



MSF'2020

Materials science of the future:
research, development, scientific training

17-18 NOVEMBER, 2020, Nizhny Novgorod, Russia

SCIENTIFIC PROGRAM

2020

Organizers

Russian Professor Assembly Lobachevsky University



Center for Collective Use "New Materials and Resource-Saving Technologies"



The instrumental base development is carried out within the framework of the project Renewal and development of the Center for Collective Use "New Materials and Resource-Saving Technologies" to support the implementation of research programs of the scientific educational center activities "(project RFMEFI59420X0020)

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Presentation of reports

Language: Russian and English

Duration of oral presentation - 10 minutes (including questions), **plenary lectures** - 30 minutes.
Time for a speech provided by this program includes 2-3 minutes to answer the questions.

Conference will be held in on-line format.

To participate in the conference, you need to download and install the Zoom program on your computer. To work you need a webcam and a headset (or headphones with a microphone).

We kindly ask you to indicate your real name and surname during the Zoom registration process. We ask you to turn off the microphones during the conference, turn them on only for questions. Questions can also be asked in the chat.

A link to connect will soon be publicly available on the conference website in the "News" section.

PROGRAM OF MSF-2020



11.00-11.10

17 November 2020, Tuesday

OPENING CEREMONY

PLENARY LECTURES

11.10-11.40

Artem R. Oganov

Skolkovo Institute of Science and Technology, Moscow, Russia

Artificial intelligence methods for discovering novel materials and exotic compounds

11.45-12.15

Dmitry A. Permin

G.G. Devyatykh Institute of Chemistry of High-Purity Substances of the RAS, Nizhni Novgorod, Russia

Hot pressing and Spark plasma sintering of MgO-Y₂O₃ IR- ceramics

SECTION 1. CHEMISTRY OF MATERIALS

12.20-12.30

Alexander G. Kvashnin

Skolkovo Institute of Science and Technology, Moscow, Russia

Computational Search For Ternary High-Entropy Transition Metal Borides

12.35-12.45

Alexey A. Sibirkin

Lobachevsky University, Nizhny Novgorod, Russia

The Role of Oxidation and Reduction Processes in Preparation of Tellurite-Molybdate Glasses with Improved Optical Transparency

12.50-13.00

Anastasia M. Kusutkina

Lobachevsky University, Nizhny Novgorod, Russia

X-ray studies of d, l-aspartic and l-glutamic acids in a wide range of temperatures

13.05-13.15

Irina G. Fedotova

Lobachevsky University, Nizhny Novgorod, Russia

The Properties of Tellurite-Molybdate Glasses Containing Lanthanum Oxide

- 13.20-13.30** **Sergey S. Kryuchkov**
Nizhny Novgorod State Technical University R.E. Alekseev, Nizhny Novgorod, Russia
- Intensification of ammonia capture by membrane-assisted gas absorption technique using deep eutectic solvents as an absorbent**
- 13.35-13.45** **Vladislav M. Goryaev**
Lobachevsky University, Nizhny Novgorod, Russia
- Preparation of TeO₂ – MoO₃ – Pr₂O₃ Glasses with Improved Optical Transparency**
- 13.50-14.00** **Artem I. Bokov**
Lobachevsky University, Nizhny Novgorod, Russia
- Synthesis, structure and thermal expansion of immobilizing materials with the eulytite mineral structure**
- 14.00-14.30** **LUNCH**
- 14.30-14.40** **Alexey A. Sibirkin**
Lobachevsky University, Nizhny Novgorod, Russia
- The Evaluation of Mo⁺⁵ Content in Tellurite-Molybdate Glasses from Optical Measurements**
- 14.45-14.55** **Darina S. Malygina**
Privolzhsky Research Medical University, Nizhny Novgorod, Russia
- Zinc oxide nanoparticles modified by triterpenoids as a promising component of new drugs**
- 15.00-15.10** **Oleg V. Timofeev**
Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences, Nizhny Novgorod, Russia
- Preparation of surfaces of optical elements of CVD-zinc selenid for magneto-rheological polishing**
- 15.15-15.25** **Elizaveta A. Tyurina**
G.G. Devyatykh Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences, Nizhny Novgorod, Russia
- Stability against crystallization of Ga_xGe_{y-x}S_{100-y} glasses as potential IR optics materials**
- 15.30-15.40** **Andrey A. Umnikov**
G.G. Devyatykh Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences, Nizhny Novgorod, Russia
- Bi-doped fiber preforms fabrication technologies**

- 15.45-15.55** **Alexey A. Zolotukhin**
G. A. Razuvaev Institute of Organometallic Chemistry of RAS, Nizhny Novgorod, Russia
- 16.00-16.10** **Redox-isomeric systems – the path to new materials for electronic devices**
Alexander V. Knyazev
Lobachevsky University, Nizhny Novgorod, Russia
- 16.15-16.25** **Physico-chemical study of compounds for the pharmaceutical and food industries**
Olga V. Krasheninnikova
Lobachevsky University, Nizhny Novgorod, Russia
- 16.30-16.40** **Study of phase transitions of lead-containing phases of Aurivillius**
Evgeny N. Bulanov
Lobachevsky University, Nizhny Novgorod, Russia
- 16.30-16.40** **Towards the creation of antimicrobial biocompatible materials**
Egor V. Syrov
Lobachevsky University, Nizhny Novgorod, Russia
- 16.30-16.40** **Synthesis and Rietveld refinement of a new Dion-Jacobson compound**
RbNdNaNb₃O₁₀
- 16.45-16.55** **Vitaly Zh. Korokin**
Lobachevsky University, Nizhny Novgorod, Russia
- Obtaining of porous materials based on fish collagen**



18 November 2020, Wednesday

PLENARY LECTURES

10.00-10.30 **Вельмузов Александр Павлович**
ИХВВ РАН, Нижний Новгород, Россия

Особо чистые стекла на основе халькогенидов германия. Получение, свойства, применение

10.35-11.05 **Alexey V. Nokhrin**
Lobachevsky University, Nizhny Novgorod, Russia

Study of corrosive resistance of ultrafine-grained α - and near- α titanium alloy

SECTION 2. PHISICS OF MATERIALS

11.10-11.20 **Pavel V. Andreev**
Institute of Chemistry of High-Purity Substances RAS, Nizhny Novgorod

Sintering kinetics of Si_3N_4 with yttrium-aluminum garnet nanocomposites

11.25-11.35 **Maxim S. Boldin**
Lobachevsky University, Nizhny Novgorod, Russia

The role of plastic deformation in the shrinkage during SPS

11.40-11.50 **Pavel D. Drozhilkin**
Lobachevsky University, Nizhny Novgorod, Russia

Compaction by spark plasma sintering of $\text{Si}_3\text{N}_4 - \text{Y}_2\text{O}_3 - \text{Al}_2\text{O}_3$ powder compositions obtained by different synthesis methods

11.55-12.05 **Anatoly A. Fagin**
G. A. Razuvaev Institute of Organometallic Chemistry of Russian Academy of Sciences, Nizhny Novgorod, Russia

Reactions of iodide-nitrides $[(\text{LnI}_2)_3\text{N}]$ ($\text{Ln} = \text{Nd}, \text{Dy}$) with chalcogenes

12.10-12.20 **Yuri M. Kuznetsov**
Lobachevsky University, Nizhny Novgorod, Russia

Thermoelectric properties of SiGe structures obtained by electro-pulse plasma sintering

- 12.25-12.35** **Evgeny A. Lantsev**
Lobachevsky University, Nizhny Novgorod, Russia
- Hard alloys with ultra-low cobalt content obtained by spark plasma sintering**
- 12.40-12.50** **Mashkina E.S.**
Voronezh State University, Voronezh, Russia
- Dynamical nanostructuring of ionic crystals near the melting point**
- 13.00-13.30** **LUNCH**
- 13.30-13.40** **Mazov L.S.**
FRC "IAP RAS": Inst. for Phys. of Microstruct. RAS, Nizhny Novgorod, Russia
- Planar "Ginzburg sandwich" for possible RTSC in perovskite-like systems**
- 13.45-13.55** **Galina S. Nagicheva**
Lobachevsky University, Nizhny Novgorod, Russia
- Research the Impact of Blast Treatment on the Microstructure and Mechanical Properties of Carbon Steel**
- 14.00-14.10** **Александр Алексеевич Попов**
Национальный исследовательский Нижегородский государственный университет им. Н.И. Лобачевского, Нижний Новгород, Россия
- Сверхпластичность мелкозернистой керамики на основе оксида алюминия, полученной методом электроимпульсного плазменного спекания**
- 14.15-14.25** **Alexander A. Pynenkov**
N.P. Ogarev Mordovia State University, Saransk, Russia
- Investigation of the structure and spectral-luminescent properties of bismuth-doped barium germanate glasses and glass-ceramics**
- 14.30-14.40** **Yana S. Shadrina**
Lobachevsky University, Nizhny Novgorod, Russia
- Studying thermal stability of cast and microcrystalline alloys Al-(2.5, 4)%Mg-Sc-Zr**
- 14.45-14.55** **Ksenia E. Smetanina**
Lobachevsky University, Nizhny Novgorod, Russia
- Study of phase composition homogeneity of WC-based ceramics obtained by spark plasma sintering**

15.00-15.10

Кирилл Олегович Каразанов

Национальный исследовательский Нижегородский государственный университет им. Н.И. Лобачевского, Нижний Новгород, Россия

Физико-механические свойства керамик на основе Si₃N₄, изготовленных методом искрового плазменного спекания

15.15-15.25

Артем Александрович Мурашов

Национальный исследовательский Нижегородский государственный университет им. Н.И. Лобачевского, Нижний Новгород, Россия

Исследование структуры и состава тонких износостойких покрытий для твердосплавного режущего инструмента

15.30-15.40

Глеб Вячеславович Щербак

Национальный исследовательский Нижегородский государственный университет им. Н.И. Лобачевского, Нижний Новгород, Россия

Исследование свойств высокопрочного композита ZTA, полученного по технологии керамической 3D-печати (LCM)

Virtual participation

SECTION 1. CHEMISTRY OF MATERIALS

Kamorin D.M.^{1,2}, Sadikov A. Yu.², Sesina N.A.², Zarubina I.S.²

¹Lobachevsky University, Nizhny Novgorod, Russia

²Nizhny Novgorod State Technical University n.a. R.E. Alekseev,

1 Nizhny Novgorod, Russia

Synthesis of stimuli-responsive polymers of N,N-[(diethylamino)alkyl](meth)acrylamides by RAFT polymerization

Akimova E.S., Apryatina K.V., Smirnova L.A.

Lobachevsky University, Nizhniy Novgorod, Russia

2 **Obtaining of selenium nanoparticles stabilized with chitosan and investigation of their properties**

Amosov A.A.¹, Knyazev A.V.¹, Shipilova A.S.¹, Knyazeva S.S.¹, Ishmayana S.², Soedjanaatmadja

U.M.S.², Shushunov A.N.¹, M. Ptak³, M. Mączka³, Gusarova E.V.¹, Kortikov A.E.¹

¹Lobachevsky University, Nizhni Novgorod, Russia

3 ²Universitas Padjadjaran, Jatinangor, West Java, Indonesia

³Polish Academy of Sciences, Wrocław, Poland

Study of the physicochemical properties of hevein

Aparina L.M.¹, Kostryukov S.G.¹, Masterova Yu.Yu.¹, Kostryukov N.S.²

¹National Research Mordovia State University, Saransk, Russia

4 ²Saint-Petersburg State University of Industrial Technologies and Design, St. Petersburg, Russia

Trimer hexamethylene diisocyanate as coupling agents for composites based on wood sawdust

Balandina A.V.¹, Knyazev A.V.¹, Dolganov A.V.², Chugunov D.B.²

¹Lobachevsky University, Nizhni Novgorod, Russia

5 ²Ogarev National Research Mordovia State University, Saransk, Russia

Sorption of Fluoride Ions onto Cellulose and Aluminum Oxide Composites

Bedin V.Y.¹, Butrina O.V.¹, Asabina E.A.¹, Pet'kov V.I.¹, Stenina I.A.², Yaroslavtsev A.B.²

¹Lobachevsky University, Nizhny Novgorod, Russia

6 ²Kurnakov Institute of General and Inorganic Chemistry of RAS, Moscow, Russia

Phase formation and electrical conductivity of the phosphates $\text{Na}_{1+2x}\text{M}_x\text{Zr}_{2-x}(\text{PO}_4)_3$ (M – Zn, Mg)

Julijana Blagojević¹, Olga Govedarica¹, Mirjana Jovičić¹, Jelena Pavličević¹, Predrag Kojić¹, Oskar Bera¹, Dragan Govedarica¹

7 ¹University of Novi Sad, Faculty of Technology Novi Sad, Serbia

The influence of vegetable extender oil on crosslink density of rubber

Julijana Blagojević¹, Olga Govedarica¹, Mirjana Jovičić¹, Jelena Pavličević¹, Predrag Kojić¹, Dragan Govedarica¹

¹University of Novi Sad, Faculty of Technology Novi Sad, Serbia

8 **Application of artificial neural networks to demulsification of water-in-crude oil emulsions**

Чугунов Д.Б.¹, Баландина А.В.¹, Осипов А.К.¹

¹*Национальный исследовательский Мордовский государственный университет им. Н.П. Огарева, Саранск, Россия*

- 9 **Механические свойства икосаэдрической и декагональной квазикристаллических фаз в литых сплавах системы Al-Cu-Fe-Cr**

Esipovich A.L.¹, Kanakov E.A.¹, Charykova T.A.¹

¹*Nizhny Novgorod State Technical University n.a. R.E. Alekseev, Nizhny Novgorod, Russia*

- 10 **Fatty acid methyl esters epoxidation with hydrogen peroxide catalyzed by polyoxotungstates encapsulated in metal-organic framework**

Zaitsev S.D.¹, Zhukova O.B.², Ryabov S.A.¹, Archipova E.V.², Golovacheva A.A.¹

¹*National Research Lobachevsky State University of Nizhny Novgorod, Russia*

²*Privolzhsky Research Medical University, Russia*

- 11 **Polymeric carriers of antineoplastic medicines based on (meth)acrylic acid with its own immunostimulating activity**

Zaitsev S.D.¹, Zhukova O.V.², Ryabov S.A.¹, Archipova E.V.², Golovacheva A.A.¹, Volkova Y.S.¹

¹*National Research Lobachevsky State University of Nizhny Novgorod, Russia*

²*Privolzhsky Research Medical University, Russia*

- 12 **Water-soluble polymeric ionic 5-fluoracil complex based on methacrylic acid copolymers**

Grigoreva A. O.¹, Tarankova K. A.¹, Zaitsev S. D.¹

¹*Lobachevsky State University of Nizhny Novgorod, Nizhny Novgorod, Russia*

- 13 **RAFT copolymerization of 1,1,1,3,3,3-hexafluoroisopropyl acrylate and glycidyl methacrylate**

Grigoreva O.P., Asabina E.A., Pet'kov V.I.

Lobachevsky University, Nizhny Novgorod, Russia

- 14 **Ceramic phosphates of iron and alkali metals as potential matrices for radwaste**

Ignatova K.F., Balueva K.V., Rostokina E.E., Komshina M.E., Plekhovich A.D., Kut'in A.M.

G.G. Devyatikh Institute of Chemistry of High-Purity Substances of the RAS,

Nizhny Novgorod, Russia

- 15 **Investigation of formation processes of glass-ceramics based on bismuth-borate glass and aluminum-yttrium garnet by TG-DSC method**

Kazarina O.V.

Nizhny Novgorod State Technical University n.a. R.E. Alekseev

- 16 **Deep eutectic solvents based on hydroxyalkylammonium salts as the potential effective ammonia absorbers**

N.G. Chernorukov, O.V. Nipruk, K.A. Klinshova, O.N. Tumaeva and D.V. Sokolov

Lobachevsky State University of Nizhny Novgorod, Nizhny Novgorod, Russia

- 17 **Investigation of heterogeneous equilibria of $M^{II}U_3O_{10} \cdot 6H_2O$ (M^{II} – Ni, Co, Cu, Zn, Mn, and Cd) in aqueous solutions**

Kostryukov S.G.¹, Petrov P.S.¹, Masterova Yu.Yu.¹, Kostryukov N.S.²

¹*National Research Mordovia State University, Saransk, Russia*

²*Saint-Petersburg State University of Industrial Technologies and Design, St. Petersburg, Russia*

- 18 **On the application of using CP MAS ^{13}C NMR spectroscopy to the analysis wood**

- Krasnov D.A.¹, Kostryukov S.G.¹, Masterova Yu.Yu.¹, Kostryukov N.S.²
¹National Research Mordovia State University, Saransk, Russia
19 **Redox-active polymer composite based on verdazyl radical, highly dispersed carbon and polyurethane matrix**
- Kryuchkov S.S., Shablykin D.S., Petukhova A.N., Stepanova E.A., Sergeeva M.S., Petukhov A.N.
Nizhny Novgorod State Technical University n.a. R.E. Alekseev, Nizhny Novgorod, Russia
20 **The roles of Tween-80 and SDS on the kinetics of semi-clathrate hydrates formation about capture carbon dioxide from flue gas**
- Kutzhanova K.Zh., Kurmanova A.F., Pustolaikina I.A., Rakhimzhanova A.S., Esenbekova S.K.
Karagandy University of the name of academician E.A. Buketov,
21 Karaganda, Kazakhstan
Modification of sodium isobutyl xanthate as a collector in the flotation of a sulfide copper ore
- Lavrenova Zh.A., Knyazev A.V.
National Research Lobachevsky State University, Nizhny Novgorod
22 **Promising cobalt-containing thermoelectric materials**
- Lavrenov D.A., Pet'kov V.I., Borovikova E.Yu.
National Research Lobachevsky State University, Nizhny Novgorod
23 Moscow State University, Moscow
New structural type of phosphates - analogues of α -CaMg₂(SO₄)₃
- Lelet M.I., Mikhailov D.A., Lelet Yu.N.
Lobachevsky University, Nizhnij Novgorod, Russia
24 **An Experimental Calorimetric Study of Thermodynamic Properties of UO₂WO₄**
- Markin G.V., Ketkov S.Yu., Lopatin M.A., Shavyrin A.S., Kuropatov V.A., Cherkasov A.V., Belikov A.A.
G.A. Razuvaev Institute of Organometallic Chemistry, RAS, Nizhny Novgorod, Russia
25 **Bis(arene)chromium indolinonespiropyrrolidinofullerides**
- N.G. Chernorukov, O.V. Nipruk, K.A. Klinshova, M.O. Bakhmetev, M.D. Nazmutdinov
Lobachevsky State University of Nizhny Novgorod, Nizhny Novgorod, Russia
26 **Synthesis and study of rubidium uranate Rb₂U₆O₁₉·10H₂O**
- Perova E.R.¹, Mayorov P.A.¹, Asabina E.A.¹, Pet'kov V.I.¹, Kovalsky A.M.²
¹Lobachevsky University, Nizhnij Novgorod, Russia
27 ²NUST MISIS, Moscow, Russia
Synthesis and thermophysical properties of phosphates M_{0.5+x}Mg_xZr_{2-x}(PO₄)₃ (M – Cd, Sr)
- Petrov P.S., Kalyazin V.A., Slepov V.O.
National Research Mordovia State University, Saransk, Russia
28 **Benzylidenemalononitrile as a useful precursor in the synthesis of substituted pyrrolidines**
- Polyakova S. K.^{1,2}, Balashova T. V.¹, Arsenyev M. V.¹, Ilichev V. A.¹, Kukinov A. A.¹, Bochkarev M. N.^{1,2}
¹G. A. Razuvaev Institute of Organometallic Chemistry of Russian Academy of Sciences, Nizhny Novgorod, Russia
29 ² Nizhny Novgorod State University, Nizhny Novgorod, Russian
Photophysical properties of substituted La and Yb oxyacridinolates

- 30 Prokhorov I.O., Mochalov L.A., Logunov A.A., Maierova V.R.
Nizhny Novgorod State Technical University n.a. R.E. Alekseev, Nizhny Novgorod, Russia
Synthesis of gallium oxide via interaction of gallium with oxygen in plasma
- 31 Prokhorov I.O., Mochalov L.A., Logunov A.A., Maierova V.R.
Nizhny Novgorod State Technical University n.a. R.E. Alekseev, Nizhny Novgorod, Russia
Plasma-chemical purification of iodine
- 32 Pustolaikina I.A., Kutzhanova K.Zh., Kurmanova A.F., Kulchukova A.R.
E.A. Buketov Karaganda University, Karaganda, Kazakhstan
A DFT study of the medium effect on proton transfer reaction at $\cdot\text{CH}_2\text{OH}$ radical and amines systems
- 33 Pustolaikina I.A., Kutzhanova K.Zh., Kurmanova A.F., Meshkova A.S.
E.A. Buketov Karaganda University, Karaganda, Kazakhstan
Quantum chemical modeling and identification of chrysin complexes with calcium
- 34 Tomilin O.B.¹, Rodionova E.V.¹, Rodin E.A.^{1,2}, Karpunina V.A.¹
¹*National Research Mordovia State University, Saransk, Russia*
²*Lobachevsky University, Nizhnij Novgorod, Russia*
The influence of the carbon nanotubes orientation in an electric field on their emission properties
- 35 Safonov A.N.^{1,2}, Kornienko P.V.², Zaytsev S.D.¹, Shirshin K.V.^{2,3}
¹*Lobachevsky University, Nizhny Novgorod, Russia*
²*V.A. Kargin Polymer Chemistry and Technology Research Institute with a pilot-production plant, Dzerzhinsk, Nizhny Novgorod region, Russia*
³*R.E. Alekseev State Technical University, Nizhny Novgorod, Russia*
Preparation of new rigid cross-linked PVC foams
- 36 Sedov V.A.¹, Asabina E.A.¹, Pet'kov V.I.¹, Deyneko D.V.²
¹*Lobachevsky University, Nizhny Novgorod, Russia*
²*Moscow State University, Moscow, Russia*
Phase formation and luminescence characteristics of europium-doped NASICON-type phosphates
- 37 Semenov N.V., Pet'kov V.I., Borovikova E.Yu.
National Research Lobachevsky State University, Nizhny Novgorod
Moscow State University, Moscow
Phosphates and arsenate-phosphates with langbeinite structure containing Cs and Sr
- 38 Shirshin K.K., Esipovich A.L., Zol'nova A.D., Korotaev M.S., Rogozhin A.E.
Nizhny Novgorod State Technical University n.a. R.E. Alexeev (Dzerzhinsk branch), Dzerzhinsk, Russia
Synthesis of N-[3-(Dimethylamino)propyl]acetamide in presence of aminoalcohols and glycols
- 39 Blokhina A.G., Knyazev A.V., Demidov D.N., Zhakupova A.A., Zhakupov R.M.
Lobachevsky University, Nizhnij Novgorod, Russia
Spectroscopic, thermodynamic and thermal investigations of compounds of pyrochlore structure

Simagin A.S.^{1,2}, Orekhov D.V.², Gurbach S.G.², Kouliali S.P.², Kazantsev O.A.²

¹*Lobachevsky University, Nizhnij Novgorod, Russia*

²*Nizhny Novgorod State Technical University, Nizhnij Novgorod, Russia*

- 40 **Preparation and properties of thermoresponsive poly[methoxy (oligoethylene glycol-*block*-oligopropylene glycol) methacrylates]**

Tarankova K.A.¹, Grigoreva A.O.¹, Zaitsev S.D.¹

¹*Lobachevsky State University of Nizhnij Novgorod, Russia*

- 41 **The main features of reversible addition-fragmentation chain transfer (co)polymerization of 1,1,1,3,3,3-hexafluoroisopropyl acrylate**

Knyazev A.V., Gelashvili D.B., Shipilova A.S., Knyazeva S.S., Vinogradova I.V.

Lobachevsky University, Nizhni Novgorod, Russia

- 42 **Collection and analysis of information on spider toxins for a short encyclopedic dictionary of biotoxins**

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- 43 **Reversible addition fragmentation chain transfer (RAFT) polymerization of glycidyl methacrylate**

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- 44 **Изучение зависимости гидrolитической устойчивости керамики от относительной плотности**

Klementyeva N. E., Kirillova N.I., Suleimanov E.V.

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- 45 **Синтез и исследование анодных материалов ТОТЭ на основе соединений со структурой двойного перовскита A_2BMoO_6 (A=Sr, Ba; B=Ni, Mg)**

Курманова А.Ф., Кутжанова К.Ж., Пустолайкина И.А., Моргун В.В.

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- 46 **Квантово-химическое исследование протолитических свойств цистеина и его производных**

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- 47 **Electron structure of solid solutions $Rb_{0.95}Nb_xMo_{2-x}O_{6.475-0.5x}$ (x=1.31–1.625) with β -pyrochlore structure**

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- 48 **Influence of the nanopowder composition on the properties of hard alloys obtained by SPS**

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Получение керамических лангбейнитоподобных материалов и их исследование