Among vegetables bacterial diseases bacterial spot of tomato, caused by *Xanthomonas vesicatoria* is one of the most spread and destructive diseases affecting both field and greenhouse-grown crops. Damage from these diseases may range from a light spotting of the foliage to almost complete defoliation of the plant, with corresponding impacts on plant morphological, structural and physiological/biochemical functions and production potential. Up to now, only limited reports are available on the use of bacteriophages for biological control of certain bacterial plant diseases [1, 2]

Study of the possibilities of phage application as a natural biocontrolling agent against Bacterial Spot of tomato has been carried out. 24h. washed off culture of 4 various pathogenic strains of *Xanthomonas vesicatoria* (of them 3 strains were isolated from the damaged tomato foliages and 1 strain from damaged tomato fruit) were used for artificial infection of tomato plants, grown in separate pots in greenhouse. $7x10^6$ p.f.u. of phage mixture of pure lines of phages mixture isolated from sewages and damaged tomato materials was sprayed to leaves. The disease development was expressed in yellowing and finally falls down of the leaves. No signs of disease were observed on the plant foliages of control plants. The disease was eliminated by phage spray--light spots remained on the infected sites, but the disease did not develop and the foliages of any plant did not yellow and fall down. Phage hindered the disease onset when it was sprayed just at the moment of bacteria

affection, after 24h. and even after 7 days. Phage untreated infected plants remained diseased. Evidence of disease was not observed within 3 weeks. Thus, bacteriophage application succeeded in dealing with bacterial spotting developed on the tomato foliages being affected with *Xanthomonas vesicatoria*.

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OP32. PROLONGED ACTION ACARICIDE PREPARATIONS

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Parasitic Ticks Animals are the cause of heavy losses in animal husbandry. These parasites distribute transmission, bacteriological and viral entomology infectious diseases, which in most cases result in mass fall of cattle. Imported (foreign made) preparations against animal parasites – mites, which are of acaricide effect (ectocodol, racidol, ciperpulvizo and others) alongside with the main active substances, contain subsidiary components, (sintetic piretroide) solvents and emulsifiers. They are fire-hazardous and belong to the II-III group of hazardous substances. Acaricide activity of working solutions made on the basis of these preparations lasts 10-12 days.

A new acaricide preparation with the main active substance,

contains, as subsidiary component, water-oily micro emulsion with high content of oily phase (70-80%) has been elaborated. To provide high content of oily phase in acaricide preparations of prolonged action, two surface active compounds are added to water-oil system one of which is water-soluble, the other is soluble in oil. Thermodynamically stable emulsion thus obtained are the spherical form aggregates of colloidal dimension (in distinct from the emulsion obtained by traditional methods) (not exceeding 0.1 mcm). In laboratory conditions to prepare the emulsion of high content of hydrocarbonaceous phase, the following components are used: Petroleum oil without admixtures (according to GOST 20799-88); Water, potable (according to GOST 2874); Organophylic surface active substance – octadecyl amine; Hydrophylic surface active substance-sulphite husk .

The main active components used in emulsion preparation are synthetic pyrethroids (permetrine, cypermetrine and others). By the dilution of the concentrated emulsion preparation in water (1:30 ratio) we obtain milk-like working liquid, in which pyrethroid content is 0.05-0.06%. High content of mineral oil in micro-emulsion working liquid guarantees reliable fixation of the preparation to the skin surface of animals and preservation of protecting acaricide properties for a long time even in case animal has contact with water.

The preparation is not fire-hazardous. It belongs to the IV class fire-hazardous substances. Field experiments implemented within the state science grant #GNST/ST07/8-272 proved the safety/harmlessness of the emulsion preparation with respect to animals. High concentration of oily phase ensures acaricide activity of working solutions made from ”Giometrin-1” for 20-25 days. Application for the invention of the developed emulsion concentrate acaricidal received a positive decision (Official Bulletins of Industrial Property #15(331)).

OP33. NANOSILVER CONTAINING SALVE'S ANTIBACTERIAL ACTIVITY AND TOXILITY

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A number of silver ion containing topical reagents are widely presented at the market and are used for localized treatment of trophic ulcers and infected wounds. Rapidly developing resistance of bacteria toward these reagents, motivated for search of new, more effective antibacterial products. Innovative new technology provides unique means for preparation of highly effective antibacterial silver nanoparticles (1 - 100nm) [1]. Nano-silver is an effective killing agent against a broad spectrum of Gramnegative and Gram-positive bacteria [2], including antibiotic-resistant strains [6]. Based on studies having shown that silver nanoparticles anchor to and penetrate the cell wall of Gram-negative bacteria [3]. Size-dependent (diameter 1-450 nm) antimicrobial activity of silver nanoparticles has been reported with Gram-negative and Gram-positive bacteria [5]. Small nanoparticles with a large surface area to volume ratio provide a more efficient means for antibacterial activity even at very low concentration [4]. In 2010 we studied various aspects of medical application of nanosilver, especially in a form of salves. Optimal base material was mixed with silver nano-powder. Following positive test results preliminary study of toxicity of the salves was conducted. It was founded that at given low concentrations of nano-component salves do not display toxicity toward live organisms. It displays high antibacterial properties, especially toward resistant pathogens Contrary to dressings, nanosilver salve is easily applicable provide more uniform absorption and distribution as well as dose control of material. There is no necessity for multiple treatments of wounds.

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OP34. ELECTRON-BEAM TECHNOLOGIES IN GEORGIA AND PERSPECTIVES OF THEIR DEVELOPMENT

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It has been studied microstructure and phase composition of the transitional zone formed on overlapped substrate of copper and titanium by means of condensations of titanium vapor stream and reaction diffusion occurring on the substrate surface. It is revealed that phases and structural constitutions in Ti-Cu system transition zone are formed as continuous interchangeable layers according to increase of titanium concentration. It is ascertained formation possibility of $TiCu_8$ phase and high-temperature $\lambda(TiCu_2)$ phase is stable conditions. These phases are created in condensed films. Possible mechanisms of these creation were worked out.

With the exception of main technological factors the real and fine structures of the substrate surface have influence on the coat structure,

phase composition and adhesion . This influence is especially strongly revealed at joining oxide films with the substrate. The problem was studied on so-called incompatible pair "aluminum-zirconia ZrO_2 ". On the base of theoretical calculations was ascertained that reason of Al-Zr pair incompatibility was a stable alumina layer naturally formed on the aluminum surface, which prevented creation of any type of transition zone between the substrate and zirconia growing film. Previous coating of the aluminum substrate by pure aluminum in the same technological cycle provided for production of undefected monolithic composite with the best adhesion of transition phases containing

Zirconium which are encroached into depth of the substrate and can be expressed by the following chart:

$$Al_{real}(Al_2O_3)+Al_{condensed} \rightarrow Zr_3Al \rightarrow ZrO \rightarrow ZrO_2$$

It was considered production of nanocrystalline powders of pure metals (Ni, Co, Ti, Mo) by electron-beam technology and presented the results of scanning electron microscope, X-ray diffraction and auger-spectroscopic of these powders.

OP35. HETEROMODULUS CERAMICS BASED ON NANOCRYSTALLINE CARBIDE ABRASIVE

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Heteromodulus ceramics are comprised of a ceramic matrix with high elastic modulus and additional components with essentially low elastic modulus. They have an ability to efficiently absorb and dissipate elastic energy.

Advantage of applying titanium-, tungsten- and boron carbides as

the matrices for heteromodulus ceramics is defined by their high melting point, high values of hardness and elastic modulus and chemical stability against aggressive environment

A technology for manufacturing nanocrystalline metal-ceramic (among them hardmetal) composite powders of a wide spectrum has been developed. The technology provides injection of liquid metal salt solutions and high-molecular hydrocarbons into a reactor with reduced or inert atmosphere at 500-950^{o}C. Each particle of the powder obtained after selective reduction and carburization processes may be composed of carbides (MoC, TiC, WC, B4C) and binding metals (Cu, Ni, Co, Fe, etc.). The technology ensures high dispersion (<50nm) and homogeneous distribution of the components, decrease of compaction temperature to 1000-1100 ^{o}C. Metal-ceramic nanocrystalline composite hardmetals of a new heteromodulus type will have a peculiar structure where metal transfers into ceramic with continuous smooth change of the structure, morphology and properties of the material without inspiring inner stresses and thus promoting to successful combination of high-temperature strength and refractory properties of ceramics with the plasticity and viscosity of metals.

OP36. INNOVATIVE TECHNOLOGY AND FOOD SUPPLY

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Starvation is the most serious world problem. More than one billion people, a sixth of the world's population, now face chronic hunger and the situation is likely to worsen more and more. Global warming, or global climate change, has a profound effect on agriculture.

As the population of the world continues to increase, the demand for food also increases. One way to solve the problem of hunger would be to develop new ways to grow agricultural products on a worldwide scale.

At present a lot of chemicals are being used in agriculture. Most

of them are toxic and dangerous for health. The use of chemicals in agriculture nowadays does not guarantee the high quality and safety of the products.

The most effective method of increasing plant productivity in the world at present is influencing them with regulators. Tens of billion of dollars are spent by the foreign firms on creating a new regulator. In spite of this, these preparations are far from being perfect.

Relying on the new scientific discipline – agrobioorganic chemistry, the author on the basis of natural raw materials created nontoxic bioregulators of a new type – bioenergyactivators, which have no analogues in the world. They are regulators of new generation, which principally differ from the well-known chemical remedies and enable to manage endogenous (self) regulatory systems of plants.

This innovation is a strong remedy to increase stability of plants towards diseases and other unfavorable conditions; enables to receive ecologically pure, rich harvest of high quality and to use land to the maximum and efficiently, that is of special importance for countries having insufficient arable land.

The new agrobiotechnology can bring the essential mite: 1. in the utilization of the barren or unproductive agricultural soil by increase of their crop-producing power; 2. by way of increasing of crop-producing power and qualitative improving of the food to decide the prevention problems of hunger and health; 3. in the effectiveness of the measures against global warming, particularly in diminution of greenhouse effect due to increase of ability of absorption of the carbon and solar radiation by plants.

OP37. PROSPECTS OF *BASIDIOMYCETES* POTENTIAL APPLICATION IN WHITE BIOTECHNOLOGY

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Last years fundamental and applied research on *Basidiomycetes* has markedly increased due to their potential use in a variety of biotechnological and environmental applications, particularly for the production of enzymes, dietary supplements, physiologically active compounds, and bioremediation. A common feature of white-rot basidiomycetes is the production of cellulases, hemicellulases, laccases, and peroxidases in submerged and solid-state fermentation of lignocellulosic substrates. This presentation integrates the recent data on the physiology of lignocellulolytic enzyme synthesis, focusing on the common characteristics and unique properties of individual fungi as well as on several approaches providing enhanced enzyme secretion by white-rot. Firstly, the enzyme yield is species-dependent and strain-dependent and selection of new organisms with tremendous synthesis of these enzymes is possible. For example, xylanase activity of tested basidiomycetes varied from 0.2 to 35 U ml^{-1}, while the laccase activity varied from 340 to 102000 U l^{-1}. Secondly, lignocellulosic substrate plays a crucial role in enzyme production. Thus, only traces of MnP produced during submerged fermentation of banana peals by *Funalia trogii* whereas the highest enzyme level accumulated in fermentation of tree leaves. Thirdly, we show that some microelements and aromatic compounds/dyes enhance the ligninolytic enzyme synthesis although their effect is very specific depending on fungi physiological peculiarities. Fourthly, our study underlines that the expression of basidiomycetes biosynthetic potential depends on the method of fungi cultivation. It has been shown that the biosynthesis of cellulases and xylanases in all white-rot basidiomycetes is inducible. The characteristic feature of brown rot fungi is constitutive synthesis of

enzymes even in the presence of glucose as carbon source. However, cellulase and xylanase of *Piptoporus betulinus* are inducible enzymes in the presence of cellobiose as a sole carbon source. In all fungi with inducible enzymes synthesis a catabolite repression of cellulase and xylanase synthesis in the presence of easily metabolizable carbon source is widespread. The duration of enzymes synthesis repression correlates with glucose concentration in the culture medium.

Results of extensive screening of fungi for antioxidant, lectin, and extracellular polysaccharide (EPS) production with high yield proved that their submerged cultivation is a very promising approach. The water and ethanol extracts from submerged mycelia of basidiomycetes showed high (more than 80%) antioxidant activity at 2 mg/ml. Moreover, all higher *Basidiomycetes* tested have the capability to accumulate hem agglutinating activity during cultivation in submerged and solid-state fermentation of agro-industrial wastes. The results showed that the hem agglutinating activity is species and strain-dependent and varies with cultivation conditions. The specificity toward a variety of sugars and the minimal inhibition concentrations has been established for different mushroom lectins. The capability to synthesize the extracellular polysaccharide (EPS) is widespread among *Basidiomycetes* species in submerged cultivation with the yield of 0.6-2.2 g/l. The physiological requirements of best producers, *Agaricus nevoi* and *Inonotus levis*, were established and the cultivation process in shake flasks was successfully reproduced in a laboratory fermentor with the highest yield of EPS (3.8-4.0 g/l).

OP38. NANOPEPTIDE BIOREGULATORS INDUCE REACTIVATION OF "AGED" CHROMATIN

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Purpose: The object of present investigation is to the study modification of chromosome (total heterochromatin, constitutive and facultative heterochromatin) under the influence of nanopeptide bioregulators (Ala-Glu-Asp-Gly and Lus-Glu-Asp-Ala) and heavy metal in cultured lymphocytes derived from old individuals

Methods: The level of chromosomes modification (level of total heterochromatin - identified by the method of differential scanning microcalorimetry; the level of facultative heterochromatin – by the method frequency of sister chromatid exchanges (SCE) and level of constitutive and satellite stalk heterochromatin - by the method of C- and Ag-positive band) under the single and combined effect of $CoCl_2$ and nanopeptide bioregulators (Epitalon - Ala-Glu-Asp-Gly and Livagen - Lus-Glu-Asp-Ala) have been studied in lymphocyte cultures from individuals at the age of 80 and over.

Results: The results showed that:

(1) progressive heterochromatinization of total, constitutive (pericentromeric, telomeric and NOR heterochromatin) and facultative heterochromatin occurred with aging;

2**)** nanopeptide bioregulators – (Epitalon - Ala-Glu-Asp-Gly and Livagen - Lus-Glu-Asp-Ala) induce deheterochromatinization of chromosomes in old age;

3) statistically higher level of SCEs (deheterochromatinization) were registered in precentromeric and telomeric heterochromatin upon combined effect of $CoCl_2$ and nanopeptide bioregulators (Epitalon, Livagen) - compared with the control group;

4) Co^{2+} ions in combination with the tetrapeptide bioregulators have different chromosomal target regions; that is, deheterochromatiniza-

tion of pericentromeric (Co^{2+} ions in combination with Epitalon- Ala-Glu-Asp-Gly) and deheterochromatinization of telomeric (Co^{2+} ions in combination with livagen- Lus-Glu-Asp-Ala) heterochromatin regions in lymphocytes of olderaged individuals.

Conclusions: The proposed genetic mechanism responsible for constitutive and facultative heterochromatin remodeling by nanopeptide (Ala-Glu-Asp-Gly and Lus- Glu-Asp-Ala) of senile pathogenesis highlights the importance of external and internal factors in the development of diseases and may lead to the development of therapeutic treat.

OP39. NON-CONVENTIONAL MACROMOLECULAR SYSTEMS COMPOSED OF NATURALLY OCCURRING AMINO ACIDS

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α-Amino acids are building blocks of important bio-molecules like peptides, polypeptides, and proteins. The orientation of amino acids in these molecules is *conventional* – "head-to-tail". This orientation determines the primary and secondary structures of the said bio-polymers that, in turn, determine their biochemical behaviour including *immunogenicity*. This along with costly manufacturing processes and products standardization complexity substantially restricts practical applications of α–amino acids based naturally occurring polymers as biomedical biomaterials.

Synthetic polymers on the basis of α-amino acids look more promising for the said practical applications. Virtually unlimited number of the synthetic polymers can be synthesized on the basis of 20 naturally occurring α–amino acids. The orientation α–amino acids in synthetic polymers can be both *conventional* and *non-conventional* ("head-to-head"

and “tail-to-tail”). Polymers with non-conventional orientation of α-amino acids we call as Amino Acid Based Bioanalogous Polymers – AABBPs. Various classes of AABBPs were synthesized and studied [1,2]. The basic idea for the synthesis of AABBPs is that non-natural molecular architecture of their macromolecules can decrease *immunogenicity* of α–amino acid based polymers. AABBPs are promising as biodegradable biometerials since “physiological molecules” – α-amino acids releasing after fragmentation of the polymers can be assimilated by the organism *via* metabolic means promoting in that way tissue regeneretion/reconstruction. To render AABBPs biodegradable with reasonable rates of biodegradation easily hydrolizable chemical sites, e.g. ester bonds, should be incorporated into the backbones. It is also important other building blocks, used for the construction of AABBPs, to be non-toxic. From this point of view poly(ester amide)s, poly(ester urethane)s and poly(ester urea)s entirely composed of naturally occurring α-amino acids and nontoxic building block like fatty diols, dicarboxylic and carbonic acids could be considered as one of the most promising representatives of biodegradable polymers [1]. The obtained polymers undergo biodegradation with desirable rates, reveal high biocompatibility, and show material properties apt for the application as various surgical implants and drug eluting/delivering devices [1]. A great commercial potential of biodegradable biomaterials has to be specially emphasized - the world market is assessed many billion dollars.

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OP40. SPECIAL SINGLE-LAYER COATINGS FOR PIPES

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Steel pipes suffer from corrosion problems when exposed in aggressive environment. To create long-wearing trunk pipelines, pipes are usually coated for adequate protection.

Enameling is one of the promising and reliable method to prevent corrosion on inner surface of oil pipelines during the service. Nowadays, a growing attention has been paid on the latest flexible direct enameling process of pipes (1 coat-1firing). This distinctive method is a viable, cost-effective solution to maintaining the integrity of your pipelines [1].

Our work was aimed at the development and the characterization of optimal compositions of one-coat fluorine-free silicate enamels for re-source- and energy-effective direct-on enameling technology of pipes [2].

The main functionally significant parameters of obtained coatings are described. It has been found that the synthesized coating system in certain parameters exceed to existent analogs. Such properties of enamel as high resistance to the effect of aggressive media, wide interval of firing are formed by addition of filler (marshallite and other). Uses siliceous material with a particle size less than 50 μm provides glassy product during firing.

Glass enamels were fired at 770-780^{o}C. After firing they form single-layer, defect-free coatings 450 μm thick. Generally the color of the enamel coating is blue. The good assimilation of mineral fillers in the amount of 15-18% confirmed by X-ray diffraction.

One the most important parameters determining practical application of enamel coatings is adherence of thin layer of oxides covers to the steel surface. It was observed that the firm grip could be achieved by using of the optimal quantity of the different adhesion activators. Good results were obtained in the case of cobalt and copper oxides.

The coatings forming mechanism on steel substrate and the role of CoO and CuO were discussed basing on X-ray diffraction and metallographic analyses. It is established, that the strong adhesion is due to the high chemical activity of enamel melts and the formation of transitive layer approximately 20-22 μm thick as a result of complex heterogeneous interaction on the “steel - enamel" contact surface. It is shown, that the degree of heterophase interaction is affected by the firing temperature and time interval.

The conducted research make it possible to obtain new nonnickel enamels with adherence of 1-2 point (EN 10209), fixed colors, resistant to corrosion destruction and abrasion and the absence of entrapped organic growth on the pipe’s inner surface.

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OP41. TUNING OF THE SIZE OF METAL NANOPARTICLES

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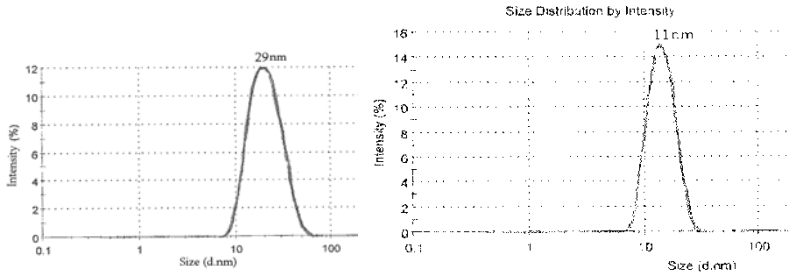
Recently novel technique for eleqtrosynthesis of metal nanoparticles (NPs) was proposed and tested [1,2]. The technique involves rotating disc electrode (cathode), which crosses permanently boundary between the immiscible organic and aqueous (electrolyte) solutions. In present study it is shown that size (in a number of cases, shape) of the NPs can be monitored by variation in disc rotation rate, or in the position of the liquid-liquid phase boundary. Both approaches affect the time (τ) during which cathode is in contact with each phase. The proposed phenomenological relationship between τ and the size of the metal NPs was experimentally

tested. In accordance with theoretical prediction it was found that decrease in τ_{aq} or increase in τ_{org} results in the decrease of the size of silver nanoparticles (fig.)



τ_{org} = 30sec τ_{org} = 48 sec

Fig. Variation in the size of Ag nanoparticles with the τ_{org}. Laser beam dynamic scattering data.

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PP1. ORGANOMINERAL ADMIXTURES FOR POULTRY FEEDING

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Intense progress in poultry and cattle breeding is one of the urgent problems in Georgia. Provision of fodder with microelements and organic substances occupies one of the leading places among the objectives

for resolution of this problem [1-4]. Therefore we decided to synthesize bio-coordination compounds consisting of microelements (Mg, Mn, Zn, Fe, Co, Cu), methionine (Mt) and citric acid (H_4L). The identity and composition of the compounds were determined by the method of elemental analysis and melting point measuring.

For the study of biological activity, we, on the bases of the synthesized compounds, have prepared the bio-stimulator (BS) with the conditional name Y. Experiments were conducted at the poultry factory on the Leghorn breed egg-laying remount chicken of 1 day to 8 weeks age. Trial lot of combined fodder was prepared by adding various amounts of the bio-stimulator Y (Y min; Y norm; Y max) and vitamins to premixes.

Table 1. Experimental results according to live mass
*WVF -whole value fodder

#	Group	Mean live mass of 56 day old chicken (g)	Live mass in comparison with control (%)
I	Control WVF*	1110	100
II	WVF+ BS Y min	1174.5	105.80
III	WVF+ BS Y norm	1185.24	107.26
IV	WVF+ BS Y max	1228.45	110.65

On thw basis of carried out out experiments it was proved that efficient dose of the bio-stimulator made by us is Y max, while the limit of live mass increase of chicken of experimental groups is 5.8-10.67 % compared with that of the control group (Table 1). The results of the investigations enable us to conclude that synthesis and study of bio-coordination compounds which contain microelements, methionine and citric acid is interesting and important both with the scientific and practical point of view and it is expedient to continue experiments to determine optimal dose of bio-stimulator, meat quality, decrease of poultry fall and economic effect.

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PP2. EFFECT OF THE ADDITIVES OF VARIOUS METALS AND ORGANIC COMPOUNDS ON THE QUALITY OF ALUMINUM ELECTROPLATING

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Annually more than 20 million tons of a metal (mainly, iron) in the form of machines – devices, equipment, constructions and etc. are oxidized all over the world as a result of corrosion. Their replacement by new ones, demounting of old and mounting of new equipment is associated with colossal expenses, comprising 2-4% of national gross revenue annually in developed countries. For example, in USA, annual losses from corrosion attain 276 milliard dollars. The improvement of old methods against corrosion and the search of new ones has attached much importance all over the world.

The advisability of the use of aluminum against corrosion (at atmospheric, as well as at high temperatures – more than 400°C) is determined by various reasons. Plating must be characterized by smooth surface, desired thickness, good adhesion, non – porosity and etc. To attain these requirements in aqueous solutions, the small additives of metal cations or organic surfactants are successively used.

The preparation of aluminum electroplating is possible only from the melts. But in high - temperature melts the use of organic additives is limited by their low thermal and chemical stability.

Low – temperature (~100°C) halide electrolyte, proposed by us, gives a large possibility for the use of the additives of organic surfactants .

The effect of small amounts of metal cations: Pb^{2+},Sn^{2+}, Eu^{2+}, Bi^{2+} and organic compounds (urea, diphenylurea, phtalamide, β – naphtylamine) - 0.2 :1.5 mass%(in terms of $ALCl_3$)on aluminum electroplating was tested. Steel – 3 was taken as a base. It was established that the compounds of lead and europium have a positive effect on aluminum plating, which is due to various properties of metal – additive(atomic structure, interaction with aluminum, parameters of crystalline lattice and etc.)

The additives of organic compounds – urea, diphenylurea, β – naphtylamine act positively on aluminum electroplating. Silvery platings of good - quality are obtained. Moreover, the volatility of $ALCl_3$ at the temperature ~100°C is considerably reduced.

PP3. ELECTROPLATING AND SURFACE ALLOYING OF HARDWARE BY COMPOSITIONS OF MOLYBDENUM-COBALT-NICKEL

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The electrochemical behavior of the compounds: Na_2MoO_4, $CoCl_2$ and $NiCl_2$ was studied for the preparation of the compositions, intermetallic compounds and platings of molybdenum – cobalt – nickel at the background of KCl – NaCl melt in the conditions of their separate and co-

presence. At the temperatures of 700 - 750°C the voltammograms were recorded on platinum electrode; polarization rate – 0.1V/sec, reference electrode – platinum. The currents of wave peak are proportional to cation – Ni^{2+} and Co^{2+} concentrations. Half – wave potentials are : - (0.57÷0.60)V and - (0.80÷0.85)V, respectively. The wave of electroreduction of MoO_4^{2-} to MoO_2 is in the range: - (1.00÷1.40)V at relatively high concentrations of molybdate and is characterized by instable reproducibility.

From the melts: K, Na Cl – Na_2MoO_4 – $CoCl_2$($NiCl_2$) the transfer of the waves of Ni^{2+} and Co^{2+} electroreduction takes place in the direction of negative potentials, by the difference, that in this case, MoO_4^{2-} is reduced to metallic molybdenum. This is determined by high polarizing action of cations Co^{2+} and Ni^{2+} on Mo –O bond. The potential of electrodeposition of molybdenum differs from elctroreduction potentials of cobalt and nickel by 1.0 and 1.2V, respectively, which is considerably more for synchronous electrodeposition of metallic pairs Mo – Co and Mo – Ni in quasi – equilibrium regime. Therefore in these conditions only the preparation of metallic mixture from mentioned melts is possible. From these systems the plating was prepared, the micro X – ray analysis of which has shown a non – uniform composition of Mo, Co(Ni) on plating surface.

In our previous investigations the possibility was shown for artificial control of the variation of the potentials of hard anions by changing of acid – base properties, by means of cations and anions:Ca^{2+}, Zr^{2+}, Ba^{2+}, Mg^{2+}, PO_3^- and MoO_7^{2+} in a melt.

To approach to each other the potentials of electrodeposition of Mo - Co(Ni) from the systems under study, the additives Mg^{2+} and PO_3^- were used. Both of them separately bring closer the potentials of deposition of Mo, Co and Ni in the range less then 200V, which is sufficient for their co – deposition in quasi – equilibrium regime. The preparation of intermetallides $MoCo_3$ and $MoNi_3$ has been made possible in the form of fine – dispersed powders.

In the melt: K, Na Cl – Na_2MoO_4 – $CoCl_2$ ($NiCl_2$) (when the ratio $CoCl_2$:$NiCl_2$=1:1 mass % in a melt) the surface alloying and electroplating of a hardware, particularly, of the steel – 3 is possible by Mo - Co – Ni

compositions. Plating thickness is 40-60mr at the temperature of 700°C and the thickness of diffusion layer 20-30mr. Micro-hardness in alloyed layer is increased by a factor of six in comparison with a base. X –ray sounding of plated surface has shown the presence of 15% of Co and Ni and the remainder being molybdenum. Mentioned platings are characterized by high hardness and corrosion resistance.

PP4. LEACHING OF CHALCOPYRITE CONCENTRATES BY MEANS OF NITRIC AND SULFURIC ACIDS MIXTURE SOLUTIONS

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Leaching of chalcopyrite concentrates (Cu-19.13%; Fe-30.95%; S-34.22%; SiO_2-7.87%, fraction:-0.063 mm) by solution of nitric and sulfuric acids mixture has been studied. Dependence of copper and iron extraction degree on process duration, temperature, concentrations of nitric and sulfuric acids and solid - liquid phases ratio has been determined.

Sulfide form partly transforms to sulfate, forming mixture of nitrate-sulfate solution during leaching of chalcopyrite concentrate by nitric acid. Tests with addition of sulfuric acid to this mixture were carried out with changing of $k = m(HNO_3)/m(H_2SO_4)$ in the range of 0 – 2.5.

Linear relationship of copper extraction degree on amount of added HNO_3 was observed in tests with $k<1$ but linearity was not preserved and extraction degree was lowered with farther increase of k values.

Lowering of excess of acidity to minimal value in solution was achieved in tests where chalcopyrite concentrate leaching proceeded in

two step operation. At the first stage, with initial concentrations of nitric acid and sulfuric acid 110-140g/L and 25-30g/L respectively, the acidity was reduced to 10g/L level. 50% for copper and 60% for iron extraction degrees were achieved after one hour of leaching. At the second step, leaching of solid residues by relatively concentrated solutions of nitric acid (280-310g/L) and sulfuric acid (40-60g/L) with presence of oxygen was performed. Extraction degrees of copper and iron exceeded 95% after three hours of operation.

technological scheme of two step leaching of Madneuli chalcopyrite concentrates by mixture of nitric and sulfuric acids, including neutralization by ammonia after first stage, complete recycling of solutions and regeneration of nitric oxide gases was designed based on these data. Production of electrolytic copper and slimes enriched up to ~ 34g/t of Au, together with co-production of Fe_2O_3 which can be used as pigment in dye production and solutions with 400-500 g/L $(NH_4)_2SO_4$, ready for utilization as a fertilizer in agrarian sector are provided that ensures economical effectiveness of this scheme of operation.

PP5. COPRODUCTION OF MANGANESE DIOXIDE AND HYDROGEN BY ELECTROLYSIS

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Under industrial conditions electrolytic manganese dioxide (EMD) is received from acidified solution of manganese sulphate at 90-97°C temperatures. Process of electrolysis is carried out in open bath that is accompanied by a variety of negative effects. Hydrogen bubbles deposited

at the cathode entrap steam, electrolyte and drops of melted paraffin that spreads in the cell (electrolysis) room and drastically impair sanitary-hygienic conditions. Besides, loss of hydrogen takes place, that is sufficiently expensive product, especially the one received by the electrolysis (cell price of 1 ton of electrolytic hydrogen is 6-8 time higher than 1 ton of EMD). It should be mentioned the fact that in important electrochemical production, such is chlorine and sodium hydroxide production by refined salt electrolysis, deposited hydrogen is not lost, but is processed into commercial by-product. It should be taken into account the circumstance that in the future strategy of clean power engineering the important role belongs to hydrogen energy that will significantly increase the demand for this product.

By taking above mentioned into account we lay down an aim to work out new construction of EMD receiving electrolyser, which implies receipt of cathode deposited hydrogen as of commercial product, arrangement of normal sanitary-hygienic conditions in cell (electrolysis) room, utilization of air-steam mixture and heat energy emitted from the bath.

Laboratory scale electrolyser of cylindrical shape (volume 2 l) has been manufactured by us, in which the space between electrolyte surface and cover was encapsulated by pad made from soft rubber and by use of special mounting device. Anode and cathode areas weren't divided by diaphragm. Hydrogen deposited at the graphite cathode has been removed by means of the pipe mounted in the cover, then was cooled in the freezer and accumulated in the storage made from polymer. Electrolysis has been carried out periodically. Its conditions were selected in such a way that quantity of oxygen deposited at titanium anode would be minimal that has been examined by anode's visual observation. Current output comprises of virtually 100 percent that provided receipt of high-purity hydrogen.

In the process of electrolysis carbon materials of new generation have been used as electrodes, in particular, carbon fiber material (CFM) as anode, while CFM and pyrolysis glass textolite (fiber-glass laminate) – as

cathode.

At the next stage of researches is foreseen manufacturing of rectangular shape large scale-laboratory electrolyser (current load 10-12 A), and in order to increase the degree of leakage corresponding changes will be made in its construction.

PP6. FORECASTING OF LOCALIZED CORROSION OF NEW METASTABLE AND DUPLEX STEELS

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New poor gas and oil wells are characterized by different aggression, so already tested widely implanted boring materials can not reveal the necessary functional properties relative to specific wells. Components of overground and boring devices should be resistant with respect to the pitting, crevice, etc. corrosion [1]. It causes necessity of working out of high mechanical and corrosion resistant new steels for the retrieval industry of oil and gas.

The Propensity to localized corrosion new duplex 08Х25Г15С and metastable 40Х8Г12 and 30Х10Г10 steels was studied using cyclic potentiodynamic polarization scan technique [2]. The structure metastable 40Х8Г12 steels was both austenitic, and martensitic. The researches was made in a solution with critical ionic composition(Cl^- - 0,985 g/l, SO_4^{2-} -10,7 g/l, pH -5,5) corresponding to an aggressive ground causing the maximum corrosion [3].

The duplex 08Х25Г15С steel is characterized by <0.00 mm/year rate of the general corrosion. According to all characteristics of cyclic

potentiodynamic polarization scan technique it keeps passivity at the corrosion potential and is characterized with low risk of localized corrosion.

The metastable steels 30Х10Г10 and 40Х8Г12 are also resistant to localized corrosion. The Corrosion rate of 40Х8Г12 with martensitic structure and 30Х10Г10 steels is ~0,20 mm/year. The steel 40Х8Г12 with austenitic structure is characterized by corrosion rate <0,1 mm/year.

The application of the studied steels is quite possible without the danger of localized corrosion for the different components of overground and boring devices.

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PP7. THE NEW PHOSPHATE COMPOSITION (ANTIPYRINE)-INCREASING THE FIRE RESISTANCE OF VARIOUS MATERIALS

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Increasing the fire-resistance of materials represents one of the considerable problems in such fields as Construction, Mechanical Engineering, Shipbuilding, Air Space-system engineering, Military and Civil insdustry.

There exist fire-protective means (antipyrines) of different composition: phosphorus-, nitrogen-, sulfur-, boron- and halogen containing organic and inorganic dissoluble compounds decomposing at high tempe-

rature at smoke and toxic substance.

The solution of new Antipyrine - Phostphate Composition (PhC) synthesized by the group of scientists of the Institute of Physical and Organic Chemistry by P.Melikishvili, increases fire resistance of following materials: wood, cloth, paper.

Antipyrine (PhC) represents ~ 10% of water solution of hydrophosphates of iron and aluminum. At high temperature (1800-2000°C) it decomposes and forms the water and insoluble salt of ferrous and aluminum phosphates and does not produce smoke and other toxic substances.

The fire-resistance of Antipyrine (PhC) was studied on the patterns of different sorts of wood: chestnut, pine, beech, as well as on polywood and medium density of fireboards. During the treatment of the patterns with the given solution, besides the fire-resistance, their solidity and specific gravity was rising. At the same time, their preservation took place, they remained colour as well as texture.

Antipyrine (PhC) is not toxic, carcinogenic and does not cause allergic reactions, at short-term contact does not irritate the skin and the mucuous membrane and it has been recognized to be ecologically innocuous.

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PP8. CATHODE MATERIALS BASED ON MODIFIED LITHIUM – MANGANESE SPINEL - $LIM_xNI_{0.5-x}MN_{1.5}O_4$, 0 ≤ X ≤ 0.3, FOR LITHIUM – ION ACCUMULATORS

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Decreasing of power and capacity of Li-ion accumulators during both the cycling process as well as after storage represents today a serious problem. The matters of achieving high performances and providing temporary stability of the system became even more essential since lithium–ion accumulators are being considered as power sources for high power and high energy consumers (space and military equipment, all kinds of transport, including trucks and others). In this respect, creation of electrodes able to work in high power devices is becoming the main task for developers of lithium-ion accumulators (LIA). Since electrochemical activity of LIA' cathode material is largely determined by their crystalline and aggregate structure, the maximum amount of energy could be produced with the small size of electrochemically active components. Therefore, to achieve high capacity of Li-ion accumulators, materials with nanoscale particles characterized by high capacity, due to high specific area and increased lithium intercalation, are being extensively investigated. 5V cation substituted spinels are being actively developed, among them $LiNi_{0.5}Mn_{1.5}O_4$ that provides high capacity. One can assume that in such compound Mn^{4+} ion is not electrochemically active any more and substituted metals allow for redox reaction in 5V range. It is known that high specific energy is the comparative advantage of 5V systems. However, in view of high voltage requirements, requirements for structure and chemical stability of electrode materials are also high.

The presented work aims at elaborating phase pure nanoscale samples of $LiNi_{0.5}Mn_{1.5}O_4$ spinel and its derivatives - $LiM_xNi_{0.5-x}Mn_{1.5}O_4$ (M – Co, Cr, Cu, Al etc), the capacity and other parameters of which are superior

to 4V $LiMn_2O_4$. At this stage, electrochemical testing of the samples with composition $LiCo_{0.2}Ni_{0.3}Mn_{1.5}O_4$ and others, synthesized by us, demonstrated the prospects for their effective application as cathode materials in the 5V range of potentials. According to our data, it is difficult to elaborate the above mentioned compounds via conventional solid state method. Actually, $LiNi_{0.5}Mn_{1.5}O_4$ and its derivatives always contain a certain amount of Mn^{3+} and impurities caused by the synthesis, which leads to low capacity and 4V plateau.

In order to synthesis promising cathode material based on lithium manganese spinel for LIA, we developed a number of methods using sol-gel process, melting – impregnation, etc. Samples of $LiMn_2O_4$ and $LiNi_{0.5}Mn_{1.5}O_4$ and its derivatives were synthesized. Their phase composition, structure and physical and chemical characteristics have been studied. Results of physical and chemical study of synthesized lithium-manganese spinels confirm formation of phase-pure nanosized (~ 20 – 30 nm) compounds with cubic structure. TEM images of the synthesized samples show the spherical particles incorporated in the agglomerates.

Materials synthesized through the developed method could be of significant interest for next generation of lithium-ion batteries. In this case their role will be increased not only for using in the portable equipment, but also in electric vehicles (EV) and hybrid electric vehicles (HEV).

PP9. REGENERATION OF EXHAUST ENGINE OILS

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The work concerns the urgent problem of today – cleaning-regeneration of exhaust automobile (engine) oils in different designation for the purpose of their reusing. At the same time regeneration of exhaust oils provides environment protection from pollution.

By compounding of regenerated engine oils with various additives (optimum selected additives) the ready engine oil was received which is characterized with low friction coefficient, high wear resistance and work longevity. With these parameters it meets technical and ecological requirements of the contemporary analogous foreign oils.

The composition and parameters of regenerated oils are studied with contemporary instrumental methods; their pasportization is done.

Regenerated oils were tested as the basic (58-60%) component required for fiber thread formation in lubricating oil; in this respect preliminary works have been performed and positive results have been received.

The same oils are used in aerosol preparations along with refrigerants as antiadhesive means for press-forms lubrication at pressing and casing of plastic articles.

In lubricating oil and antiadhesive agent the regenerated mineral oil substitutes high-price and scarce siloxane fluid which lefts thin liquid layer on the surface of pressed members. This fact is quite negatively affecting pressed radio parts as it dimunishes the conductance coefficient of member surface.

In the future it is supposed to test regenerated oil in lubricating oil needed for fiber thread formation produced from basalt stone as the basic component where it will again substitute siloxane fluid.

The substitution of 1 ton siloxane fluid with the same amount of regenerated oil increases economical effect approximately 10-times.

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PP10. ECONOMICALLY ALLOYED DUPLEX STEEL WITH INCREASED CORROSION RESISTANCE FOR CONSTRUCTION OPERATING IN THE OIL AND SEA WATER CONTAINING HYDROGEN SULFIDE

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Now designs and apparatus producing hydrocarbons will work at high loads in environments with different aggression, in particular, contain chloride ion, hydrogen sulfide. For such constructions are widely used ferritic-austenitic so-called duplex steel, in which the main alloying elements are chromium, nickel and molybdenum [1].

In the F.Tavadze Institute of Metallurgy and Materials Science is developed duplex stainless chromium-manganese steel 08Х25Г15С [2], which is considerably economical compared with nickel steels and has good corrosion resistance in different corrosive environments. From this steel produced boiler and vacuum equipment for the production of sodium sulfide.

The present work studies the alloy 0.05%C, 24%Cr, 7%Mn, 0.4%N, 0.01%Ca, whose mechanical properties: $\sigma_в$(MPa)=850-860; $\sigma^{\circ\prime 2}$(MPa)=750-755; δ%=22,5; Ψ%=38,5; KCU MJ/m²=0,55-0,8, is a better than the high manganese steel. To improve the mechanical properties of steel and the settlement ratio of ferrite and austenite in the structure, addition of nitrogen was carried out as austenite forming element in the compensation of manganese compared to 08Х25Г15С steel.

Reduction of manganese content, the addition of nitrogen and calcium in the steel did not affect the corrosion rate in sodium sulfide (0,102-0,209 mm/year). This alloy has not a tendency to grain boundary corrosion. There has been no grain growth after 930^{o}C annealing. Does not form a σ -phase even after annealing for 550 hours at 800^{o}C.

Investigated chromium-manganese steel with nitrogen can be recommended for constructions operating in the oil and sea water containing hydrogen sulfide.

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PP11. USE OF CARBON MATERIALS OF NEW GENERATION IN CURRENT SOURCES OF THE SYSTEM MANGANESE DIOXIDE-ZINC

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The galvanic cells of the system manganese dioxide-zinc are the most widespread at the market of current chemical sources because of the set of technical and economic factors. Their electrotechnical characteristics are depend considerably on the properties of the used carbon materials. Within recent period the new generation of such materials (pyrolytic, polymeric, fiber, colloidal, composite and etc.) with improved and some-

times, unique properties were created. Carbon fiber material (CFM) and colloidal graphite were used as current conducting additive for cathode mixture of alkaline and saline galvanic elements of MnO_2-Zn system. Experimentally the optimal content of mentioned carbon materials in current-conducting additive and optimal ratio between active compound–electrolytic manganese dioxide (EMD) and current-conducting additive in positive electrode were established. The partial replacement of cell graphite, used at present, by carbon materials of highly developed surface and of better electric conductance caused the reduction of internal electric resistance of current sources. In Leclanshe cell, prepared by the details used in a production and in model alkaline current source the increase of the electric capacity and of the coefficient of the use of active compound by 15-20% have been attained.

Production of current sources of MnO_2 –Zn System involves several labour intensive and ecologically harmful operations starting with the preparation of EMD. To exclude some of them the cathode of galvanic cell was prepared by electrochemical formation − MnO_2 was deposited on Ti-CFM electrode of unconventional construction. This fact improves an electric contact between the active and electric conducting materials and reduces an internal resistance of current source. Moreover, current-conducting compound of a cathode is a wisp of integral and continuous CFM instead of discrete one (powder of a graphite and a black). This fact reduces a cathode destruction in the course of its discharge and, especially, at cycling. Positive results, obtained at the testing of galvanic cells with electrochemically formed cathodes represent a good reason for an extension of a work in the direction of study of primary, as well as of secondary current sources of MnO_2 –Zn system.

PP12. EFFICIENT TECHNOLOGY FOR COPPER SULFIDE CONCENTRATES PYROMETALLURGICAL PROCESSING

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Classical pyromatallurgical technology of the copper sulphide processing is characterized by the following:

- By multi-stepped process (7steps), by volume- and power- intensive processes;
- Low coefficient of heat exploitation;
- By three very complicated high-temperature successive technological processes (partial desulphurization in a boiled layer, smelting of pyrite cinder on a matte and a bessemerizing conversion of a matte) which are vulnerable to hermetic sealing;
- By the high volume burned gases release, with a low content of sulphurous anhydride (7-13% SO_2) implying nearly insuperable ecological obstacle.

As mentioned above, a radical improvement of existing pyrometallurgical method for polymetallic raw materials processing or its substitution is a highly topical problem.

New technology for processing of a copper sulphide raw material is proposed which provides:

- Total cycle of the raw material processing in 5 steps;
- Total desulphurization of sulphide raw material in a single technological step, in a single apparatus, subjected to hermetic sealing and mechanization;
- Obtaining an oxide cinder (25-30% Cu, <1% S) and less than four times the volume a roast gas containing around 75 ÷ 80% SO_2 as a result of desulphurization.

- Obtaining a metallic copper by reduction Remelting of oxides cinder and further refining;
- Obtaining a sulphuric acid by catalytic- or electro-synthesis methods from liquid sulphur dioxide.
- Technology is tested in laboratory and large-scale laboratory conditions.

Classical pyrometallurgical method of the ore processing is profitable only in a very large-scale conditions. Proposed technology permits to be a profitable even at the assimilation in a small-scale. Thus it will be possible to include deposits of medium and low thickness into a world balance of the deposits of industrial importance.

The presented work has been fulfilled by financial support of the Georgia National Science Foundation (Grant #GNSF/ST07/7-261).

PP13. PREPARATION OF EFFICIENT CATALYSTS – ADSORBENTS FROM CONCENTRATES OF GEORGIAN MANGANESE NATURAL ORES FOR CLEANING OF HYDROCARBON FROM SULFUR COMPOUNDS

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By scientific group of the Laboratory of catalysis in R. Agladze Institute of Inorganic Chemistry and Electrochemistry a systematic investigations have been executed by following lines: elaboration of manganese catalysts and cleaning of technological gases from sulfur

compounds, neutralization of exhaust gases of nitric acid production from nitrogen oxides, removal of oxygen traces in inert gases and desulfurization of sulfur containing oils and separate fractions of benzene. Investigations were carried out mainly by use of manganese active masses, obtained from Georgian ores of high, as wel las of low quality.

An analysis of scientific publications permits to note a positive sides of the use of solid adsorbents, obtained from manganese natural ores in sulfur cleanig processes: sufficiently large sulfur capacity-up to 15,0 mass%, cheapness and ecologically pure industrial wastes.

In spite of the efficiency,a wide practical use of such catalysts in modern high-technology processes is limited by their unsufficient operating characteristics:small specific sulface, low mechanical and thermal stability, single use of a mass.

From above mentioned , a search of the ways for rational use of Georgian manganese natural ores and wastes of the production of manganese compounds may be considered as much more advisably and economically attractive: from this viewpoint, an elaboration of physical-chemical and technological prerequisites for preparation of new competitive production (catalysts) viewpoint, an elaboration of physical-chemical and technological prerequisites for preparation of new competitive production (catalysts) may be seen as one of the promising lines. Results of theoretical and experimental investigations allow to conclude that manganese catalyst-absorbers by their activity, critical values of sulfur capacity and by technological regime of the operation are highly competitive with industrial zinc oxide containing adsorbents. Requirement for relatively cheap and efficient catalysts is in Georgia-Rustavi Joint stock company “Energy invest” as well as at similar chemical factories of other countries

Development of the technology of manganese oxide containing catalysts for processes of gas cleaning and other important chemical-technological processes permits to substitute a costly catalysts (Ni, Co, Cr,Zn) by significally cheaper Mn-Fe-Ca systems. This prospect is particularly important for Georgian economy, based on the fact, that a

concentrates of reguired chemical composition and physical-chemical properties, obtained from Chiatura manganese deposits,will be used as a raw material.

PP14. WORKS OF ACADEMICIAN RAFAEL AGLADZE ON GENERATING COMPLEX IONS IN WATER SOLUTIONS CONTAINING AMMONIUM AND MANGANESE COMPOUNDS

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While studying one of the most important fields of chemistry – the aspects of the history of formation and development of Coordination Chemistry, we became interested in one part of the works [1-3] of Rapiel Agladze, the famous Georgian Electrochemist-Technologist, Academician of the Academy of Sciences of Georgia, creator of the electrolysis method of receiving pure metal manganese from manganese sulfate water solutions and initiator of its introduction in industry (USSR State Prize, 1943). According to these works he can be supposed a beginner of development of chemistry of complex compounds in Georgia

In R. Agladze's works on the examples of sulfuric acid-manganese-ammonium and hydrochloric acid-manganese-ammonium salts the following has been defined on the basis of complex $[Mn(NH_3)^6]^{++}$ ion generated in the solutions: reason and result connections of 1) supporting electrodeposition of metal manganese and maintenance of constant pH in the electrolyte by means of high buffer ability of manganese and ammonium water solutions, 2) pH low value of the solutions of the compound of manganese and ammonium salts, 3) fine-crystal structure of metal manganese received by means of electrodeposition during the coexistence of ammonium salts, 4) hindrance in releasing manganese

hydroxide by means of adding ammonium salts, 5) the existence of more inclinable forms of cathode polarized curves of solution containing both ammonium and manganese ions comparing with the solution of manganese salt.

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PP15. ADSORPTION PURIFICATION OF AIR FROM NITROGEN OXIDES BY NATURAL H-MORDENITE

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Adsorption of gaseous and liquid compounds by solid materials is investigated by both statistic and dynamic methods. For this reason, more unexpensive and not scarce natural zeolites (Georgia is rich in these minerals) are successfully used together with synthesized zeolites.

Possibility of application of hydrogen forms of natural mordenite (HM) in the process of purification of nitrogen oxide containing (NO_2 and N_2O) air is studied in the presented paper (Bolnicy-Rustavi deposits, Georgia).

The model mixture (air + N_2O + NO_2) was passed through the adsorbent layer (HM) activated at 400^oC for 3 hours at 100 ml/min speed. The remaining mix (NO_2 and N_2O) in the purified air was determined by gas chromatography. The main information about the work of adsorbent layer is given in isoplans, made in the c/c_o-t coordinates; where c is concentration and t-time. The experiment was carried out up to the complete treatment of zeolite layer.

In the process of sorption dynamic, the shape of the target curve is mainly determined by mass transfer describing kinetic and diffusive processes in the granulated zeolite. Generally it is shown by the size of the mass transfer zone (L_o) that might be described by character of the isoplan; the more inclined it is the smaller the zone of mass transfer.

The values of the adsorptive characteristics of H-mordenite obtained at 20 ^oC of the adsorption column are given the Table.

Table. The values of the dynamic characteristics of the adsorption process of nitrogen gases.

Model mix: Air + nitrogen oxides	Dynamic activity of the adsorbent layer a_d, g/100g	Equilibrium activity of adsorbent layer a_{eq}, g/100g	Length of the mass transfer zone L_o, cm	Degree of use of adsorbent layer activity η, %	Time of the work of the adsorbent layer $\tau_{prot.}$, min.
N_2O	0.0112	0.01479	5.84	75.73	372
NO_2	0.0696	0.09774	4.30	71.21	348

As it is seen from the tabular data, the time of protection action ($\tau_{prot.}$) and the size of the working layer (L_o) against N_2O and NO_2 differ from each other. It might be explained by the difference in the electron structure of the molecules of these compounds that determines their stability and intensity of action towards the zeolite centers and by molecular-sieve effect as well; though, molecular-sieve effect of zeolite probably is not determining in the discussed process.

PP16. BIOETHANOL PRODUCTION FROM UNEDIBLE PLANT RAW MATERIALS

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To reduce environmental pollution with carbon dioxides different countries of the world add ethanol in petrol. Ethanol is produced from cellulosecontaining renewable raw materials and it is a high-octane fuel[1].

Any vegetable wastes contain cellulose and lignin. Biofuel production from edible plant raw materials will decrease food product quantity and therefore this will cause price increase in developing countries. Also bioethanol production from unedible raw materials such as straws, and other vegetable wastes will cause feeding problems for cattle. So the best way is to produce biofuel from wood wastes, such as sawdust[2,3].

Hydrolysis of cellulose to monosaccharides is carried out in two ways: chemical and enzymatic.

The acid hydrolysis is more complete than the enzyme, because acid molecules are smaller so they can reaches in the crystalline structure of cellulose more easily and causes its dissolution with heigher degree, but the process is quite expensive. Unfavorable products like furfural, organic acids and others are produced during this process.

Enzymatic conversion of cellulose is carried out with microorganisms (bacteria, fungi) strains, which have the ability of cellulasa synthesis.

Biofuel reception from renewable unedible raw material using enzymatic biodegradation serves on the increase in the share of alternative energy, that improves environmental conditions. It is possible to work-out rational method of efficient biofuel production taking into consideration local conditions and opportunities due to alcohol distillation from the mixture received as a result enzymatic degradation of wood processing

residues - sawdust and fermentation. Optimization of acid and enzymatic hydrolysis and planning new approaches are necessary for development bioethanol production.

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PP17. HYDROBIOMETALLURGICAL METHOD FOR COMMERCIAL UTILIZATION OF THE MANGANESE – CONTAINING WASTE

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The work concerns developing a combined hydrobiometallurgical method for utilizing the industrial waste – manganese-containing dust (Mn-24.8%, SiO_2-28.2%, Fe_2O_3-2.3%, Al_2O_3-4.8%, CaO-7.8%, P-0.06%) and pyrite (Fe^{2+} -52.6%, S-46.2%) - exuded during the melting of the silicon manganese at the “Georgian Manganese Holding” and JSC “Madneuli”, two major industrial entities of our country. The aim of the work is to enable ecologically safe and energy-saving production of manganese sulfate – the new commodity product. In this regard the method of bacterial alkalizing of steels is unrivalled.

For the provided conditions, T. ferrooxidans highly active production trunk 209 adapted to 25 g/l sulfuric acid was selected as the material culture. During the incubational period, everyday pH control of

the to-be alkalized solution was carried out, as well as its setting to the necessary conditions using 10n H_2SO_4. Duration of alkalizing process was 8 to 10 days. Amount of manganese in the final solution amounted to 50.2 g/l, which corresponds to the 96.3% alkalizing of manganese. Setting the pH of the resulting solution to 6.2 enabled its cleansing from steel and other admixtures. As a result, manganese sulfate monohydrate $MnSO_4*H_2O$ -160 g/l with 84-85% purity was obtained, suitable for obtaining metallic manganese and manganese dioxide via electrolysis method. The process is involves the following chemical reactions [1]:

$FeS_2 + 3\ ½O_2 + H_2O + T.ferrooxidans \rightarrow FeSO_4 + H_2SO_4$;

$2FeSO_4 + MnO_2 + 2H_2O + T.ferrooxidans \rightarrow MnSO_4 + Fe_2(SO_4)_3 + 2H_2O$;

$MnCO_3 + H_2SO_4 + T.ferrooxidans \rightarrow MnSO_4 + CO_2\uparrow$

The sorrel acid synthesized by T. ferrooxidans is actively involved in restoring the manganese dioxide. Restoring the manganese from manganese dioxide via organic acid of the sorrel acid is carried out 10 times faster than via mineral acids:

$$HOOCOOH + MnO_2 + 2H^+ \rightarrow Mn^{2+} + 2H_2O + 2CO_2\uparrow$$
$$Mn(OH)_2 + H_2SO_4 \rightarrow Mn^{2+} + SO4^{2-}$$

The mentioned studies allow for developing industrial technology enabling the reprocessing of millions of tons of harmful industrial waste, piled for decades at the ferroalloying factories and “Madneuli” mountainous enriching enterprises, into manganese sulfate – a product on international demand. New impulse will be given to the industrial capacity of the country by including the manganese-containing waste - currently stored without benefits – into industrial cycle. In this regard there is a lot of potential in Georgia, as the country holds one of the leading positions in the world in regard of manganese stocks. Modern biotechnological production does not demand a great deal of investment, is easy for implementation and safe in ecological regards. Cleanness of basic mixtures will be raised, as will specifics of their operation. High-scale production of particular mixtures of steels - obtained via principally new biotechnological methods – will be initiated in a highly efficient character.

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PP18. MINERALIZATION OF ATRAZINE AND CYANURIC ACID BY ELECTROCHEMICAL ADVANCED OXIDATION PROCESSES

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Atrazine has been the most widely used s-triazine herbicide. It has been detected in natural waters presenting a potential danger for public health because it is considered an endocrine disruptor. The use of chemical, photochemical and photocatalytic advanced oxidation processes (AOPs) to decontaminate waters containing this herbicide only allowed its conversion into the cyanuric acid as ultimate end-products, since it cannot be destroyed by hydroxyl radicals (•OH) produced in these techniques [1]. The same behavior was previously reported for anodic oxidation and electro-Fenton with Pt anode, although better performances were found using boron-doped diamond (BDD) anode but without explaining the role of generated •OH [2]. Here, the oxidative action of these radicals in such electrochemical AOPs has been clarified by studying the mineralization process and decay kinetics of atrazine and cyanuric acid in separated solutions by anodic oxidation with BDD and electro-Fenton with Pt or BDD

anode using an undivided cell with a carbon-felt cathode under galvanostatic conditions. Obtained results showed that electro-Fenton with BDD anode was the more powerful treatment to destroy both compounds. Almost total mineralization (97% TOC removal) of atrazine was only feasible by this method with a faster removal of its oxidation intermediates by •OH formed at the BDD surface than that formed in the bulk from Fenton reaction, although the latter process caused a more rapid decay of the herbicide. Cyanuric acid was much slowly mineralized mainly with •OH produced at the BDD surface.

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PP19. TREATMENT OF WATERS CONTAMINATED BY ANILINE BROME – AND CHLORINE CONTAINING COMPOUNDS BY ELECTRO-FENTON METHOD

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Aniline and its halogen derivatives are widely used in dye production. These are biologically refractory toxic compounds and their content in waste waters is strictly regulated.

Purification of waters, contaminated by 2.6-Dichloroaniline and 4 – bromoaniline by means of Electro-Fenton method has been studied in this work. Contaminated water circulated in a filter-press reactor where hydrogen peroxide has been generated via two electron reduction of oxygen on air-diffusion electrodes. Then the process continued by adding Fe(II) ions to H_2O_2 in a separated tank with formation of strong

nonselective oxidant – peroxide radicals (*OH) which were in charge for mineralization of organic compounds by "Ex-cell method" [1].

The purification degree of contaminated waters was controlled using chemical oxygen demand (COD) determined by standard permanganate titration method [2]. It has been found:

a) 90% percent current efficient of H_2O_2 generation on gas-diffusion electrodes was obtained.
b) After treating of solution with initial content of 100mg/L 2.6-Dichloroaniline using "ex-cell" Electro-Fenton process, 82.9% purification degree has been achieved in first 5 minutes of operation, and for 4 – bromoaniline at same conditions this value was 84.8%.

The work has been done under supervision of Prof. G. Agladze

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PP20. THERAPEUTIC AND PROPHYLACTIC FUNCTIONAL FOOD STUFFS ON NEW GENERATION

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Today the issue of nutritional provision of population is of great importance as the food stuffs together with the nutrient qualities regulates many biochemical processes of the human organism. During the influence of some toxicants it is necessary not only the filling of essential food products, but also inclusion into the food such a products which help to

detoxication of harmful chemical compositions of food and their fast elimination from the human organism. In other case such an action has incorrigible, more strong impact to the human health, than ecological contamination, because the complete demolition of food structure becomes the main factor.

On the biochemical level nutrient substances influence each other and change their biological compatibility. During the determination of proportions and concentrations of some nutrients it is required to achieve their synergism – to minimize the antagonism.

At the same time, the circle of unsolved issues requires the necessity of the seeking of new effective prophylactic measures (therapeutic and prophylactic nutrition, biologically active additives for food, functional food stuffs).

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PP21. USING LOCAL SORBTION MATERIALS TO TREAT USED **MOTOR** <CASTROL 15 W-40> OIL

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Motor oil deteriorates during long operation; it changes its features, it is exposed to thermic decomposition, that consequently necessiates the exchage of the oil. In order to use the used oil again, it is

processed again (100 tone of used oil is changed into 60-80 kg of regenerated oil).

The work deals with the results of treating motor oil using materials. The method is based on the application of sorption materials, natural and synthetic adsorbents to absorb asphaltene –resinous compounds. The advantage of using kaolin is biased by the correlation of quantities of $SiO_2$and $A1_2O_3$. The more the correlation, the better the effect of whitening is. For the regeneration of the motor oil, the additives of sorption materials have been used. Please see the Table 1 for the composition of the additives.

Table 1. Composition of used adsorbents (compositive additive)

Name of adsorbents	AL_2O_3%	SIO_2 %	Fe_2O_3%	Correlation AL_2O_3 /SIO_2	Price tone/GEL
Askangel	14,38	65,26	2,84	4,6	15
Diatomit	5.0	81.7	3.5	16.3	17
Perlit	10.96	68.51	2.9	6.2	12
Ceolit	13.3	62.6	3.6	4.84	14

The following scheme was elaborated in order to treat the used oil: suspension, adsorbtion, centrifuging, vacuum filtration. The outcome of the received oil was 50% of the original weight. The state standard of **ГОСТ 11858** was used to determine the quantitative composition of asphaltene – resinous compounds.

In order to decrease the viscosity, we have diluted it with a variety of solvents. The following solvents were used:

1. Petrol fraction T=70-180°C:
2. Kerosene fraction T= 180- 200°C
3. Gasoline fraction. T=200- 250°C.

Through the application of th emethod, it has become possible to separate asphaltene –resinous compounds from oil fraction. The outcome oil was the subject of further distillation in order to remove solvent. After the distillation, the viscocity of oils has increased (100 °C from 7 to 9

mm^2/second) $\partial\partial^2/\eth\partial$.). As a result of treating, the temperature of explosion has relatively increased and acid number of oil has decreased.

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PP22. AIR-AL FUEL CELL WITH HYDROGEN PEROXIDE CO-GENERATION

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Original design of Air-Al alkaline fuel cell with co-generation of hydrogen peroxide and electric power has been developed [1].

Figure 1 represents experimental loop of the filter-press cell, equipped with a gas-diffusion cathode attached to the air chamber fed from a compressor, aluminum anode, ion-selective membrane and circuits of catholyte and anolyte circulation through intermediate vessels.

Effect of electrolyte type (NaOH, KOH) and concentration; influence of different types of O_2-diffusion electrodes ("$A12H_2O_2$ Specialty ELAT®" covered by VOLCAN CX-72R type active carbon black (USA) and electrode covered by Black Pearl 2000 (Sweden)); also effect of the nature of cation-selective (MK-40, NAFION 117, ASAHI GLASS) and anion-selective membranes (MA-40, NEOSEPTA, AMI 7001S,) on characteristics of fuel cell have been studied.

Based on results of the experimental study optimal regime of fuel cell operation has been achieved which guarantees 80-90% current

efficiency of hydrogen peroxide co-generation together with at of 23-30 mA/cm^2 current density of generated power.

Designed reactor can be used for purification of waste waters in remote areas.

The project was supported by GNSF/ST08/7-483 grant.

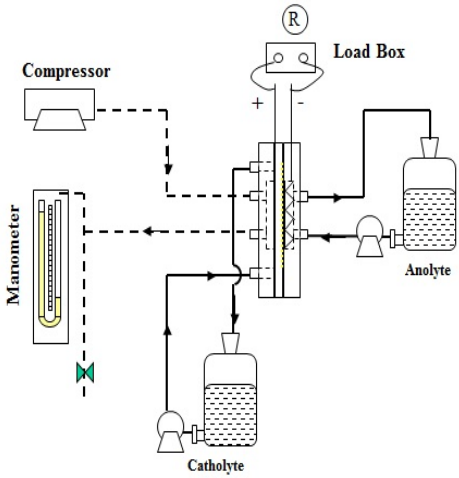

Fig. 1. Air-Al fuel cell set up scheme

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PP23. NEW SYSTEM OF DIRECT METHANOL FUEL CELLS WITH H_2O_2 GENERATION

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Two new types of direct methanol fuel cells (DMFC), operating with co-generation of electric power in the outer circuit and of powerful oxidant - hydrogen peroxide in the catholyte have been developed [1, 2]. Filter-press type fuel cells consist of cathode and anode departments, frames spacers of catholyte and anodlyte were used for distribution of electrolytes at electrodes, which were pressed between rubber gaskets; oxygen (or air) was supplied threw e gas chamber and nickel mesh which served as a cathode current feeder to the reverse side of O_2-diffusion cathode; the anolyte supplied through the inlet whole to the anode frame was washing the GDE, fixed on the DSA mesh which served as a current feeder; electrode compartments were separated by ion-exchange membrane.

In one type of a fuel cell membrane is hot pressed on anode and electrolyte runs through the area between membrane free anode side and the outer wall of the cell and catholyte goes between membrane and cathode.

Higher hydrogen peroxide current efficiency and increased generated power of the fuel cell have been reached in modified systems with anodes consisting of A11STDA electrode (0.5mg/cm^2 Pt:Ru 1:1) soldered by cationexchange membrane Nafion 115, Black Pearls 2000 cathode, and 2M KOH + 1M CH_3OH used as aqueous catholyte. Electrolyte flow rate was 1000 mL/min.

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PP24. COGENERATION OF ALKALI METAL PEROXIDE AND/OR PERBORATE IN BOROHYDRATE FUEL CELL SYSTEM

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Sodium borohydride ($NaBH_4$), is a most promising fuel for borohydrate fuel cells (BFCs) due to highest content of hydrogen (10.66%), simplified requirements for storage and handling. Elevated operating potential, higher power density and easy thermal and water management are main advantages of BFCs in comparison to other types of fuel cells.

Rapid progress has been achieved recently in the development of fuel cells equipped with chamber for pre-reforming of borohydride to hydrogen as well as of direct borohydride fuel cells (DBFCs). Water or hydroxyl ions are cathodic products (reactions 1, 2) and sodium metaborate ($NaBO_2$) is produced as a waste product (reactions 3,4) both in known DBFCs and H_2-O_2 system FCs with $NaBH_4$ pre-reforming.

$$O_2 + 4H^+ + 4\bar{e} \rightarrow 2H_2O \quad (1)$$
$$O_2 + 2H_2O + 4\bar{e} \rightarrow 4OH^- \quad (2)$$
$$NaBH_4 + 2H_2O \rightarrow 4H_2 + NaBO_2 \quad (3)$$
$$NaBH_4 + 8OH^- \rightarrow NaBO_2 + 6H_2O + 8\bar{e} \quad (4)$$

Novel DBFC systems with co-generation of hydrogen peroxide have been developed in the present work [1]. The process is based on replacement of reaction (2) by two-electron reduction of oxygen (reaction 5).

Utilization of metaborate, generated in the reformer or in the anodic chamber, has been achieved by means of mixing with the H_2O_2, generated in the cathodic chamber, resulting (reaction 6) in formation of valuable bleaching agent – sodium perborate ($NaBO_3$).

$O_2 + H_2O + 2\bar{e} \rightarrow HO_2^- + OH^-$ (5)

$NaBO_2 + H_2O_2 + 3H_2O \rightarrow NaBO_3 \cdot 4H_2O$ (6)

Different types of gas-diffusion electrodes and cation– and anion-selective membranes have been tested. Cells equipped with membranes or membrane-electrode assemblies ensuring minimal mixing of catholyte and anolyte have been designed.

Optimal parameters for H_2O_2 and $NaBO_3 \cdot 4H_2O$ electrosynthesis in the FC system as well as of crystallization of produced perborate have been defined and appropriate reactors have been designed [1].

References:

[1] G. Agladze, P. Nikoleishvili, Georgian Patent Application № AP 2010 11924/01, 2011.

PP25. THERMODYNAMIC PROPERTIES OF THE FERRITES OF SPINEL TYPE

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At present the new materials and innovative technologies are of particular attention. They provide a progress in science and technics. To prepare the ferrospinels of predetermined properties and to predict them it is necessary to obtain the hand-book information about such thermodynamic parameters as enthalpy, heat capacity, entropy and Gibbs energy. In spite of the fact that the structure and magnetic properties of ferrospinels are well-known, there are lack in the study of their thermodynamic properties.

In N.Landia Laboratory of Thermal Chemistry of R. Agladze Institute of Inorganic Chemistry and Electrochemistry the systematic investigations of thermodynamic properties of the ferrites of spinel type are carried out by calorimetric methods.

Enthalpy was determined at high-temperature adiabatic calorimeter of mixed type in the temperature range from 300 to 1300 K; true heat capacity was measured at differential-scanning calorimeter DSK-111 in the range 300-900 K.

Individual ferrites of Ni,Co,Zn,Cu,Mg,Li and solid solution of the ferrites: Ni-Zn,Co-Zn,Mg-Zn and Li-Zn were studied. The main thermodynamic parameters-heat capacity, enthalpy, entropy and Gibbs energy were determined in a wide range of temperatures (300-1300K). For the ferrites: Zn,Li and Li- Zn the values of enthalpy, heat capacity, entropy and Gibbs energy were obtained in the range: 10-300K by comparison of low-temperature and high-temperature data.

Experimental results- the thermodynamic functions (heat capacity, enthalpy, entropy, Gibbs energy) are presented in the form of interpolating equations and tables. Because of high experimental accuracy they represent the data of hand-book character.

PP26. THE TREATMENT OF WATERS CONTAMINATED BY PESTICIDE B-58 USING CHEMICAL AND ELECTRO-FENTON METHODS

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Inappropriate maintaining of pesticides which leads to contamination of soil and ground waters with non-biodegradable

hazardous compounds harming living organisms determines necessity of development of effective methods of water treatment from pesticides.

We report on treatment of water contaminated by commercially available and widely exploited in Georgia pesticide “B-58 new” (B-58 new contains: *O,O*-dimethyl *S*-2-(methylamino)-2-oxoethyl dithiophosphate ($C_5H_{12}NO_3PS_2$)) using chemical and electrochemical Fenton methods.

Chemical Fenton process has been conducted by using solutions containing 424g/L H_2O_2, prepared by “antraquinone” method. In the electrochemical Fenton method hydrogen peroxide generated on gas diffusion anode reacted with Fe^{2+} in the same reactor with contaminated solution (method I) or electrogenerated H_2O_2 reacted with Fe(II) sulfate added in a separate chemical reactor (method II). In both cases a strong oxidant - *OH radical which oxidizes organic pollutants to carbon dioxide or destroys them to harmless compounds was produced.

The degree of degradation of organic compounds was estimated by chemical oxygen demand (COD) determined using permanganate method.

In case of method I the model, contaminated solution was prepared as follow: 1 mL pesticide was dissolved in 1000mL water, 0.0728 g $FeSO_4$ and 7.1 g Na_2SO_4 (to increase the conductivity) were added to 100 mL of contaminated solution. The electrolyze of model solution has been conducted for 1 hour under load of 0.3A current.

In case of method II, 0.0728 g Fe(II) sulfate was added in the separate reactor to solution containing H_2O_2 generated in the electrochemical cell.

COD for the first case was reduced from 545mg/L to 215mg/L and from 545mg/L to 118mg/L for the second case. The degree of purification were 60.5% and 78.3% for the first and the second cases respectively. Disappearance of strong specific odour coming from original contaminated solution was observed in both cases.

The work was performed under the supervision of Prof. Giorgi Agladze.

PP27. TREATMENT OF WATERS CONTAMINATED BY NITRO- AND AMINO PHENOL DERIVATIVES USING ELECTRO-FENTON METHODS

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Phenolic compounds are hazardous, refractory pollutants widely presented in wastewaters of different industrial and agricultural enterprises. Penetration of nitrophenol impurities to Amur river branch in 2005 was belongs to the most dramatic ecological catastrophes as the adequate purification method was not found at that time. Results of phenol and 4-chlorophenol treatment by means of Electro-Fenton method were reported in our previous publication [1]. The method is based on generation of effective, non-selective oxidants – hydroxyl radicals (*OH) which by reaction of hydrogen peroxide, formed due to electroreduction of oxygen at air-diffusion anodes in the membrane cell with Fe^{2+} ions or appropriate salts. Treatment of waters, contaminated by m-aminophenol, p-nitrophenol and sodium 4-nitrophen oxide using "In – cell" mode of the electro-Fenton method has been studied in the present work. Treatment efficiency was determined due to COD analysis using standard permanganometric titration method.

The degrees of treatment of contaminated waters, initially containing 100 mg/L of pollutant, 0.5 mol/L $FeSO_4$, and 0.5 mol/L Na_2SO_4 as supporting electrolyte after 15 minutes, 3 A/L current concentration and 0.075 A/m^2 current density in case of m-aminophenol, p-nitrophenol and sodium 4-nitrophenoxide were 100%, 94.9%, 89.5% respectively .

This work was conducted under the supervision of Prof. G. Agladze.

References

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PP28. DEPENDENCE OF MANGANESE HYDROXIDE PRECIPITATION PH ON TEMPERATURE IN MANGANESE AND AMMONIA SULFATES SOLUTIONS

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Simultaneous electrodeposition of most valuable manganese products - Electrolytic manganese metal (EMM) and Electrolytic manganese dioxide (EMD) in the membrane cell [1] proceeds at significantly higher catholyte temperatures, than this, determined as optimal for the separated, conventional EMM electrowining process (35^{o}C). Variation of the manganese hydroxide precipitation pH value in $MnSO_4$ – $(NH_4)_2SO_4$ - H_2O within (50-70°C) influences decreased current effiency and increased non-metallic impurities into the deposit.

Dependences of pH and manganese hydrate formation on temperature change in range of 25-70°C of the solution containing different concentrations of $MnSO_4$ and $(NH_4)_2SO_4$ has been studied. Using precise MP512 pH meter the following results have been obtained:

a) The rise of temperature of mixture of manganese – ammonia sulfate solution (15-45 g/L Mn^{2+} + 30-100 g/L $(NH_4)_2SO_4$)) causes decrease of pH especially when concentration of manganese ions is increased.

b) Manganese hydrate precipitation pH becomes lower in manganese – ammonia sulfate solutions at high temperatures.

c) At high temperature, as higher is concentration of manganese ions as lower is manganese hydrate precipitation pH and it is practically independent from concentration of ammonia sulfate (see table).

Table. Manganese hydrate precipitation pH values in manganese – ammonia sulfate solutions at 70°C

№	Solution Composition	Manganese hydroxide precipitation pH
1	15g/L (0.27 mol/L) Mn^{2+} + 30 – 100g/L (0.23 – 0.76 mol/L) $(NH_4)_2SO_4$	7.25
2	30g/L (0.54 mol/L) Mn2+ + 30-100g/L (0.23 – 0.76mol/L) $(NH_4)_2SO_4$	6.9
3	45g/L (0.54mol/L) Mn2+ 30-100g/L (0.23-0.76mol/L) $(NH_4)_2SO_4$	6.75

The work is performed under the supervision of Prof. G. Agladze

Reference

[1] G. Agladze, Georgian Patent 2273, 1999

Exhibition

1. **Art Glass & Ceramics**

G. Gaprindashvili, M. Kekelidze, S. Sanadze

2. **Nanotechnology for Preparation of the "Safe" Water and Air**

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