



*PROCEEDING*  
*of the 3rd International Conference on*  
**Energy, Earth, Environment & Engineering**



**TOPICS:**

- Renewable Energy & Energy Conversion
- Environmental Technologies
- Earth Resources Engineering
- Metallurgy and Material Science

**5 December 2023**

**Uzbek-Japan Innovation Center of Youth  
Tashkent, Uzbekistan**

Register by email at [4econfg@gmail.com](mailto:4econfg@gmail.com) or by telegram [econfg\\_2023](https://t.me/econf_2023).

**ORGANIZERS:**



heterostructures in $Y_xSi_{1-x}$ material systems .....	67
<b>M.A.Tursunov, A.V.Qudratov, B.B.Umarov, M.M.Amonov, Q.G'.Avezov, B.Sh. Ganiyev</b> 1-(3-Furanil)-4,4,4-Triflorbutandion-1,3 hosilalari tautomeriyasi .....	68
<b>F.B.Eshkurbonov, E.R.Safarova</b> Synthesis of ionites forming complex compounds based on local raw materials .....	69
<b>Rakhmataliyev Shohruh</b> Calculation of Thermodynamics of Phase Gibbs Energy of Aluminum and Tin Steel Alloys .....	70
<b>G.Q.Xoliqova, B.Sh.Ganiyev, O'.M.Mardonov</b> Mochevina mono- va difosfat tuzlari eritmalari ta'sirida "Jondor" tuprog'i namunasining paramagnit markazlar tabiatini EPR spektroskopik tahlili .....	71
<b>Е.В. Киньшакова, Б.С. Торамбетов, Ш.А. Кадирова</b> Синтез 2-аллилсульфанил-5-метил-1,3,4-тиадиазола .....	72
<b>Х.Ш.Рахимов, С.Б.Мирзажанова, Б.А.Бадалов</b> Термодинамические характеристики процесса обжига механоактивированного сульфидно-сурьмяного концентрата с хлоридом натрия .....	73
<b>M.A.Tursunov, F.N.Xayrullayev, B.B.Umarov, M.M.Amonov, B.Sh.Ganiyev</b> 3-Fenil-3-Oksopropion Aldegidi p-Metilbenzoihidrazonining kristall tuzilishi ...	74
<b>Kh.R.Khaydaraliyev, D.B.Kholikulov</b> Hydrometallurgical processing of zinc cakes .....	75
<b>Rakhmataliyev Shohruh, Khojiev Shokhrux</b> SnS <sub>2</sub> Surface Alumina Coatings of Lithium-Ion Batteries by Atomic Layer Deposition .....	76
<b>R.R.Khaydarov, O.U.Gapurova, Praveen Thaggikuppe Krishnamurthy</b> Surface modification of carbon nanotubes for biomedical applications .....	77
<b>B.Sh.Ganiyev, S.N.Samiyev, Z.R.Jumayeva, O'.M.Mardonov</b> Glutamin molekulasining turli usullardagi DFT hisoblashlari .....	78
<b>U.Z. Sharafutdinov, I.M. Razhabboev, Sh.Sh. Yuldashev</b> Influence of nitrate ions in the process of uranium sorption .....	79
<b>Y.E.Nazarov, Kh.Kh.Turayev, J.M.Ashurov</b> [Cu(2.6-DPA)(CL) <sub>3</sub> ](8-HQ)(H <sub>2</sub> O) <sub>2</sub> complex synthesis and IR-Spectrum analysis .....	80
<b>Sh.Ch.Xolmatov, Z.M.Xakimova, N.T.Kattaev, H.I.Akbarov</b> Nitron tolasining g-C <sub>3</sub> N <sub>4</sub> bilan nanokompozitlarining fotokatalitik xossalari .....	81
<b>L.M.Qurbanova, N.B.Eshmamatova, Kh.I.Akbarov</b> Physico-chemical properties inhibitors of corrosion on the base of nitrogen, phosphorous-containing compounds .....	82
<b>Jamshid Qayumov</b> The positive effects of using virtual reality glasses in chemistry lessons .....	83
<b>Eshkobilova Mavjuda, Abdurakhmanov Ergashboy</b> Zol-gel synthesis of nanocomposites and gaseous materials .....	84
<b>P.P.Бабаева, А.М.Каромова, С.Н.Самиев, Б.Ш.Ганиев</b> Составление алгоритма квантово-химических расчетов аминокислот .....	85
<b>M.M.Yakubov, Sh.A.Mukhamedzhanova, O.M.Yoqubov</b> Study of the possibility of application of manufactured raw Materials in the selting of sulfide copper concentrates in the Vanyukov furnace at JSC "Almalyk MMC" .....	86
<b>М.Н.Муратова, Б.Ш.Ганиев, У.М.Мардонов, И.Н.Турсунова, З.Ш.Рахматов</b> Анализ результатов изучения антипиреновые	

эффeктивности продуктов кислотной переработки образцов НСФ .....	87
<b>O.N.Mamatkulov, S.T.Matkarimov, Kh.J.Kuziev, O.U.Nuraliev, B.R.Karimdjonov</b> Current state and prospects for processing steelmaking slags	88
<b>Tursunbaev Sarvar, Turakhodjaev Nodir, Kamalov Khayriddin, Tashbulatov Sherzod</b> Influence of germanium oxide on the alloy structure in the Al-Cu system .....	89
<b>S.T.Mansurov, Sh.M.Qo'ldoshev, N.T.Turovov</b> Fe(III) ionini spektrofotometrik aniqlash uslubini ishlab chiqish .....	90
<b>Sh.Chorshanbiev, N.Turakhodjaev, A.Erkinjonov, X.Kamolov</b> Increasing the durability of parts made of modified 110G13L steel .....	91
<b>Tursunbaev Sarvar, Turakhodjaev Nodir, Tashbulatov Sherzod, Mardonakulov Sharofuddin</b> Change in hardness of aluminum alloys under the influence of the element germanium .....	92
<b>A.Erkinjonov, N. Turakhodjaev, Sh. Chorshanbiev, X. Kamolov</b> Effect of alloying elements on alloyed steels .....	93
<b>J.B.Ismailov, U.A.Akramov, S.T.Matkarimov, F.B.Tukhtamurodov, B.R.Karimdjonov</b> New methods of separation zinc from zinc cakes .....	94
<b>М.Н.Мухамаджанова, Р.В.Халимова, А.К.Осербаева</b> Исследование ингибирования коррозии сталей электрохимическим методом .....	95
<b>O.U.Nuraliev, O.N.Mamatkulov, S.T.Matkarimov, B.R.Karimdjonov</b> Determination of the granulometric composition of steelmaking slag .....	97
<b>Р.К.Ниязбекова, А.А.Ибжанова, М.А.Серекпаева, Л.С.Шаншарова</b> Исследование влияния производственных отходов, содержащих нанодисперсии, на свойства композиционных материалов на основе цемента .....	98
<b>S.S.Murodov, Q.T.Siddiqova, Z.Ch.Kadirova, Sh.Sh.Daminova</b> Complex compound of cobalt(II) Acetyl Acetate with 2-Aminobenzimidazole derivatives .....	100
<b>B.Y.Ruzieva, B.T.Daniyarov, Z.Ch.Kadirova, Sh.Sh.Daminova</b> FTIR analysis of mixed-ligand complex compounds of rare earth elements .....	101
<b>Sh.S.Rakhimjanova, A.A.Khudayberdiev</b> Recommendations and mathematical calculations on scheme of installation 10A of process of heating of oil-gas-condensate mixture in heat-exchange apparatus 10E06 .....	102
<b>Л.Гапурова, Д.С.Рахмонова, Ш.А.Кадирова, З.Ч.Кадирова, М.И.Олимова</b> Анализ поверхности хиршфельда комплекса ацетата Cu(II) с 2-Гидроксиметилбензимидазолом .....	103
<b>O.U.Nuraliev, B.T.Berdiyarov, O.N.Mamatkulov, S.T.Matkarimov, B.R.Karimdjonov</b> Analysis of physico-chemical processes occurring during heat treatment of root fuel pellets .....	104
<b>Л.Н.Гапурова, Д.С. Рахмонова, Ш.А. Кадирова, М.И.Олимова</b> 2-Аминобензимидазолнинг сульфатли тузини рентген структура анализи ёрдамида кристалл тузилишини ўрганиш .....	105
<b>Г.А.Абдуллаева, З.Ч.Кадирова, Ш.Ш.Даминова</b> Молекулярное моделирование процесса сорбции пиридилазонафтаола на поверхности оксида алюминия .....	106

<b>S.M.Mukhammadiev, S.B.Rajabov, Sh.Sh.Daminova</b> Synthesis of 1,3-dihydro-3-metil-2H-benzimidazol-2-iminium 2-hydroxy-5-sulfobenzoate .....	107
<b>S.S.Murodov, Q.T.Siddiqova, Z.Ch.Kadirova, Sh.Sh.Daminova</b> Thermal study of the complex compound of cobalt(II) Acetylacetonate with 2-Aminobenzimidazole derivatives .....	108
<b>Н.Д.Аманова, Х.Х.Тураев, Ж.А.Мамадуллаев</b> Исследование свойств модифицированного серобетона .....	109
<b>Х.А.Жабборова, Х.Х.Турсунбоева, З.Ч.Кадирова, Ш.Ш.Даминова</b> ИК-спектроскопическое изучение строения разнолигандных комплексов уранила на основе аминокбензимидазола .....	110
<b>О.Т.Ражаматов, Ж.З.Шерматов, М.С.Пайзуллаханов</b> Магнитно-мягкие материалы на основе апатита синтезированных на солнечном свете .....	111
<b>Б.Ю.Рузиева, Ш.Ш.Даминова</b> Аралаш лигандли лантаноидли комплекс бирикманинг термик тахлили .....	112
<b>Н.Д.Аманова, Х.Х.Тураев, Ю.Махмудова</b> Изучение свойства модифицированный серы .....	113
<b>Х.А.Жабборова, Х.Х.Турсунбоева, З.Ч.Кадирова, Ш.Ш.Даминова</b> Изучение состава и микроструктуру комплексного соединения урана .....	114
<b>G.M.Allaberganova, A.M.Muzafarov, U.U.Sharafutdinov</b> Features of changes in $\sum\alpha$ and $\sum\beta$ activity depending on radionuclides concentration .....	115
<b>О.Т.Ражаматов, Ж.З.Шерматов, М.С.Пайзуллаханов</b> Полимерные магнитные материалы на основе апатита, синтезированных на солнечном свете .....	116
<b>H.R.Raupov</b> Issues of personnel training for mining and metallurgy industry enterprises .....	117
<b>N.B.Ashurova, M.N.Nodirov, A.Sh.Ashurov, R.R.Burhanova</b> Features of implementation of mixed models of project management and possibilities for their development .....	118
<b>M.S.Isaev, S.S.Sayitov</b> Research on the mineralogy of technogenic waste .....	119
<b>I.B.Rasulov, R.M.Khamdamov, G.D.Ulugov, A.N.Saidov, Kh.Ashurov</b> Influence of manganese oxide on the properties of steel 120G17HRL .....	120
<b>CONTENT</b>	121

# SnS<sub>2</sub> Surface Alumina Coatings of Lithium-Ion Batteries by Atomic Layer Deposition

Rakhmataliev Shohruh<sup>a</sup>, Khojiev Shokhrukh<sup>b</sup>

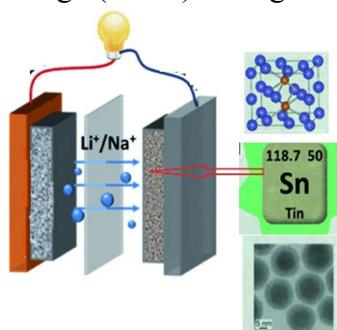
<sup>a</sup>University of Miskolc, Institute of Physical Metallurgy, Metalforming and Nanotechnology,  
MiskolcEgyetemvaros, Hungary

<sup>b</sup>Tashkent State Technical University, Tashkent, Uzbekistan

[shohrux2596@gmail.com](mailto:shohrux2596@gmail.com)

Tin disulfide (SnS<sub>2</sub>) hierarchical structures were successfully synthesized through a straightforward hydrothermal method, with the aim of optimizing their application in lithium-ion batteries. A prevalent issue in these batteries, marked by rapid capacity deterioration during cycling, can be attributed to substantial volume fluctuations, resulting in particle fragmentation and suboptimal contact between the active material and the current collector. This problem has been addressed and mitigated in an innovative manner through the surface modification of the entire SnS<sub>2</sub> electrode using a convenient technique known as atomic layer deposition (ALD). ALD offers the advantage of uniformly creating a conformal layer of aluminum oxide (Al<sub>2</sub>O<sub>3</sub>) on the porous electrode, effectively enhancing the electrochemical performance of these materials.

Because of its huge gravimetric and volumetric capacity, light weight, extended cycle life, and memory-free effects, rechargeable Li-ion batteries (LIBs) have become one of the most appealing energy storage systems for HEVs and EVs. Because conventional graphite anodes are incapable of forming next-generation LIBs that demand high capacity and power density as well as exceptional safety, a plethora of innovative anode materials for LIBs have been discovered in recent years. For example, there is an increase in research on tin-based materials for the LIB anode, particularly SnS<sub>2</sub>. It has a multilayer hexagonal CdI<sub>2</sub>-type structure for the crystal, with tin atom sheets sandwiched between two densely packed sulphur atom sheets and held together via van der Waals forces. It has a larger theoretical Li-storage capacity of 645 mA h g<sup>-1</sup> than graphite (372 mA h g<sup>-1</sup>), but it has drawbacks such as low cycle stability. The fast capacity degradation of SnS<sub>2</sub> is attributed to its massive volume change (200%) during the Li-ion insertion/extraction process, which might cause stresses and cracks as well as increased pulverization of the active SnS<sub>2</sub> particles. Many possible answers to the problem have been presented, which may be broadly categorized into three types. The first is to fabricate nanostructured materials SnS<sub>2</sub> in a 0 D to 3D configuration that can survive volume changes and promote charge transfer. The second is to create SnS<sub>2</sub> composites with carbonaceous materials (carbon particles, CNTs, graphene, etc.) and semiconductors (TiO<sub>2</sub>) that may not only cushion volume expansion but also increase SnS<sub>2</sub> conductivity.



1 fig. lithium-ion batteries

[1] D sheng Guan et all: Atomic Layer Deposition of Alumina Coatings onto SnS<sub>2</sub> for Lithium-Ion Battery Applications, *Electrochimica Acta*, [www.elsevier.com/locate/electa](http://www.elsevier.com/locate/electa)