



International Meeting

CLUSTERS AND NANOSTRUCTURED MATERIALS (CNM'5)

PROGRAM and MATERIALS



Uzhgorod Ukraine
22 – 26 October, 2018

National Academy of Sciences of Ukraine
Institute of Physics
G.V.Kurdyumov Institute for Metal Physics
Institute for Information Recording
Uzhgorod laboratory of optoelectronics and photonics materials of the
Institute for Information Recording
Uzhgorod National University

INTERNATIONAL MEETING

**CLUSTERS AND NANOSTRUCTURED
MATERIALS
(CNM-5)**

**Uzhgorod *Vodograj* Ukraine,
22-26 October 2018**

**PROGRAM & MATERIALS
OF THE MEETING**

**Uzhgorod
2018**



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The materials represent the contents of meeting's reports based on the results of fundamental and applied works on topical questions in the field of nanostructured systems, nanomaterials and nanotechnologies. Main attention is given to the consideration of problems of nanophysics and nanoelectronics, to atomic and electronic structure of cluster and nanostructured materials, amorphous alloys, nanostructured films and coatings, colloidal and biofunctional materials, to study of their properties. The results of investigations in the field of supramolecular chemistry, synthesis of nanoparticles, nanostructures and multifunctional nanomaterials, physico-chemistry of superficial phenomena and diagnostics of nanosystems are presented.

The edition is designed for scientists, engineers, higher school lecturers, post-graduates and students of corresponding specialities.

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PROGRAM



MONDAY, 22TH OF OCTOBER, 2018

8⁰⁰ – 13⁰⁰ – registration of CNM'5 participants, coffee-break

13⁰⁰ – 14⁰⁰ – lunch

15⁰⁰– 15³⁰ – Opening MEETING (official speakers)

PLENARY

Chairman: **Studenjak I.**

15³⁰ – 16²⁰ – **NANODIMENSIONAL SYSTEMS: INVESTIGATIONS FND
DEVELOPMENT IN THE NATIONAL AKADEMY OF SCIENCE OF
UKRAINE**

Uvarov V.M., Malchevskii I.A., Bespalov S.A.

16²⁰ – 17¹⁰ – **USING A DIRECT LASER RECORD TO CREATE SUB-MICRON
STRUCTURES**

Petrov V.V., Kryuchyn A.A., Shanoylo S.M., Beliak Ie.V., Manko D.Yu.,
Gorbov I.V. .

17¹⁰ – 18⁰⁰ – **FERROELECTRIC NANO-STRUCTURES FOR ULTRAFAST THZ
COMMUNICATIONS, LOW-DISSIPATION ELECTRONICS, AND
MULTI-LOGIC COMPUTING CIRCUITS**

Igor Lukyanchuk, Daoud Mezanne, Anna Razumnaya, Yuri Tikhonov,
Elena Zaitseva, Vitaly Levashenko

19⁰⁰ – 20⁰⁰ – dinner

TUESDAY, 23TH OF OCTOBER, 2018

8⁰⁰ – 9⁰⁰ – breakfast

PLENARY

Chairman: **Malchevskii I.**

9⁰⁰– 9⁵⁰ – **PHONON SPECTRUM OF COMPOSITE OXIDE SYSTEMS OF THE PEROVSKITE FAMILY IN THE CONCEPT OF SUPER SPACE SYMMETRY**

Shkyrta I. M., **Nebola I. I.**, Katanitsa A. F., Ochkaev I. I.

9⁵⁰– 10⁴⁰ – **SEMICONDUCTORS – FERROICS OF PHOSPHOROUS CHALCOGENIDES FOR VERY DENSE AND FAST MEMORY ELEMENTS**

Vysochanskii Yu., Haborets V., Yevych R., Glukhov K., Babuka T., Medulych M., Kohutych A., Molnar A.

10⁴⁰ – 11¹⁰ – coffee-break

PLENARY

Chairman: **Vysochanskii Yu.**

11¹⁰ – 12⁰⁰ – **NEW NONLINEAR NON-STATIONARY OPTICAL PHENOMENA IN THE INTERACTION OF ULTRASHORT LIGHT PULSES WITH MATERIALS FOR OPTOELECTRONIC AND TELECOMMUNICATION USE: FUNDAMENTAL AND APPLIED ASPECTS**

Blonskyi I.V., Kadan V.M., Dmytruk A.M., Dmitruk I.M., Korenyuk P.I., Pavlov I.A., Pavlova S.V., Rybak A.S., Shpotyuk O.I., Yarusevych O.I.

SECTION

12⁰⁰ – 12²⁰ – **GRAPHENE-LIKE MATERIALS AND NANOCOMPOSITES BASED THEREON: MECHANOCHEMICAL PREPARATION, STRUCTURE, PROPERTIES AND FUNCTIONAL APPLICATION**

Posudievsky O.Yu., Kondratyuk A.S., Kozarenko O.A., Koshechko V.G., Pokhodenko V.D.

12²⁰ – 12⁴⁰ – **HIGH TEMPERATURE PLASMONS AND CARRIER MOBILITY SIMULATION IN n-type WIDE HgTe QUANTUM WELLS**

Melezhik E.O., Gumenjuk-Sichevska J.V., Mikhailov N.N.

12⁴⁰ – 13⁰⁰ – **NANOCLASTERS IN HEA COATING**

Danylenko M.I., Gorban' V.F., Krapivka M.O., Firstov S.O.

13⁰⁰ – 14⁰⁰ – lunch



SECTION

Chairman: **Uvarov V.**

14⁰⁰ – 14²⁰ – THE ALUMINUM METALOTERMIC ALLOYS

Zhiguts Yu.Yu., Lazar V.F., Levdar K.E.

14²⁰ – 14⁴⁰ – METHOD OF DETERMINATION OF PHASE COMPOSITION OF SYNTHESIZED ALLOYS BY THE METHODS OF GEOMETRIC THERMODYNAMICS

Zhiguts Yu.Yu., Polishchuk O.S., Beyresh Ya.Ya.

14⁴⁰ – 15⁰⁰ – PROPERTIES OF CLUSTERED METAL AND HIGH-ENTROPY ALLOY COATINGS TiZrHfVNbTa

Gorban V.F., Andreev A.A., Firstov S.A., Chikryzhov A.M., Stolbovoy V.A., Krapivka N.A.

15⁰⁰ – 15³⁰ – coffee-break

SECTION

Chairman: **Kokenyesi S.**

15³⁰ – 15⁵⁰ – STRUCTURE AND PROPERTIES OF NANOCRYSTALLINE COPPER- AND ALUMINUM-BASED CONDENSATES

Zhadko M.A., Lutsenko E.V., Sobol' O.V., Zubkov A.I.

15⁵⁰ – 16¹⁰ – SUPERCONDUCTIVITY OF GASB MICROCRYSTALS AT WEAK MAGNETIC FIELDS

Druzhinin A.A., Ostrovskii I.P., Khoverko Yu.M., Liakh-Kaguy N.S.

16¹⁰ – 16³⁰ – PHOTOCATALYTIC PROPERTIES OF POLYSULFONIC MEMBRANES MODIFIED WITH SnO₂ NANOPARTICLES

Kolesnyk I., Dzhodzhyk O., Konovalova V., Burban A.

16³⁰ – 16⁵⁰ – SPHEROIDAL MULTILAYER NANOSCALE CARBON CLUSTERS - POLYFUNCTIONAL FUEL ADDITIVES OF NEW GENERATION

Polunkin Ye.V., Gaidai O.O., Bereznitskyi Ya.O., Pilyavskyi V.S., Kamenieva T.M.

16⁵⁰ – 18⁰⁰ – POSTER SECTION (DISCUSSION)

19⁰⁰ – 20⁰⁰ – dinner

WEDNESDAY, 24TH OF OCTOBER, 2018

8⁰⁰ – 9⁰⁰ – breakfast

PLENARY

Chairman: **Bespalov S.**

9⁰⁰– 9⁵⁰ – **DEVELOPMENT OF FUNCTIONAL POLYMER NANOCOMPOSITES FOR DIRECT OPTICAL RELIEF RECORDING**
Molnar S., Burunkova J., Bohdan R., Bako J., Daroczi L., **Kokenyesi S.**

9⁵⁰ – 10²⁰ – **INFLUENCE OF TECHNOLOGICAL FACTORS AND THERMAL TREATMENT ON THE STRUCTURE AND PROPERTIES OF CHALCOIODIDE GLASSES AND NANO-, MYCROCOMPOSITES ON THEIR BASIS**
Rubish V.M., Rizak I.M., Mykaylo O.A., Maryan V.M., Gorina O.V., Gasinets S.M.

10²⁰ – 10⁵⁰ – coffee-break

SECTION

Chairman: **Rubish V.**

10⁵⁰ – 11¹⁰ – **SELF-ORGANIZATION OF CRACKING IN THIN FILMS OF CHALCOGENIDE GLASS As₂S₃**
Kozak M.I., Loya V.Yu., Zhikharev V.N., Fedelesh V.I.

11¹⁰ – 11³⁰ – **MAGNETICALLY SENSITIVE NANOCOMPOSITES BASED ON MAGNETITE AND GEMCITABINE FOR APPLICATION IN ONCOLOGY**
Petranovska A.L., Abramov M.V., **Opanashchuk N.M.**, Turanska S.P., Kussyak N.V., Gorbyk P.P., Lukyanova N.Yu., Chekhun V.F.

11³⁰ – 11⁵⁰ – **SELF –ORGANIZED HETEROSTRUCTURES INORGANIC CARRIER – NATIVE ENZYME MIXTURE AND THEIR ELECTROCHEMICAL APPLICATIONS**
Kazdobin K.A., Pershina K.D., Khodykina M.O., Trunova E.K., Bepaliuk A.A.

12⁰⁰ – 13⁰⁰ – lunch

PLENARY

Chairman: **Mykaylo O.**

13³⁰ – 14⁰⁰ – **THE EFFECT OF VACANCIES ON CHARACTERISTICS OF METAL CLUSTERS**
Pogosov V.V., Reva V.I., Korotun A.V.



14⁰⁰ – 14³⁰ – NEWTYPE RECORDING MEDIA BASED ON “NOBLE METAL NANOPARTICLES/ChVS FILMS” COMPOSITIES

Rubish V.M., Trunov M.L., Lytvyn P.M.

**14³⁰ – 19⁰⁰ – POSTER SECTION (DISCUSSION)
EXCURSION**

19⁰⁰ – 20⁰⁰ – dinner



THURSDAY, 25TH OF OCTOBER, 2018

8⁰⁰ – 9⁰⁰ – breakfast

SECTION

9³⁰– 12³⁰ – Satellite conference ACCELERATE

Chairman: **Rizak V.**

CERIC-ERIC, THE MULTI-TECHNIQUE RESEARCH INFRASTRUCTURE FOR MATERIALS RESEARCH IN CENTRAL-EASTERN EUROPE

Matthias Girod

TEACHER OF PHYSICS AND INNOVATION CHANGES IN SLOVAK SCHOOL EDUCATION

Seben Vladimir

"HORIZON" OF DEVELOPMENT AND INNOVATION FOR UzhNU AND TRANSCARPATIA

Taisiya Symochko

XPS, SRPES, LEED AND NEXAFS INVESTIGATION OF ADENINE THIN FILM ON TITANIUM OXIDE SURFACES

V. Matolin A. Barta, S. Bercha, N. Popovych, N. Tsud, T. Duchon, K. Veltruska, I. Khalakhan, V. Rizak

X-RAY STUDY OF ELECTROCHEMICAL STERN LAYER: ORDERING AND LAYERING

Yihua Liu, Tomoya Kawaguchi, Michael S. Pierce, **Vladimir Komanicky**, Hoydoo You

HIGH-PRESSURE SINGLE-CRYSTAL SYNCHROTRON DIFFRACTION STUDY OF LIKB₄O₇

L. Dubrovinsky, I. Chobal, A. Pakhomova, O. Chobal, D. Simonova, A. Kurnosov, V. Adamiv, V. Rizak

NEAR-AMBIENT PRESSURE XPS STUDIES OF THE CATALYTIC AND GAS SENSING PROPERTIES OF COPPER AND TIN OXIDES

Vorokhta M., Khalakhan I., Hozák P., Vrnáta M., Vondráček M., Lančok J., Matolín V.

INFLUENCE AMMONIA AND HUMIDITY ON THE LUMINESCENCE OF QUANTUM DOTS IN NANOCOMPOSITE STRUCTURES BASED ON BACTERIOHODOPSIN

S. O. Korposh, I. I. Trikur, I. Y. Tsoma, M.Y. Sichka, V. M. Rizak

MICRO- AND NANOSIZED PROTECTIVE ELEMENTS ON As-Se AND Ge-As-Se THIN FILMS

A. Feher, B.V. Bilanych, O. Shylenko, V. Komanicky, V.S. Bilanych, I.M. Rizak, V.M. Rizak



13⁰⁰ – 14⁰⁰ – lunch

PLENARY

Chairman: **Mitsa V.**

14³⁰ – 15²⁰ – ON THE DERIVATION OF THE DIRAC EQUATION

Simulik V.M., Bulgakova A.I., Zajac T.M.

15²⁰ – 16¹⁰ – CARBONIZATION PROCESSES AND FORMATION OF METAL NANOPARTICLES IN ION-IRRADIATED POLYMERS AND COMPOSITE MATERIALS: POSITRON ANNIHILATION SPECTROSCOPY APPROACH

Kavetsky T. and Kiv A.

16¹⁰ – 16⁴⁰ – coffee-break

SECTION

Chairman: **Kavetsky T.**

16⁴⁰ – 17⁰⁰ – THE FLASH-LAMP TREATMENT OF THE Cu₂ZnSnS₄ NANOCRYSTALS AND THE RAMAN CHARACTERIZATION OF POSSIBLE SECONDARY PHASES SYNTHESIZED BY THE SAME METHOD

Havryliuk Ye.O., Dzhagan V.M., Yukhymchuk V.O., Valakh M.Ya.

17⁰⁰ – 17²⁰ – DFT-CALCULATIONS OF THE STABILITY AND RECONSTRUCTION OF THE CRYSTAL SURFACE

Nykyruy L.I., Naidych B.P.

17²⁰ – 18⁰⁰ – POSTER SECTION (DISCUSSION)

19⁰⁰ – 20⁰⁰ – dinner



FRIDAY, 26TH OF OCTOBER, 2018

8⁰⁰ – 9⁰⁰ – breakfast

PLENARY

Chairman: **Uvarov V.**

9⁰⁰– 9⁵⁰ – COORDINATION DEPENDENCE OF BOSON PEAK POSITION AND CRYOGENIC THERMAL ANOMALIES IN NANOSTRUCTURED As_xS_{100-x} GLASSES

V. Mitsa, A. Feher, V. Tkáč, R. Holomb, M. Veres, N. Shumilo

9⁵⁰ – 10⁴⁰ – NANOSTRUCTURED UREASIL-BASED POLYMER COMPOSITES FOR CONSTRUCTION OF AMPEROMETRIC ENZYME BIOSENSORS: STATE-OF-THE-ART AND FUTURE OUTLOOK

Kavetskyy T.

10⁴⁰ – 11¹⁰ – coffee-break

11¹⁰ – Closing MEETING

POSTERS

- **OBLIQUE LOCALIZED JOSEPHSON PLASMA WAVES IN A PLATE OF LAYERED SUPERCONDUCTOR**
 Shymkiv D.V., Rokhmanova T., Maizelis Z.A., Kadygrob D.V., Apostolov S.S.
- **NANOCOMPOSITES OF GRAPHENE-LIKE CARBON AND COBALT OXIDES FOR CATALYTIC HYDROGENATION OF QUINOLINE**
Asaula V. N., Pariiska O. O., Ryabukhin S. V., Gavrilenko K.S.,
 Volochnyuk D. M., Kolotilov S. V.
- **ELECTRONIC AND VIBRATIONAL PROPERTIES OF Cu(Ag)InP₂S(Se)₆ CRYSTALS: THEORETICAL INVESTIGATION**
Babuka T., Glukhov K., Vysochanskii Yu., Makowska-Janusik M.
- **METHOD FOR IDENTIFICATION OF OPTICAL RESONANCES OF METAL FILMS**
Barabash M.Yu., Vlaykov G.G., Martynchuk V.E., Kolesnichenko A.A.,
 Rybov L.V.
- **INVESTIGATIONS OF MECHANICAL PROPERTIES IN Cu₆PS₅I-BASED THIN FILMS**
Bendak A.V., Bilanych V.V., Skubenych K.V., Bilanych V.S., Studenyak I.P.
- **EFFECT OF GREEN BODY ANNEALING ON LASER PERFORMANCE OF YAG:Nd³⁺ CERAMICS**
Bezuglyi V.A., Yavetskiy R.P., Parkhomenko S.V., Vorona I.O., Tolmachev A.V., Kosyanov D.Y., Kuryavyi V.G., Mayorov V.Y., Gheorghe L., Croitoru G., Enculescu M.
- **MAGNETO - INDUCED ANISOTROPY IN A MAGNETOACTIVE ELASTOMER**
A. V. Bodnaruk, A. Brunhuber, A. A. Snarskii, M. M. Kulyk, V. M. Kalita, S. M. Ryabchenko and Mikhail Shamonin
- **Hg₃Te₂Cl₂ AS AN EFFICIENT NANOMATERIAL FOR NONLINEAR OPTICAL APPLICATIONS**
 Bokotey O.V., Slyvka V.A., Bokotey O.O., Slivka A.G.
- **ON THE STRUCTURAL AND OPTICAL PROPERTIES OF TERNARY THALLIUM CHALCOGENIDE COMPOUNDS**
Bokotey O.V., Slivka A.G.



- **HIGH-TEMPERATURE ELECTROCHEMICAL SYNTHESIS OF MOLYBDENUM CARBIDE NANOSTRUCTURED COATINGS ON THE SURFACES OF DIELECTRICS AND SEMICONDUCTORS IN IONIC MELTS**

Gab A.I., Shakhnin D.B., Lukashenko T.F., Boliukh O.S., Malyshev V.V.
- **COMPOSITE POLYMER FIBERS COATED WITH NANOSTRUCTURED INORGANIC PARTICLES: SYNTHESIS AND APPLICATION**

Bondar Yu., Kuzenko S., Slivinsky V.
- **LUMINESCENT PROPERTIES OF YTTRIUM OXIDE NANOPOWDERS**

Burlak G., Vilinskaya L.
- **PORPHYRINS WITH PERIPHERAL SUBSTITUENTS AS INHIBITORS OF AMYLOID FIBRIL FORMATION**

Kovalska V., Chernii S., Losytskyy M., Kelm A., Yarmoluk S., Gorski A., Chernii V.
- **SYNTHESIS OF PHOTOCATALYTIC ZnO NANOMATERIALS FORM DIFFERENT ROUTES**

Danilenko I., Gorban O., Volkova G., Glazunova V., Burkhovetsky V., Bryukhanova I., Konstantinova T.
- **INVESTIGATION CRYSTALLIZATION KINETICS OF Ge-As-TE AND As-S (Sb) -I SYSTEM FILMS USING OPTICAL METHOD**

Turianytsia I.I., Tsyhyka V.V., Kozusenok O.V., Chychura I.I. Slavik V.M.
- **OBTAINING A SUBMICROCRYSTALLINE ZR-TI-NB ALLOY USING HIGH PRESSURE TORSION**

Kulagin R., Mazilkin A., Beygelzimer Y., Savvakina D., Zverkova I., Oryshych D., Davydenko O.
- **IMPROVEMENT OF THE METHOD OF SINGLE OPTICALLY ACTIVE DEFECTS ACTIVATION IN 4H-SIC**

Demenskyi O. M., Glukhova V. I., Krasnov V. A., Shutov S. V., Yerochin S. Yu.
- **THE EFFECT OF EXTERNAL FACTORS ON THE STRUCTURAL, PHYSICAL AND CHEMICAL PARAMETERS OF WATER**

S.O. Dolenko, H.M. Kravchenko, M.D. Skilska
- **INTERACTION OF ELECTRONS WITH NANOCLUSTERS OF ATOMIC AND MOLECULAR GASES**

Doronin Yu.S., Danylchenko O.G., Konotop O.P., Tkachenko A.A., Vakula V.L.



- **THERMAL DIFFUSIVITY EVALUATION AND SEIRA-SPECTROSCOPY OF EXPANDED GRAPHITE - CARBON NANOTUBES COMPOSITES**

Morozovsky N. V., Barabash Yu. M., Dovbeshko G. I., Grebelna Yu. V., Kartel M. T., Sementsov Yu. I.
- **MASS-SPECTRUM AND EVAPORATION MECHANISM OF AS-S GLASSES**

Ivanitsky V.P., Kryshenik V.M., Kolinko S.O.
- **INVESTIGATION OF THE INFLUENCE OF GEOMETRY AND TECHNOLOGICAL PARAMETERS OF PRODUCTION ON THE STRUCTURE AND PROPERTIES OF SPHERICAL CELLULAR STRUCTURES OBTAINED BY SLM**

Travyanov A.Y., Petrovskiy P.V., Cheverikin V.V., Sokolov P.Yu., Davidenko A.A., Fartushna I.V.
- **KINETICS OF DISPERSION DURING ANNEALING IN VACUUM OF NIOBIUM AND HAFNIUM NANOFILMS DEPOSITED ONTO NONMETALLIC MATERIALS**

Gab I.I., Stetsyuk T.V., Kostyuk B.D., Naidich Y.V.
- **INFLUENCE OF LOW TEMPERATURE ANNEALING ON CRYSTALLIZATION PROCESSES IN $(As_2S_3)_{100-x}(SbSI)_x$ GLASSES**

Gasnets S.M., Gorina O.V., Horvat Yu.A., Rizak I.M., Solomon A.M., Shpyrko G.M., Bandurin Yu.A.
- **FERROELECTRICITY IN UNDOPED BINARY OXIDES**

Glinchuk M. D., Kalinin S. V. and Morozovska A. N.
- **TEMPERATURE DEPENDENCE OF RAMAN-ACTIVE MODES OF $TlIn(S_{0.95}Se_{0.05})_2$ SINGLE CRYSTAL**

Gomonnai O.O., Ludemann M., Gomonnai A.V., Roman I.Yu., Guranich P.P., Slivka A.G., Zahn D.R.T.
- **Ag-DECORATED WIDE GAP OXIDES**

Gorban O., Danilenko I., Volkova G., Gorban S., Akhkozov L., Bryukhanova I., Konstantinova T.
- **NANOSTRUCTURED WEAR-RESISTANT SURFACE LAYERS Cu-Fe-O**

Grypachevskiy O.M., Tykhonovych V.V., Uvarov V.M.
- **STRUCTURAL PROPERTIES AND CHEMICAL COMPOSITION OF THE MICRO- AND MESOPOROUS ACTIVATED CARBON SURFACE**

Guzenko N.V., Lodewyckx P., László K.



- **STRUCTURAL AND OPTICAL STUDY OF $(\text{Ge}_{40}\text{S}_{60})_{100-x}\text{Bi}_x$ THIN FILMS PREPARED BY THERMAL EVAPORATION**

Horvat H., Khalakhan I., Vlcek M., Rizak V.
- **INFLUENCE OF INTRINSIC POINT DEFECTS ON THE ELECTRONIC STRUCTURE, PHOTOELECTRIC AND PHOTOLUMINESCENCE PROPERTIES OF GeSe_2**

Bletskan D. I., Kabatsii V. N., Vakulchak V.V., Cheryanyk D.R.
- **DYNAMICAL AND ELASTIC PROPERTIES CHANGES INDUCED BY SUBSTITUTIONAL IMPURITIES IN β - InSe QUASI-TWO-DIMENSIONAL CRYSTALS**

Kharkhalis L.Yu., Glukhov K.E., Babuka T.Ya., Lyakh M.V.
- **MULTIFUNCTIONAL NANOSTRUCTURED COATINGS, DEPOSITED BY VACUUM-ARC METHOD**

Klimenko I.O., Belous V.A., Ovcharenko V.D., Kuprin A.S.
- **STRUCTURAL TRANSFORMATION OF As_2S_3 CHALCOGENIDE MATERIALS BY DOPING OF Mn AS PROSPECTIVE MATERIALS FOR THE NANOOPTICS AND COMPUTER ENGINEERING**

Kondrat O., Holomb R., Csik A., Takats V., Kondrat O., Shumylo N., Ihnatolia P., Olashyn D., Veres M., Paiuk O., Stronski A.V. and Mitsa V.M.
- **THE DIPOLE POLARIZABILITY OF AN ELLIPSOIDAL BIMETALLIC NANOPARTICLE**

Korotun A. V., Koval' A. O. and Kurbatsky V. P.
- **SUBDIFFUSION IMPEDANCE OF STRUCTURES WITH QUANTUM ENERGY ACCUMULATION MECHANISM BASED ON SUPRAMOLECULAR ENCAPSULATED GaSe**

Kostrobij P., Grygorchak I., Ivashchyshyn F., Markovych B., Viznovych O., Tokarchuk M.
- **THE CHEMICAL POTENTIAL AND THE WORK FUNCTION OF A METAL FILM ON A DIELECTRIC SUBSTRATE**

Kostrobij P., Kurylyak I., Markovych B.
- **TUNGSTEN AND MOLYBDENUM CARBIDE NANOSTRUCTURED POWDERS AND COATINGS OBTAINING BY MOLTEN SALTS ELECTROLYSIS**

Malyshev V.V., Shakhnin D.B., Gab A.I., Zalubovskyi M.G., Kovtoniuk A.V.
- **CALCULATING METHOD OF THE EVAPORATION PROBABILITY OF CHALCOGENIDE GLASSES VAPOUR CLUSTERS**

Kovtunencko V.S.



- **2D-MATERIALS BASED ELECTROCATALYSTS FOR HYDROGEN EVOLUTION AND OXYGEN REDUCTION**

Kozarenko O. A., Kondratyuk A.S., Posudievsky O.Yu, Koshechko V.G., Pokhodenko V.D.
- **PRESENTATION DEVELOPMENT OF INSTITUTE FOR INFORMATION RECORDING IN THE FIELD OF HIGH TECHNOLOGY IN THE INSTITUTE SITE**

Kryuchyn A.A., Solonina N.V.
- **INTERACTION OF POLYMETHINE DYES WITH DETONATION NANODIAMONDS IN AQUEOUS SOLUTIONS**

Kulinich A. V., Ishchenko A. A., Mchedlov-Petrossyan N. O., Kamneva N. N., Ōsawa E.
- **INFLUENCE OF NATURAL MINERALS NANOPARTICLES ON THE SYNTHESIS OF BIOLOGICALLY ACTIVE COMPOUNDS BY BACTERIA-COMPONENTS OF THE PREPARATION AZOGRAN**

Kurdish I.K., Skorochochod I.O.
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POTENTIAL USAGE OF THIOPHENE AND PYRIMIDINE DERIVANTS (BYPRODUCTS) IN CONTROLLING THE CAPACITY OF NANOSCALE (NANOSCALE ORGANIZED) BODY SYSTEMS

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Being a well-developed biological system organism, with its organization and functionality is totally based on the reactional mutual transformations of organic compounds, which are realized subject to availability of biological catalysts, functioning in homeostatically permanent medium. Homeostasis as an integral complex of local intraorganic medium conditions, the required level of which is maintained by self-regulatory body systems, is empirically characterized by the list of criteria parameters, the stability of which is dynamically controlled and corrected by the reverse signaling (feed-back effect) and compensatory-and-adaptive reacting of executive systems and by renewable mechanisms, phylogenetically inherent to organism as being a biological system. Making analysis of such functional systems organization, it should be noted that the prevailing majority thereof is presented by protein-molecular-organized complexes, whereas the organization of self-regulation thereof is based on the interactive interlocking of humorally-regulated receptor-and-mediator complexes which by means of involving different physiological mechanisms eliminate the symptoms of parameters deviations / abnormalities, permanently maintaining the optimal conditions for effective behavior of required biochemical reactions. Analyzing the structure and special aspects of local intraorganic and intratissual conditions functioning, it should be mentioned that they cohere in one general concept – juxta-reactional medium, – particularly the set of conditions in which a certain reaction behavior and its accompanying side effects behavior can be observed. The concept ‘juxta-reactional medium’ is of great importance and necessity, since local (juxta-reactional) conditions determinate the order and producing capacity of reactional process. Particularly juxta-reactional – local conditions – i. e. those which directly verge on reactional process are characterized by criteria parameters inherent to dynamic changes which are not always timely removed by homeostasis-regulated mechanisms, so it means whereas determining the state of specific system they can constitute the cause of pathological process.

Regulation of reactional processes behavior is completely dependent on the catalytic process vessel, which appears in organism like enzymes (unorganized ferments) and enzyme-type substances. Enzyme-type substances are bioorganic compounds and protein structures which though do not appear like biological catalysts in regards to their primary purpose, however, are able to affect certain bonds of biochemical reactions, thus presenting the substances which regulate the rate of certain reactions (for instance, some RNA molecules pertain certain catalytic properties).

Functional activity of enzymes consists in fundamental ability thereof to reduce the total level of external energy, which is necessary to activate / labilize the substrate molecule, which allows such labilized molecules to enter into reactional process upon condition of less energy ‘excitation’, by means of what a safe behavior of ordinary natural reactions in body is actually ensured.

Activity of enzymes is fully dependent on spatial conformation thereof which is stipulated by both internal components (genetically-defined sequence of amino-acid residues in a specific protein molecule – primary and secondary structures), and external components – i.e. local impacts – specifically: by local temperature (t°), by juxta-reactional (local) concentration of hydrogen ions (pH), by concentration of reactional precursor substance (substrate), by the rate of its delivery / transportation (inward juxta-reactional medium), as well as by the rate of usage / decrease resultants concentration – stipulated by the elimination / transportation (outward), or by subsequent

consumption in the following metabolic transformations – in the conforming to an established rule sequential chains of biochemical reactions.

We would like to emphasize that enzymes being biochemical elements are to a certain extent similar to receptor structures both, by metric scale and general mechanisms (functionality). Their commensurability allows to refer them to nanoscale systems (nanosized systems), and so it means that impacts on structural objects / targets organized at such level should be referred to nano-technological processes. Proceeding from the position that all the receptors as well as enzymes present ‘dynamical’ proteins, which are able to change their spatial form /outline (conformationally labile), then impacts which cause their spatial conformation will cause the alteration of their functional activity. Conformational changes in ‘dynamical’ proteins, including (metabo- and ionotropic) receptors, enzymes, enzyme-type compounds, as well as membrane- and free carrier/transport protein, circulating in blood or functioning on the cell membranes – constitute the key to regulatory mechanisms of organism/body. Feasibility of curative effect on such structures and primarily on receptors and enzymes should be considered the systems of nano-scale impact organization level.

It should be noted that conformational changes of proteins might as well result from mediator-and-receptor reciprocal interactions, – which in fact determine compliance (loss modulus) of biological system to internal regulation (control). Classical example of such regulatory reciprocal interaction would be mediators and receptors of sympathetic and parasympathetic system, histamine-receptor structures, serotonin- and tryptophan-sensitive systems. In fact xenobiotic impact on such systems determinates the clinical aspect of traditional pharmacological treatment-and-regulatory agency. Effect of virtually all pharmaceutical substances is based on the ‘imitation’ of natural mediator, and optimality of pharmaceutical substance lies in selection of substances which in chemical structure maximally verge the natural substances, causing as few as possible irrelevant (clinically unfavorable) effects. Investigations over past few years are being carried out with the purpose of detection of chemical compounds which possess impacts/effect necessary in clinical practice of medical care. It has been particularly ascertained that pyrimidine derivants (namely: 2,4-dioxo- and 4-imino-2-oxo-3-phenil-5-R-6-R`-thieno[2,3-d]pyrimidine-1-yl`y), which due to their spatial-structural constitution are able to enter into ligand-mediatory reciprocal interaction with organism structures which present receptors to pyrimidine nucleotides. Alternatively, the thiophene derivants having sulfur atom in molecule most probably simulate the availability of disulphide bridges in complex-conformed ternary structures of proteins, which actually causes their multi-agent reaction-responses of body systems. It should be as well noted that thiophene derivants taking into account their more ‘simple’ spatial structure, in comparison with natural mediators, interact with ‘thiophene’-sensitive receptor zones – and cause substantially bigger variety of reactions-responses of organism than natural mediators which is clinically reasonable, however requires additional clinical-pharmaceutical affinitive correction in order to get the accurate clinical effect. We would like to mention that affinitive conformation of receptor zones might as well be derived with the help of physical factors which unlike chemical (pharmaceutical factors-agents) have no toxicity, but instead, they are marked by some ‘lack of impact specificity’ regarding the controlled object. Physiotherapeutic factors (at the absolute non-pharmacological option of their impact) – do not affect only a certain type of receptors (as in case of pharmacological receptor specific substance), but also all the structures which may be subject to such influence.

The clinical multivalent efficiency that was found in bi-products of pyrimidine and thiophene, indirectly proves the certainty of mediatory-ligand affinity of specified substances with common mediators of biological systems. Such affinity shall be considered perspective, as the interaction, which occurs to the receptor structures, is close to natural and does not perturb the receptor (and neither makes its “unplanned” expression necessary), however only temporarily connects with its active site, recalling natural reaction without any problems concerning further metabolism and elimination – and those are accomplished as it occurs to natural mediators.

However, it should be noticed that certain difficulty appears in distinct specification of the effect pharmacological substances have on specific types of receptors. Besides, such target effect of



pharmacological agent can be achieved with several methods namely with affinity of active site by extra physical factors, as well as with synthetic “improvement” of active pharmacological substance itself, which can be achieved by adding chemical radicals that modify clinical and biological properties of the substance, however the latter is far more problematic than physiotherapeutic affinity, as the addition of chemical radicals is always linked to the aspect of organic oriented toxicity (as well as teratogenicity, embryotoxicity, oncogenicity etc.) and other unfavorable physiological and clinic pathophysiological aspects of xenobiotic compounds.

In view of above it is possible to make substantiated conclusions, namely:

- research of nanostructural biological objects such as active sites of receptors and enzymes affinity zones is a perspective direction of further study in the area of inventing new pharmacological therapeutic agents;
- in case of considering the receptor structures as the nano-sized organizational systems they shall require a special approach when adding special therapeutic – recovery agents, and also they provide their impact through conformational changes of steric structural organization;
- usage of mediator kind compounds (namely bi-products of pyrimidine and thiophene), which possess relatedness and affinity to certain types of receptor zones, is advisable and reasonable as based on the agency of substances close to natural compounds thereby to the implementing of natural impact on receptor elements.
- for the purpose of full-rate implementation of pharmacological agents with nano-sized organization level it is advisable to use additional conformation modifying factors (which are able to modify conformational structures of receptor zones and active sites of catalytic active compounds and their analogues).
- Conformation modifying factors that impact the nano-sized organizational systems are first of all physio therapeutic effects in their intact form (not linked with direct transportation of pharmacological agents : electrophoresis, phonophoresis, inhalation therapy apparatus) able to modify the conformational structure of receptor elements, active sites of protein structures and affinity zones of catalytically active compounds.