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GEORGIA

1. Annals of Agrarian Science. – 2020. – vol. 18. – #1; – 2021. – vol. 19. – #3.
2. Bulletin of the Georgian National Academy of Sciences. – 2021. – vol. 15. – #1, #2, #3.
3. Ceramics and Advanced Technologies. – 2020. – vol. 22. – #2(44).
4. Collection of Scientific Works of Tbilisi State Medical University (TSMU). – 2020. – vol. 54.
5. Georgian Medical News (GMN). – 2021. – #2(311), #3(312).
6. 6th International Conference – Nanotechnology. Book of Abstracts. – Tbilisi. – 4-7 October. – 2021. – pp. 116.

ARMENIA

1. Armenian Journal of Physics. – 2021. – vol. 14. – #1, #3.
2. Proceedings of NAS RA. Physics. – 2020. – vol. 55. – #4; – 2021. – vol. 56. – #1, #2, #3.

AZERBAIJAN

1. Azerbaijan Chemical Journals. – 2020. –#4; – 2021. – #1, #2, #3.

1. NANOPHYSICS

1.2. Properties of Materials and Structures

3.1.2.1. The effect of high-amplitude deformation and high-frequency magnetic field exposure on the elastic/inelastic properties of PTFE-based hybrid nanocomposite filled with Fe cluster-doped CNTs. /E. Kutelia, G. Darsavelidze, T. Dzigrashvili, D. Gventsadze, I. Kurashvili, O. Tsurtsumia, L. Gventsadze, L. Nadaraia, L. Rukhadze, T. Kukava, S. Bakhtiyarov/. Bulletin of the Georgian National Academy of Sciences. – 2021. – v. 15. – #1. – pp. 38-44. – eng.; abs.: eng., geo.

The influence of high-amplitude torsional deformation ($\varepsilon \sim 10^{-1} \div 10^{-2}$) and high-frequency (2.4 GHz) magnetic field treatment on elastic/inelastic properties of PTFE-based new hybrid nanocomposites modified with a two-component filler (2.5 wt% Fe-cluster-doped CNT nanopowder + 5wt% chalcopyrite micropowder) was studied using low-frequency amplitude-independent (AIIF) and amplitude-dependent (ADIF) internal friction measurements. The behavior of elastic/inelastic properties of the new trial PTFE-based hybrid nanocomposite modified by a two-component filler (Fe-cluster-doped CNTs + chalcopyrite micro-particles) was investigated in dependence on highamplitude torsional deformation ($\varepsilon \sim 10^{-1} \div 10^{-2}$) and post-deformation high-frequency (2.4 GHz) magnetic field exposure and additional thermal treatment, using AIIF and ADIF measurements. It is shown that self-healing of micro/nano-cracks nucleated in the deformed samples of the nanocomposite may be properly performed via their exposure to high-frequency magnetic field and the additional annealing at 200˚C that leads to the recovery of the values of microplastic deformation beginning critical amplitude (ε_c) to the values even exceeding its initial magnitude by ~38%. Fig. 3, Tab. 2, Ref. 10.

Keywords: PTFE, hybrid nanocomposite, Fe-cluster-doped CNTs, chalcopyrite, magnetic field, internal friction

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3. Jiaxin Ye., David L. Burris and Ting Xie (2016). A review of transfer film and their role in ultra-low-wear sliding of polymers. Lubricants 4(4): 1-15.
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7. Kutelia E., Darsavelidze G., Dzigrashvili T., Kukava T., Rukhadze L., Gventsadze L., Tsurtsumia O., Nadaraia L., Kurashvili I., Bakhtiyarov S. (2018). Internal Friction in PTFE-based nanocomposite materials filled with Fe cluster-doped CNTs. Georgian Engineering News. 87 (3): 5-13.
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3.1.2.2. Nonmonotonic carrier dispersion in dimensionally quantized nanostructures with broken symmetries. /H.S. Nikoghosyan, S.L. Harutyunyan, V.F. Manukyan, G.H. Nikoghosyan/. Proceedings of NAS RA. Physics. – 2020. – vol. 55. – #4. – pp. 537-549. – rus.; abs.: rus., arm., eng.

The features of the energy spectrum and carrier motion in one-dimensional asymmetric semiconductor nanosystems are considered. Asymmetric structures with an additional dip in the potential profile in quantum wells make it possible to vary the positions of size-quantized levels. And the additional influence of an external magnetic field leads to non-monotonic dispersion and a transverse local carrier drift. Such violations of fundamental symmetries will entail corresponding changes in the nature of electronic transitions. The dynamic properties of the electronic system of the nanostructure with the asymmetry of the quantum profile are analyzed, depending on the strength of the external magnetic field. Fig. 4, Ref. 12.

Keywords: energy spectrum, one-dimensinal assymetric semiconductor nanosystems, fundamental simmetries, quantum profile, external magnetic field

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3.1.2.3. Physical adsorption of single-stranded DNA on carbon nanotube. /D.G. Khechoyan, V.F. Morozov/. Proceedings of NAS RA. Physics. – 2021. – vol. 56. – #1. – pp. 100-105. – rus.; abs.: rus., arm., eng.

The results of simulation modeling of single-stranded DNA adsorption on the surface of a single-walled carbon nanotube performed by the molecular dynamics method using the GROMACS software package are presented. The dependence of the timescale and degree of DNA adsorption was studied in dependence on the chirality of the carbon nanotube and the DNA sequence. Fig. 4, Ref. 16.

Keywords: simulation, single-stranded DNA, single-walled carbon nanotube, GROMACS software package, DNA adsorption

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3.1.2.4. Geometric features and numerical analysis of InAsSbP composition micro- and nano-structures shape transformation at nucleation from liquid phase. /K.M. Gambaryan, V.M. Aroutiounian/. Proceedings of NAS RA. Physics. – 2021. – vol. 56. – #2. – pp. 208-217. – rus.; abs.: rus., eng.

Results of the characterization and numerical analysis of InAsSbP composition strain-induced micro- and nanostructures shape transition are presented. Nucleation is performed from In–As–Sb–P quaternary composition liquid phase in Stranski–Krastanow growth mode. Geometric features and the shape transformation chronology of truncated pyramidal islands, lens-shape and pyramidal quantum dots (QDs) are under consideration, which opens up new possibilities at nanoscale engineering and nanoarchitecture of several types of nanostructures. High-resolution scanning electron (HR-SEM) and transmission electron (TEM) microscopes are used for micro- and nanostructures characterization. We show that as the islands volume decreases, the following succession of shape transitions are detected: truncated pyramid, {111} facetted pyramid, {111} and partially {105} facetted pyramid, completely unfacetted “prepyramid”, which gradually evolve to hemisphere and then again to pyramidal QD but with higher facet indexes. Critical sizes of islands shape transformation from “pre-pyramid” to hemisphere (500–550 nm) and then from lens-shape again to pyramidal QDs (5–7 nm) are experimentally detected and theoretically evaluated. It is shown that theoretically calculated values coincide with experimentally obtained data. Fig. 2, Tab. 1, Ref. 21.

Keywords: numerical analysis, InAsSbP, Stranski–Krastanow growth mode, pyramidal quantum dots (QDs), truncated pyramid, facetted pyramid, pyramidal QDs

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3.1.2.5. Monovalent and diavalent impurity states in a semiconductor nanoplatelets. /V.A. Harutyunyan, H.A. Sarkisyan/. Proceedings of NAS RA. Physics. – 2021. – vol. 56. – #3. – pp. 348-355. – rus.; abs.: rus., arm., eng.

Within the framework of the variational method, hydrogen-like impurity states in the semiconductor nanoplatelets with the shape of a rectangular parallelepiped of a small thickness are investigated. Due to the small thickness of the nanostructure, it is shown that, the impurity can be considered two-dimensional. In the case of a divalent impurity, the electron-electron interaction is also considered two-dimensional and taken into account as a perturbation. By the analogy with the theory of the helium atom, the electron-electron interaction energy is determined for the para-state. Fig. 4, Ref. 16.

Keywords: variational method, semiconductor nanoplatelets, nanostructure, divalent impurity, helium atom, electron-electron interaction

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3.1.2.6. Electrical characteristics and photoresponse of the "carbon nanofilm on silicon" heterostructure. /G. A. Dabaghyan, L.M. Matevosyan, K.E. Avjyan/. Proceedings of NAS RA. Physics. – 2021. – vol. 56. – #3. – pp. 374-383. – rus.; abs.: rus., eng.

The electrical characteristics and photoresponse of the “carbon nanofilm on silicon” heterostructure obtained by pulsed-laser deposition, where the thickness of the carbon nanofilm is selected from the condition of the maximum antireflection effect of the substrate, have been investigated. It was found that the obtained heterostructure is rectifying with a rectifying coefficient of 35 at 1 V. The direct current-voltage characteristic from 0.1 V to 0.35 V is in satisfactory agreement with the expression $J = J_0 \exp(eU/\eta kT)$. An increase in the voltage in the forward direction leads to the appearance of the space charge-limited currents ($J = AU^2$). Linearization of the C^{-2} - U dependence indicates the sharpness of the impurity distribution in the space charge region. The mechanism of the photoresponse of the

heterostructure is similar to the photoresponse of anisotype heterostructures with the "window" effect. The longwavelength edge (1.1 μm) of the photosensitivity is determined by the silicon substrate, and absorption in the carbon nanofilm leads to an additional expansion of the photosensitivity region. The heterostructure has uniform photosensitivity at the level 0.8 of a relative photoresponse in the wavelength range of 0.55–1.1 μm. The short-wavelength tail reaches up to 0.4 μm. Fig. 8. Ref. 17.

Keywords: "carbon nanofilm on silicon" heterostructure, maximum antireflection effect of the substrate, space charge-limited currents, short-wavelength tail

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3.1.2.7. Investigation of properties of graphene quantum dots and carbon nanotubes synthesized in a colloid solution. /N.B. Margaryan, N.E. Kokanyan, E.P. Kokanyan/. Proceedings of NAS RA. Physics. – 2021. – vol. 56. – #3. – pp. 392-398. – rus.; abs.: rus., eng.

In this paper, a simple and effective method for the synthesis of carbon nanotubes, graphene-based quantum dots is described. The topological properties of these nanostructures are studied by atomic force and scanning electron microscopes. The potential of quantum dots is investigated by the Kelvin probe method. To study the formed bonds and for a detailed structural analysis, Raman spectroscopy is performed. Other self-organized structures based on graphene are also disclosed using Raman spectroscopy. The effect of photon-phonon scattering on the Raman scattering spectrum is discussed. Fig. 4, Ref. 26.

Keywords: synthesis of carbon nanotubes, graphene-based quantum dots, Kelvin probe method, Raman spectroscopy, photon-phonon scattering

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3.1.2.8. Physicomechanical properties of nanocomposites based on copolymers of ethylene with α-olefins and clinoptilolite. /N.T. Kakhramanov, I.V. Bayramova, V.S. Osipchik, A.D. Ismayilzade, S.R. Abdalova, I.A. Ismayilov, U.V. Namazli/. Azerbaijan Chemical Journal. – 2020. – #4. – pp. 22-27. – eng.; abs.: eng., az., rus.
DOI: https://doi.org/10.32737/0005-2531-2020-4-22-27
The results of studying the effect of clinoptilolite concentration on the properties of nanocomposites based on of ethylene with butylene and of ethylene with hexene copolymer are presented. The effect of clinoptilolite particle size on ultimate tensile stress, elongation at break, flexural modulus, heat resistance, and melt flow index of composites was studied. It is shown that nanocomposites based on ethylene copolymers are characterized by higher values of physicomechanical properties. The additional use of ingredients such as alizarin and calcium stearate contributes to a significant improvement in the complex of properties of nanocomposites based on ethylene copolymers and clinoptilolite. Tab. 3, Ref. 12.

Keywords: ultimate tensile stress, elongation at break, heat resistance, flexural modulus, composite, copolymer

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3.1.2.9. Copper-containing nanocomposites on the basis of isotactic polypropylene and butadiene-nitrile rubber. /T.M. Gulieva/. Azerbaijan Chemical Journal. – 2021. – #3. – pp. 38-42. – eng.; abs.: eng., az., rus.
DOI: https://doi.org/10.32737/0005-2531-2021-3-38-43
The influence of additives of nanofillers containing nanoparticles of copper oxides stabilized by a polymer matrix of maleinized high-pressure polyethylene obtained by the mechano-chemical method on the structure and properties features of metal-containing nanocomposites based on isotactic polypropylene and butadienenitrile rubber by X-ray phase and differential thermal analyses is studied. The improvement of strength, deformation and rheological parameters, as well as thermal-oxidative stability of the obtained nanocomposites was revealed, that is probably due to the synergistic effect of interaction of copper-containing nanoparticles with maleic groups of maleinated high-pressure polyethylene. It is shown that nanocomposites based on isotactic polypropylene and butadiene-nitrile rubber can be processed both by pressing method and by injection molding and extrusion methods. The prospects of using a nanofiller containing NPs of copper oxide stabilized by a high-pressure polyethylene matrix obtained by the mechanochemical method as an additive to TPE based on PP/BNR is shown to contribute to the creation of a fine-crystalline structure of the composition, and therefore its properties are improved and thereby expand scope of the obtained nanocomposite. Fig. 4, Tab. 1, Ref. 18.

Keywords: isotactic polypropylene, butadiene-nitrile rubber, metal-containing nanocomposites, copper oxide nanoparticles, maleinized high-pressure polyethylene, thermal properties, XRD, SEM analyses

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3.1.2.10. Copper-containing nanocomposites based on isotactic polypropylene and high pressure polyethylene. /S.K. Ragimova/. Azerbaijan Chemical Journal. – 2021. – #3. – pp. 49-53. – eng.; abs.: eng., az., rus.
DOI: https://doi.org/10.32737/0005-2531-2021-3-49-53
The effect of nanofilles additives containing copper oxide nanoparticles stabilized by a polymer matrix of high-pressure polyethylene obtained by the mechanochemical method on features of the structure and properties of metal-containing nanocomposites based on isotactic polypropylene and high-pressure polyethylene was studied using differential thermal (DTA) and X-ray phase (XRD) analyzes. The improvement of strength, deformation and rheological parameters, as well as thermal-oxidative stability of the obtained nanocomposites was revealed, that apparently, is associated with the synergistic effect of

interfacial interaction of copper-containing nanoparticles in the PE matrix with the components of the PP/PE polymer composition. Fig. 2, Tab. 2, Ref. 19.

Keywords: isotactic polypropylene, high pressure polyethylene, copper oxide nanoparticles, thermal properties, DTA and XRD analysis

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2. NANOCHEMISTRY

2.1. Inorganic Materials

3.2.1.1. Microwave synthesis of ZnO/Ag nanocomposite. /A.A. Sargsyan, V.V. Baghramyan, N.B. Knyazyan, R.K. Hovsepyan, N.R. Aghamalyan, G.R. Badalyan/. Proceedings of NAS RA. Physics. – 2020. – vol. 55. – #4. – pp. 559-565. – rus.; abs.: rus., arm., eng.

A microwave (MW) method has been developed for the production of ZnO/Ag nanocomposites using chemical precipitation and decomposition of thermally unstable compounds. Chemical co-precipitation is a simple and effective method compared to other methods for producing ZnO/Ag nanocomposites. The characteristics of the synthesized product were determined by differential thermal analysis (DTA), X-ray phase analysis (XRD) and scanning electron microscopy (SEM). The studies show the effectiveness of MW processing for the preparation of ZnO/Ag nanocomposites. Fig. 4, Ref. 15.

Keywords: microwave (MW) method, ZnO/Ag nanocomposites, chemical precipitation and decomposition, differential thermal analysis (DTA), X-ray phase analysis (XRD), scanning electron microscopy (SEM)

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2.2. Organic Materials

3.2.2.1. Photochemical degradation of phenol with the participation of TiO_2 nanoparticles and ethyl-3,3,5,5-tetraciano-2-hydroxide-2-metil-4,6-diphenyl cyclohexane carboxylate. /E.M. Gadirova/. Azerbaijan Chemical Journal. – 2021. – #2. – pp. 101-105. – eng.; abs.: eng., az., rus.

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The photochemical decomposition of phenol with the participation of TiO_2 nano-particles and ethyl3,3,5,5-tetraciano-2-hydroxide-2-metil-4,6-diphenyl cyclohexane carboxylate by UV spectroscopy was studied for the first time. It has been shown, that UV irradiation of this mixture during 1 hour brings to 52% decomposition of phenol. Fig. 5, Ref. 12.

Keywords: UV decomposition, photocatalysis, ethyl-3,3,5,5-tetraciano-2-hydroxide-2-metil-4,6-diphenyl cyclohexane carboxylate, phenol, waste water solution

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4. NANOTECHNOLOGY

4.1. Materials and Structures

3.4.1.1. Research of the possibility of nanostructuring functional materials by pre-recrystallization heat treatment. /O. Dubovyy, A. Karpechenko, T. Makryha, M. Bobrov, A. Labartkava, A. Labartkava/. Bulletin of the Georgian National Academy of Sciences. – 2021. – v. 15. – #1. – pp. 45-51. – eng.; abs.: eng., geo.

The paper is devoted to the research of the possibility of nanostructuring of functional materials, steels and ceramic sprayed coatings by pre-recrystallization heat treatment. The effect of the size of coherent X-ray scattering regions, the number of nanostructured elements and the subgrains misorientation angle on the physical and mechanical properties of technically pure iron and steel were experimentally studied. The possibility of thermal stabilization of a 62% polygonization nanoscale substructure during pre-recrystallization heat treatment at 500°C after combined plastic deformation is shown. A combination of 30% dynamic and 30% static deformations makes it possible to use such treatment in industry. Fig. 2, Tab. 3, Ref. 16.

Keywords: physical and mechanical properties, thermal sprayed coatings, deformation of steels, pre-recrystallization heat treatment

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3.4.1.2. 6th International Conference - Nanotechnology. Book of Abstracts. – Tbilisi. – 4-7 October. – 2021. – pp. 116.

Book of Abstracts contains more than 100 abstracts of papers submitted to the 6th International Conference “Nanotechnology”, 4–7 October 2021, Tbilisi, Georgia (GTUnano2021) organized by the Georgian Technical University (GTU). The GTUnano2021 is held in memory of Prof. Alex Gerasimov, the initiator of GTU’s regular series of nanoconferences in Georgia. The 6th conference participants represent universities, institutes, research centers, etc. leading in the field of nanotechnology and nanosciences from 20 countries (Armenia, Azerbaijan, Belarus, China, Czech Republic, Georgia, Germany, Hungary, India, Iraq, Japan, Kazakhstan, Mexico, Poland, Russia, Serbia, Spain, Turkey, Ukraine, and United States of America). Fig. 43. Tab. 3, Ref. 197.

Keywords: 6th International Conference “Nanotechnology”, abstracts of papers, GTU, nanotechnology and nanosciences, conference participants

4.2. Obtaining Technologies

3.4.2.1. Receipt and technology of aloe floating tablets. /M. Bakuradze, L. Bakuridze, E. Mosidze, D. Berashvili, I. Tsurtsumia/. Collection of Scientific Works of TSMU. – 2020. – v. 54. – pp. 29-31. – geo.; abs.: geo., eng.

In regenerative medicine, plants may be used as an alternative transplantation source. There is plenty of structural similarity between the vegetative and animal tissues and similarly to the human blood vessels, the plant fibers may be used as nutrient carriers. In tissue engineering, a decellularized plant may become a unique, multifunctional medical device, a plant matrix, the so-called scaffold. The performed studies resulted in the optimal composition of plant decellularization agents. It was determined that the duration of the process significantly depends on the morphological, anatomic and histological peculiarities of the plant. The biopharmaceutical studies proved that the absorption method is the most appropriate for plant decellularization for it shortens the process and is easier to perform than the perfusion. Employment of the 0.1% methylene blue made it evident that the decellularization technology does not affect the integrity and conductivity of the matrix fibers. On the grounds of the biopharmaceutical studies, we provided the plant matrix made up of the silver bionanoparticles. The properties of the silver bionanoparticles in the matrix were studied by the transmission electron microscope. The size of silver bionanoparticles is 1000 nm. and those are distributed across the matrix. We studied the silver separation dynamics from the nanodesigned plant matrix and determined that 70% of silver was separated after 12h exposition of the matrix. Tab. 1, Fig. 4, Ref. 5.

Keywords: regenerative medicine, alternative transplantation source, decellularization agents, plant matrix, silver, bionanoparticles, aloe tablets, morphological, anatomic and histological peculiarities

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3.4.2.2. Microwave synthesis, characterization and testing of acute toxicity of boron nitride nanoparticles by monitoring of behavioral and physiological parameters. /A. Chirakadze, N. Mitagvaria, D. Jishiashvili, G. Petriashvili, N. Dvali, Z. Shiolashvili, K. Chubinidze, N. Makhatadze, A. Jishiashvili, Z. Buachidze, I. Khomeriki/. Bulletin of the Georgian National Academy of Sciences. - 2021. – v. 15. – #2. – pp. 120-126. – eng.; abs.: eng., geo.

Hexagonal boron nitride nanoparticles, nanosheets and nanotubes (BNNPs) are even more promising materials for biomedical application than carbon nanotubes (CNTs) and nanoparticles (CNPs) due to their negligible cytotoxicity. The reported research yielded in development and testing of two distinctive microwaves enhanced comparatively low-temperature methods of synthesis of the hexagonal boron nitride nanoparticles and nanosheets with reduced distortion of the crystal lattice, and an improved method of general toxicity testing of the developed nanomaterials utilizing continuous observation of behavioral effects in white rats in combination with blood oxygen saturation, systolic blood pressure and body temperature measurements in full agreement with the 4R principles of animal welfare in scientific research. The obtained results allow us to expect that the developed materials can be a good basis for developing highly effective modalities for anticancer (in combination with chemotherapy, hyperthermia and radiotherapy) and antiviral (in combination with chemotherapy and hyperthermia) treatment. Fig. 2, Ref. 14.

Keywords: cancer, low-temperature synthesis, microwave radiation, boron nitride, nanoparticles, turbostratic effect, behavioral testing

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preliminary toxic characteristics of silver doped lanthanum manganite nanoparticles using conventional and microwave heating. Proceedinga of MTP: Modern Trends in Physics. 47-51, Baku.
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3.4.2.3. Obtaining of β-SiAlON nanocomposite with alumothermal and nitrogen processes. /Z. Kovziridze, N. Darakhvelidze, N. Nijaradze, G. Tabatadze, M. Mshvildadze, Z. Mestvirishvili, M. Balakhashvili, V. Kinkladze/. Ceramics and Advanced Technologies. – 2020. – vol. 22. – #2(44). pp. 21-36. – geo..; abs.: geo., eng.

To obtain a composite in SiAlON-Al_2O_3 system and to study its properties. Obtaining the composite by metallothermic and nitrogenation methods. In the present work, the composite containing SiALON is obtained through alum-thermal process, by the reactive sintering method in nitrogen medium, from the mixture of aluminosilicate raw material (Prosyanaya kaolin and Polog refractory clay - Ukraine), nanopowder of aluminum oxide (German company “ALCOA”), and metallic silicium with small additives of glass perlite Aragac (Armenia). The advantage of this method is that the aluminosilicate raw material decomposes during the heat treatment process and the alum-thermal-nitration process takes place at the same time, making it easier to open AlN and AL_2O_3 in the newly formed β-$S_{i3}N_4$ crystal lattice, which provides β-SiALON generation at a relatively low temperature, 1250-13000^{o}C. Corundum-SiALON composite material is obtained by reactive sintering process at a temperature of 14500C.The corundum and sialon phases in the composite are confirmed by X-ray phase, spectral and electronmicroscopic analyzes. To obtain consolidated samples, the material obtained by reactive sintering was grounded in the attritor and hot pressed at 30 MPa and 1620^0 C and was kept at the final temperature - 7 min. The phase composition of the obtained samples remained unchanged after hot pressing, the density increased and the porosity dropped below 1%, accordingly the numerical values of the mechanical properties were increased: $\sigma_{press.}$ - 1600 MPa; σbend. - 460 MPa; HV - 19.7 GPa. Obtained corundum-SiALON composite with its physical-technical properties: porosity – 0-1%; density - 3.21 g/cm3; σpress. - 1923 MPa; σbend. - 470

MPa; HV - 19.7 GPa, elasticity modulus - 22 GPa; dynamic hardness - 3214 N/mm2; chemical stability to sulfuric acid (density - 1.84 g/cm3) - 99.3%, to water - 99.8%.The obtained materials may be recommended in armor engineering, when measuring temperature in metals molten as protective coatings for the thermocouple, as well as in high-temperature furnace linings, as well as in clean processing operations as a metalworking cutting material. Fig. 5, Tab. 6, Ref. 29.

Keywords: β-SiAlON, corundum, reactive sintering, composite, properties, metalworking cutting material

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3.4.2.4. Synthesis, characteristic and activity of nanosized Cu–Me (Me–Co, Zn, Ni) oxide systems in co oxidation in the presence of H_2. /S.T. Jafarova/. Azerbaijan Chemical Journal. – 2021. – #1. – pp. 48-54. – eng.; abs.: eng., az., rus.
DOI: https://doi.org/10.32737/0005-2531-2021-1-48-54
Nanooxides of Cu–Me composition (Me–Co, Zn, Ni) were synthesized by hydrothermal reduction of metal salts with subsequent calcination and the influence of their properties (size, morphology, structure) on catalytic activity of deep CO oxidation reaction in the presence of H_2 was considered. The nanooxides have been characterized by XRD and SEM methods. It was revealed that particles of Cu–Co–O are nanoplates (30–35 nm), and Cu–Zn–O (12.5–20 nm) are nanorods. The SEM method revealed a higher structural organization of the Cu–Co–O particles than Cu–Zn–O; the growth of nanocrystals is shown by varying the magnification of the scale grid of images. The highest activity of the Cu–Co–O system was found among the mentioned and corresponding individual oxides. The effect of metal (Cu/Co) ratio on the dispersibility and morphology of nanoparticles and their activity has been studied. The non-additive increase in activity is explained by the redox properties of cobalt oxides and the contribution of copper to electronic state of this element. The variation of composition, as well as high dispersibility (30–35 nm) make it possible to reduce the temperature of oxidation beginning (T50%) of CO to less than 115^0 C. Fig. 7, Ref. 17.

Keywords: nanooxides, nanoplates, nanorods, modification, morphology, structure, CO oxidation, electron microscopy

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The newest achievement in the synthesis of cobalt oxide nanoparticles are considered. Cobalt oxide nanoparticles have attracted a great attention due to their uncommon properties and application in a supercapacitor, optoelectronic device, Li-ion battery gas sensor and electrochromic devices. Recently, nanostructured transition metal oxides with valuable properties have become a new class of materials for many technological fields. Cobalt oxide nanoparticles obtained from various precursors show different size distribution as well as different optical, electrical, magnetic, and electrochemical properties. A reduction in particle size to nanometer-scale leads to changes in properties compared to bulk ones due to quantum size effects. Depending on the application area, the choice of an appropriate synthesis method for nanoparticles with desirable properties is a crucial factor. This work aims to provide additional information on the synthesis methods and properties of cobalt oxide nanoparticles. Fig. 4, Tab. 1, Ref. 96.

Keywords: cobalt oxide, crystallite size, supercapacitor, synthesis method

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4.3. Processing Technologies

3.4.3.1. Anionic zeolite nanomaterial – environmentally safe complex fertilizer with prolonged action. /G. Tsintskaladze, T. Sharashenidze, M. Zautashvili, M. Burdjanadze, G. Antia, N. Mumladze/. Bulletin of the Georgian National Academy of Sciences. – 2021. – v. 15. – #3. – pp. 59-64. – eng.; abs.: eng., geo.

The development and implementation of effective and cost-effective environmental technologies is one of the priority problems in Georgia for the rehabilitation of soil fertility and natural vegetation cover. The paper proposes a new method for nanomodification of natural zeolite - clinoptilolite, based on the introduction of the appropriate salt into the structure of the zeolite so that the resulting material does not lose its zeolite structure and acquires both cation-exchange and anionexchange properties. Some amount of ammonium dihydrogen phosphate ($NH_4H_2PO_4$), potassium nitrate (KNO_3) and cations mixed with them (Fe, Ca, Mn, Zn, Mg, Cu, Mo, Co, Sn) were introduced by fusion method into the clinoptilolite structure. Only the amount of ammonium dihydrogen phosphate changed, while the amount of potassium nitrate (KNO_3) and cations remained unchanged. Accordingly, zeolite nanomaterials of various composition, structure and properties were obtained, which were studied by the methods of chemical, IR spectroscopic and X-ray diffractometric analyses. The obtained zeolite nanomaterials as fertilizers of complex composition and long-term action were used to study their effect on wheat productivity both in the open field and in laboratory conditions. Zeolite nanomaterials of three different compositions were studied. Tab. 3, Ref. 14.

Keywords: natural zeolite, zeolite-anionic form, nanomodified, I.R. spectroscopic, agriculture

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4.4. Nanobiotechnology

3.4.4.1. Growing technology for soybeans with nanoherbicides. /A. Korakhashvili, T. Kacharava, L. Korakhashvili/. Annals of Agrarian Science. – 2021. – v. 19. - #3. – pp. 199-203. – eng.; abs.: eng.

Modern herbicide market in agriculture is about 2 billion tons and about 73 billion dollars industry with sophisticated multi-impact problems with food safety and human health, with increasing of weed resistance with every passing year at the topmost. Nanoherbicides under development in the current decade of our century could be a new strategy to address all the issues caused by the con-ventional non-nanoherbicides. From the beginning of 21 century group of Georgian scientists with farmers associations have begun development nanoherbicides (experimental name “Nanocooper 076”, which is under registration) in soybean experimental pilot plots and farmer’s fields, which will allow farmers to clear

their soybean plantings from weeds without using toxic chemicals, like Glyphosate. As the potential use of nanostructured nanomaterials enables the use of nanoherbicides effectively and rules out the emergence of various weed-resistant population at an early stage of growing agricultural crops (first weeks after sowing), these very desirable nano technological methods and practices in general agriculture are reviewed by this article. Fig. 2, Tab. 1, Ref. 18.

Keywords: soya seed pilling, Nanocooper 076, soil contamination, friendly nanotechnologies, nanoherbicides, agriculture

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5. NANOENGINEERING

5.1. Devices and Sensors

3.5.1.1. Single wall carbon nanotube gas sensors. /V.M. Aroutiounian/. Armenian Journal of Physics. – 2021. – vol. 14. – #1. – pp. 74-84. – eng.; abs.: eng.
DOI: https://doi.org/10.52853/18291171-2021.14.1-74V
Excellent physical properties of carbon nanotubes (CNTs) are used for manufacturing of many electronic devices. Single wall version of CNTs is promising for detection many important gases including gases exhaled by the organism. The most promising is the realization of gas sensors based on metal oxides doped with CNTs. Application of CNT-based sensors to breathe analysis, properties of the SWCNTs gas sensors with metal nanoparticles and metal oxides and CNTs biosensors are reviewed in this paper. Fig. 1. Tab. 2, Ref. 83.

Keywords: carbon nanotubes CNTs, electronic devices, gas sensors, CNT-based sensors, biosensors

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6. NANOMEDICINE

6.1. Medical Physics

3.6.1.1. Development and testing of nanoparticles for treatment of cancer cells by Curie temperature controlled magnetic hyperthermia. /A. Chirakadze, N. Mitagvaria, D. Jishiashvili, M. Devdariani, G. Petriashvili, L. Davlianidze, N. Dvali, K. Chubinidze, A. Jishiashvili, Z. Buachidze, I. Khomeriki/. Bulletin of the Georgian National Academy of Sciences. – 2021. – v. 15. – #1. – pp. 91-98. – eng.; abs.: eng., geo.

A vast amount of nanoparticles has been developed and proposed for the local hyperthermia of cancer during the last decades, but only a few of them correspond to the mandatory requirements of having therapeutic range Curie temperature (T_C = 41-45^{0}C), high-rate crystallinity and "strong" magnetic properties, strictly controlled homogeneity and dispersion of the nanoparticles, good biocompatibility and harmless decomposition products. Among them are the nickel-copper (Ni-Cu) and silver doped lanthanum manganite ($Ag_xLa_{1-x}MnO_3$) nanoparticles. The developed research showed that the materials obtained at lower than usual temperatures using microwave enhanced synthesizes and annealing can be successfully used for local hyperthermia revealing high magnetic properties. Behavioral toxicity testing of the developed nanoparticles was enhanced by blood oxygen saturation measurements using noninvasive oximetry in white rats. Both of the developed nanomaterials revealed a lower toxicity level than the commercially available Fe_2O_3 nanoparticles. Fig. 4, Ref. 14.

Keywords: Cancer, magnetic hyperthermia, behavioral tests, toxicity, nanoparticles, synthesis, magnetic properties, microwave, blood oxygen saturation

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DOI: https://doi.org/10.52853/18291171-2021.14.3-148
In brief is summarized information about artificially intelligent nanoarray for detection of various diseases in nanomedicine. Ref. 20.

Keywords: artificially intelligent nanoarray, detection of various diseases, nanomedicine

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6.2. Medical Chemistry

3.6.2.1. Pseudoprotein-based nanoparticles show promise as carriers for ophthalmic drug delivery. /Tem. Kantaria, Ten. Kantaria, S. Kobauri, W. Zhang, N. Eter, P. Heiduschka, A. Kezeli, G. Chichua, D. Tugushi, R. Katsarava/. Annals of Agrarian Science. – 2020. – v. 18. – #1. – pp. 43-53. – eng.; abs.: eng.

Drug delivery used to treat ocular disease still poses a challenge to modern ophthalmology. Well-established intravitreal injections imply discomfort to the patients and risk of ocular complications. Therefore, opportunities to deliver drugs by topical administration are investigated thoroughly. Despite its seemingly easy accessibility, the eye is well protected by efficient mechanisms that rapidly remove drugs after instillation on the eye surface. Hence, eye drops are less effective for the treatment of various diseases, which necessitates a risk-containing procedure of intravitreal injection. One of the rational ways to overcome the problem is the application of drug-loaded polymeric nanoparticles (NPs) that are able to penetrate through ocular barriers when administered topically. Pseudo-proteins (PPs) - amino acid-based biodegradable polymers are one of the most suitable materials for the design of drug delivering NPs. One of the most important features of such kind of nanovehicles is “disappearance” from the body after their function is fulfilled. We have prepared biodegradable NPs of various types by nanoprecipitation of the PEA-class of PP composed of L-leucine, 1,6-hexanediol and sebacic acid (8L6). The originally designed arginine-based cationic PEA and comb-like PEA containing lateral PEG-2000 chains along with 8L6 anchoring fragments in the backbones were used to construct positively charged and PEGylated NPs. The NPs were loaded with fluorescein diacetate (FDA) as a fluorescent probe to detect if the NP penetrated through the ocular barriers. A preliminary in vivo study on intraocular infiltration of the NPs has been done using wild-type C57BL/6 mice. After penetrating into the cellular lysosomes, FDA probes became visible due to the hydrolysis of the diacetate groups, thus allowing for the detection of the NPs as tiny fluorescent spots inside the tissues. One day after administration, fluorescent dots were found at various sites - always in the peripheral cornea and the sclera, and in different layers of the outer retina depending on the type of NPs used. Four days after administration, fluorescent dots were still visible in the peripheral cornea and the sclera with some of the NPs. These results show that the new type of NPs infiltrate the ocular tissues after topical administration and are taken up by the cells. This raises hope that the NPs may be useful carriers for ocular delivery of therapeutic agents. Fig. 4, Tab. 3, Ref. 35.

Keywords: biodegradable polymers, pseudo-proteins, nanoparticles, biodegradable surfactant, PEGylation, ocular penetration

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3.6.2.2. Biopharmaceutical understanding of formulation preparation variability of PLGA nanoparticles loaded with erysimum extract. /L. Ebralidze, A. Tsertsvadze, L. Bakuridze, D. Berashvili, A. Bakuridze/. Georgian Medical News (GMN). – 2021. – #2(311). – pp. 173-177. – eng., abs.: eng., geo., rus.

The purpose of this study was to evaluate effect of process and formulation variables on the preparation of Erysimum extract loaded PLGA nanoparticles. The influence of the various biopharmaceutical factors such as type of organic solvent, type and concentration of surfactant, polymer concentration in the organic phase, ratio of organic phase and water phase were studied. Modified emulsification solvent evaporation method was used for preparation of nanoparticles. Based on the performed experiments optimal formulation of nanocomposite is suggested. Nanoparticle size, size distribution and entrapment efficiency were determined. Among five non-ionic surfactants polyvinyl alcohol provided more stable nanocomposite. Influence mechanisms of different surfactants on nanoparticle formation are provided. Water miscible organic solvent, acetone obtained 232 nm nanoparticles with improved size distribution. Entrapment efficiency was increased to 73% by reducing ratio of organic and water phases. Based on experiments nanoparticles with stable, reproducible properties are fabricated. Fig. 9, Tab. 4, Ref. 9.

Keywords: polymeric nanoparticle, PLGA, formulation variables, endemic plant species

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3.6.2.3. Formulation thermoresponsive nanocomposite hydrogel with embedded PLGA nanoparticles containing cytotoxic agent. /L. Ebralidze, A. Tsertsvadze, L. Bakuridze, D. Berashvili, A. Bakuridze/. Georgian Medical News (GMN). – 2021. – #3(312). – pp.133-138. – eng., abs.: eng., geo., rus.

The aim of the study was to develop and characterize the nanocomposite in-situ hydrogel as local drug delivery system of cytotoxic agent. In-situ hydrogel consisting of 15% ther- mosensitive (Poloxamer 407) and 1% mucoadhesive (sodium alginate) polymers was selected as the optimal formulation by the conducted studies. The influence of nanoparticle concentration on gelation time and temperature has been experimentally established. As a result, the optimum concentration of nanoparticles (5%) is selected, which does not alter the gel forming process. The resulting nanocomposite hydrogel was characterized through Fourier transform infrared spectroscopy (FT-IR), scanning electron microscopy (SEM), rotational viscometer (LVDV- 1T). FT-IR spectra confirmed the PLGA nanoparticles pres- ence within the hydrogel matrix through the absorption peak located at 1750 cm^{-1}. SEM images allowed observing the nanoparticles to be homogenously dispersed. The release pattern of the active substance from the nanocomposite hydrogel is following: at 72 h, 64% and 78% of the active substance were released into the phosphate buffer and cell culture area, respectively. Irritation test on hen's egg model revealed that formulated nanocomposite hydrogel did not show damage of vascular system. Fig. 10, Tab. 1, Ref. 9.

Keywords: Nanocomposite, thermosensitive hydrogel, PLGA nanoparticles

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