NAZARBAYEV UNIVERSITY

NAZARBAYEV UNIVERSITY

Institute of Batteries

INESS

The 5th International Conference on Nanomaterials and Advanced Energy Storage Systems

ABSTRACT BOOK

The 4th Workshop on Water and Soil Clean-up from Mixed Contaminants

9 - 11 August, 2017
Astana, Kazakhstan

Dear Colleagues!

We greatly appreciate your participation and valuable contribution to our Conference. We are honored and pleased to welcome you at INESS-2017 and hope that you will have enjoyable time in Astana, Kazakhstan!

The Organizers will put all efforts to make these days at INESS very efficient time to exchange and discuss the ideas, establish and strengthen collaboration in various fields of research. We hope that INESS will serve as an effective platform to establish new opportunities for joint works in science and education for sustainable development and the best future.

We will be looking forward to seeing you again.

Yours sincerely,

On behalf of the Organizers,

Prof. Zhumabay Bakenov

ORGANIZERS

Nazarbayev University,

National Laboratory Astana (NLA)

and Institute of Batteries LLC

NAZARBAYEV UNIVERSITY

Institute of Batteries

NAZARBAYEV UNIVERSITY
NATIONAL LABORATORY ASTANA

Content

	Authors and topic	Page
	Invited speakers	
1.	Kanamura K., Kozuka K., Shoji M., Kimura T., Munakata H. **Preparation of all solid state battery by aero sol deposition method**	11
2.	Huo D., Contreras A., Laik B., Bonnet P., Guérin K., Muller-Bouvet D., Ceaac-Morthe C., Baddour-Hadjean R., Pereira-Ramos J. P. **Understanding of the nanosize effect on the structure and electrochemistry of V_2O_5 obtained via fluorine chemistry**	12
3.	Munakata H., Kikuchi S., Peediyakkal H. P., Yu J., Kanamura K. **Ionic liquid/phosphoric acid mixed electrolyte for non-humidified intermediate temperature fuel cells**	13
4.	Kostecki R. **Probing charge and mass transport phenomena across interfaces and interphases in Li-ion batteries**	14
5.	Kim S. S. **Improvement of rate capability of graphene for Li secondary batteries**	15
6.	Kosova N. V. **Possibilities of mechanochemical approach to synthesize nanostructured electrode materials for modern Li and Na batteries**	16
7.	Choi J. U., Kim J. S., Kim S. J., Myung S. T. **Distorted orthorhombic type Na-Mn-O cathode materials**	17
8.	Sun Y. K. **Progress in high-capacity gradient cathode materials for rechargeable lithium batteries**	18
9.	Myronov M. **Overcoming limitations of silicon carbide heteroepitaxy on Silicon wafers**	19
10.	Mansurov Z. A., Yesbolov N., Kaydar B., Smagulova G. T. **Bitumen based carbon fibers for various applications**	20
11.	Zhang Y., Tan T., Wang X. **Novel graphene based materials encapsulated sulfur as cathode for lithium/sulfur batteries**	21
12.	Stevenson K. J. **Understanding ion solvation structure, energetics and kinetics in super-concentrated electrolytes for energy storage**	22
	Oral presentations	
13.	Wu N. L. **Novel polymeric artificial solid electrolyte interphases for enhancing performance of Li-Ion battery cathodes**	23
14.	Yan W., Sun D., Jiang J., Ma X., Jin Y. **Facile synthesis of hierarchical Mn_2O_3 nanomaterials as anode material for Li-ion batteries**	24
15.	Skryabin I. , Radchik A., Maisano J. **Minimisation of Electricity Cost through Optimal Battery Operation**	25
16.	Rezepova D. O., Kosova N. V. **$Na_{1+y}VPO_4F_{1+y}$ ($0 \le y \le 0.5$) as cathode materials for hybrid Na^+/Li^+ batteries**	26
17.	Saobayeva (Muzdubayeva) A., Karymsakov A., Sultanov M., Molkenova A., Bakenov Z. **$Li_4Ti_5O_{12}$/Si/c-PAN composite as anode material for lithium-ion batteries**	27
18.	Pelegov D. V., Slautin B. N., Gorshkov V. S., Koshkina A. A., Makhmutov A. R., Pryakhina V. I., Kuznetsov D. K., Zelenovskii P. S., Yang C. C., Wu Y. S., Kholkin A. L., Shur V. Ya. **Local heterogeneity study of LTO, LFP and its composites LTO/C, LFP/C and LFP/C/LTO by micro-Raman, XPS, EDX and Big-Data Analysis**	28
19.	Molkenova A., Akhmetova N., Mentbayeva A., Bakenov Z. **A new step towards the development of 3D Zn/$LiFePO_4$ aqueous hybrid battery with polymer separator**	29
20.	Slautin B. N., Alikin D. O., Romanuyk K. N., Pelegov D. V., Shur V. Ya., Kholkin A. L. **Ion transport properties probing by electrochemical strain microscopy**	30
21.	Yermukhambetova A., Tan C., Daemi S. R., Bakenov Z., Brett D. J. L., Shearing P. R. **X-ray tomography studies of Li-S battery**	31
22.	Nurpeissova A., Adi A., Aishova A., Tolegen B., Bakenov Z. **Development of 3D Li-S batteries**	32
23.	Tereshchuk I. V., Askenov D., Drozhzhin O. A., Presniakov I. A., Sobolev A. V., Striukov D., Zhugayevych A., Stevenson K., Antipov E. V., Abakumov A. M. **The role of "dangling" oxygen atoms for intercalation chemistry of the metal-ion battery polyanion cathodes in the case of Na_2FePO_4F**	33
24.	Pavlenko V., Abbas Q., Prikhodko N., Biisenbayev M., Kurbatov A., *Begum F.*, Mansurov Z. **Producing of carbons for supercapacitor applications by chemical activation of plant biomass**	34
25.	Mukanova A., Nurpeissova A., Molkenova A., Bakenov Z. **Porous Cu current collector for Si thin film anode for Li-ion batteries**	35

Film as Gel Polymer Electrolyte for Rechargeable Hybrid Aqueous Batteries 65

56. Kurmanbayeva I., Adi A., Kulametov Z., Zhunisbek A., Sadykova A., Bakenov Z. **Silica Based Anode from Agricultural Waste** 66

57. Kurmanbayeva I., Adi A., Tolegen B., Karim M., Bakenov Z. **SiO_2 based composite as anode material for Li-ion batteries** 67

58. Mentbayeva A., Kurmanbayeva I., Kulametov Z., Baimyrza A., Bakenov Z. **Ceramic and polymer solid electrolytes for thin film Li-ion batteries** 68

59. Mukanova A., Colston G., Batyrbekuly D., Molkenova A., Nurpeissova A., Myronov M., Bakenov Z. **Durable and Safe 3C-SiC Thin Film as an Anode for Li-Ion Batteries** 69

60. Murat E., Adi A., Aishova A., Nurpeissova A., Bakenov Z. **3D intermetallic anodes for Lithium-ion batteries** 70

61. Nazhipkyzy M., Temirgaliyeva T., Tolegen B., Nurgain A., Bakenov Z., Lesbayev B., Prikhodko N., Mansurov Z. **Application of Carbon Soot as a Composite Material for Li/S Battery Electrodes** 71

62. Batyrbekuly D., Bakenov Z., Ould Ely T. **Scaling-up Nanomaterials for Various Energy Applications** 72

63. Zharbossyn A., Mukanova A., Nurpeissova A., Molkenova A., Bakenov Z. **P-Type Doped Amorphous Si Thin Film on Graphene Coated Ni Foam for Li-Ion Battery Application** 73

64. Makhmutov A. R., Gorshkov V. S., Slautin B. N., Pryakhina V. I., Kuznetsov D. K., Zelenovskii P. S., Yang C.-C., Wu Y.-S., Kholkin A. L., Shur V. Ya., Pelegov D. V. **Characterization Heterogeneity of LFP/C and LFP/C/LTO Composites by Micro-Raman Spectroscopy and Energy-Dispersive X-ray Spectroscopy** 74

65. Podkorytova O. A., Kosova N. V. **The Influence of Synthesis Method on Structure, Morphology and Electrochemical Properties of the $LiFe_{0.5}Mn_{0.5}PO_4$ Cathode Material** 75

66. Inerbaev T. M., Abuova A., Abuova F., Kilin D. S. **The Influence of Counterelectrode Material on Photocurrent Nonadiabatic Dynamics with Non-Collinear Magnetism for La-doped NaYF** 76

67. Inerbaev T., Gavryushkin P., Litasov K., Abuova F., Abuova A., Akilbekov A. **P-V-T Equation of State and Thermoelastic Properties of Shortite $Na_2Ca_2(CO_3)_2$ from First Principles** 77

68. Aidarkhanov D., Lerov Y., Cordan A.-S. **2D Drift-Diffusion Model of Bulk-Heterojunction Organic Solar Cell for Morphology Effect Studies** 78

69. Amerkhanova Sh. K., Shlyapov R. M., Uali A. S. **The Obtaining of Copper and Some Noble Metals Nanoparticles by Processing of Supramolecular Gels by Electric Alternating Current** 79

70. Rysbekova A., Aukenova A., Baptayev B., Balanay M. **Assessment of Blocking Layers for Highly Efficient Dye Sensitized Solar Cells** 80

71. Bakhytzhan Y. G., Abildina A. K., Beisenova G. S., Kurbatov A. P., Argimbayeva A. M. **Regularities of Charge Transfer in Magnesium Corrosion Films** 81

72. Baptayev B., Adilov S., Balanay M. **Aza-BODIPYs as Co-Sensitizers in Dye-Sensitized Solar Cells** 82

73. Baishagirov K. **Energy of Steppes** 83

74. Bereketova G., Askarova G., Galeyeva A., Kurbatov A. **Optimization of Synthesis Method of Composite Polymer Electrolytes with the Structured Inorganic Fillers** 84

75. Mukhambetov D. G., Kargin D. B., Kozlovskiy A. L., Ibrayeva A. D. **The Influence of Thermal Treatment on Maghemite Obtainment** 85

76. Ilyassov B., Alekseev A., Yedrissov A. **Charge Carriers Transport and Recombination in Organic Solar Cells** 86

77. Kaldemeyer C., Boysen C., Tuschy I. **A Generic Formulation of Compressed Air Energy Storage (CAES) as Mixed Integer Linear Program (MILP) - Modelling Specific Technical Concepts in Arbitrary Market Environments** 87

78. Kalyyeva A., Kudreeva L., Zhumasheva N. **Electrochemical Reduction of Perrhenate Ions in the Electrolytes of Different Composition** 88

79. Kalyyeva A., Supiyeva Zh., Pavlenko V., Kurbatov A., Kudreyeva L. **Electrochemical Behavior of Perrhenate Ions in Non-Aqueous Dimethylformamide Solutions of Electrolytes** 89

80. Serikbaev B. A., Kamysbaev D. Kh., Galina S. Arbuz **Synthesis of Modified Electrode for Electrochemical Sensing** 90

81. Kenzhina I. E., Abdullm Kh., Chikhray Ye. V., Gabdullin M. T. **Obtaining a High Capacity Electrode of Few-layer Graphite** 91

Application of Carbon Soot as a Composite Material for Li/S Battery Electrodes

Nazhipkyzy M.[1,2], Temirgaliyeva T.[1,2], Tolegen B.[3], Nurgain A.[1,2], Bakenov Z.[3], Lesbayev B.[1,2], Prikhodko N.[1,4], Mansurov Z.[1,2]

[1]*Institute of Combustion Problems, 172, Bogenbay Batyr St., Almaty, Kazakhstan*

[2]*Al-Farabi Kazakh National University, 71, al-Farabi Ave., Almaty, Kazakhstan*

[3]*Institute of Batteries LLC, 53 Kabanbay Batyr Ave., Astana, Kazakhstan*

[4]*Almaty University of Energetics and Communications, 126, Baytursinova St., Almaty, Kazakhstan*

E-mail: *tolganay.o1@gmail.ru*

Lithium/sulfur batteries have gained intense attention as one of the most promising candidates for high energy density rechargeable batteries due to their high theoretical specific capacity of 1672 $mAhg^{-1}$ and theoretical energy density of 2600 $Whkg^{-1}$ based on cathode materials. In addition, sulfur has the advantages such as low cost, natural abundance, and environmental friendliness. However, there are still several significant technical limitations that hinder the commercialization of Li/S batteries. The main problems include: low utilization of sulfur because of its poor electrical conductivity and rapid capacity loss on repeated cycling because of dissolution of polysulfides into the electrolytes. To overcome these issues, there have been tremendous effort to find a host material, which would improve the electrical conductivity of the sulfur cathode and trap the soluble polysulfide intermediate. For example, micro-/mesoporous carbon, carbon nanotubes, or graphene are promising conductive frameworks to composite with sulfur.

In this work, carbon soot was used as composite material for Li/S battery electrodes. Preparation of carbon nanomaterials is an important field. It was synthesized carbon soot through the combustion of propane-butane mixture. Experimental studies on the synthesis of soot produced in the combustion process of the propane-butane gas mixture were carried out on an installation that consists of a system for the dosed supply of gases, a burner and a drum-type soot collection. The structure and property of soot particles depends on the temperature in the volume of the flame. The morphology structure of synthesized materials were investigated by scanning electron microscope (SEM), Raman spectroscopy.

We have been developed the simple method of synthesize sulfur/soot/polyacrylonitrile composite. Sulfur/soot/polyacrylonitrile composite was synthesized by heat treatment at 300 ^0C for 3 h in inert atmosphere. This preparation methods of synthesize composite based on heat treatment possesses the advantages of simplicity and low cost. Then the composite cathode was prepared by mixing 80 wt.% Sulfur/soot/polyacrylonitrile composite, 10 wt.% polyvinylidene fluoride (PVDF) (Kynar, HSV900) as a binder, and 10 wt.% acetylene black (MTI, 99,5 % purity) conducting agent in 1-methyl-2 pyrrolidinone (NMP, Sigma-Aldrich, ≥99,5% purity). The cell with this S/soot/PAN composite cathode demonstrates a stable reversible specific discharge capacity of 800 mAh g^{-1} after 50 cycles at 0,2 C.