POSTER PRESENTATIONS

TABLE of CONTENTS

SELECTIVE HYDROGENATION OF ACETYLENE TO ETHYLENE ON COBALT CATALYSTS Aitugan A.N., Tanirbergenova S.K., Tileuberdi Ye., Mansurov Z.A.
THE PROCESS OF GASIFICATION AND COMBUSTION OF COAL FINES IN A MAGENTOELECTRIC FIELD Baubek A.A., Abzhaliyev A.K., Kalybai A.A.
СИНТЕЗ И ФУНКЦИОНАЛИЗАЦИЯ ОКСИДА КРЕМНИЯ ДЛЯ МОДИФИЦИРОВАНИЯ НЕФТЯНЫХ БИТУМОВ А.Б.Жамболова, Е.Тилеуберди, Е.К.Онгарбаев, С.О.Rossi
POWDER MIXTURES FOR EXOTHERMIC REACTIONS AND THEIR INDUSTRIAL APPLICATIONS Kaliyeva A., Tileuberdi Ye., Ongarbayev Ye., Galfetti L., Mansurov Z.
LIGNIN BASED ELECTROSPUN FIBERS Globisz M., Turganbay A., Nazhipkyzy M., Zhaksilikova A., Mitchell G., Mansurov Z.
CHEMICAL SYNTHESIS OF PYROTECHNIC SUBSTANCE USING ADDITIVE TECHNOLOGY Naurzbayeva G., Sultakhan Sh., Nazhipkyzy M., Mansurov Z.A., Mitchell G.R.
NANO/MICROSTRUCTURED POROUS SILICON-GRAPHENE COMPOSITE FOR LI-ION BATTERY ANODE MATERIAL APPLICATION Sarsembayeva B.D., Yeleuov Y.A., Beisenova Y.Y., Beisenov R.Y.
ТЕРМОСТОЙКОСТЬ И ВНУТРЕННЕЕ НАПРЯЖЕНИЕ ОГНЕУПОРОВ В УСЛОВИЯХ ТЕПЛОВЫХ ВОЗДЕЙСТВИЙ Акишев А.Х., Фоменко С.М., Толендиулы С.
ПОЛУЧЕНИЕ БИТУМОВ ПУТЕМ ОКИСЛЕНИЯ РАЗЛИЧНЫХ НЕФТЯНЫХ ОТХОДОВ Сағынғазин Ш.А., Аққазин Е.А.
НОВЫЕ ВЫСОКОДЕМПФИРУЮЩИЙ ЖЕЛЕЗАУГЛЕРОДИСТЫЙ СПЛАВ Беркинбаева А.С., Абилкасова С.О.

LIGNIN BASED ELECTROSPUN FIBERS

[1,2]Globisz M., [1,2]Turganbay A., [1,2]Nazhipkyzy M., [2]Zhaksilikova A., [3]Mitchell G., [1,2]Mansurov Z.

[1]Institute of Combustion Problems, 050012, Kazakhstan, Almaty, Str. Bogenbai Batyr, 172
[2]Al - Farabi Kazakh National University, Kazakhstan, Almaty, Ave. al - Farabi, 71
[3]Centre for Rapid and Sustainable Product Development, Polytechnic of Leiria, Marinha Grande, Portugal

Introduction

In [1] it was developed the first piece of crystalline silicon solar cells with 4,5% conversion efficiency, which opened up a new era in the application of solar energy. The solar energy technology development has gone through three stages, such as, monocrystalline and polycrystalline silicon solar cells; amorphous silicon thin film solar cells; the third generation solar cells referring to new concept solar cells with high conversion efficiency. Whereas many approaches have been made in photovoltaic devices, efforts still need to be made to dramatically enhance the conversion efficiency of photovoltaic cells. One efficient strategy is the introduction of new structured materials like electrospun nanofiber materials.

Nanofibers are promising materials for lithium-ion batteries (LiBs) because of their good electrochemical activity, high mechanical strength, and high specific surface area. In this section, recent advances in the areas of electrospun nanofibrous cathode, anode, and separator materials for LiBs are briefly summarized.

Nanostructured $LiCoO_2$ fiber electrode prepared by electrospinning exhibited enlarged Li ion and electron conductivity due to the short diffusion distance. As prepared electrode could display good rate capability and high power density. Unfortunately, such nanofibrous electrodes have shown poor cycling stability [1].

Carbon nanofibers have been the popular anode materials for LiBs due to several advantages such as low cost, easy availability, and long cycle life. However, there are also some drawbacks about carbon nanofibers such as relatively low specific capacity and rate capability.

Supercapacitors are considered to be one of the most promising new energy storage devices in different areas, such as transportation, electricity, communications, defense, consumer electronics, and other applications depending on their high power performance, long cycle life, and low maintenance cost. According on various energy storage mechanisms, supercapacitors can be classified: pseudocapacitors and electrical double layer capacitors. Pseudocapacitors store energy based on fast reversible surface redox reactions, whereas electrical double layer capacitors store energy using ion adsorption and desorption at the electrode and electrolyte interface. Recently, novel carbon-based materials with rational design of material composition, size, and morphology have been explored for high-performance electrical double layer capacitors [1].

Electrospinning produces fibers with diameters from nanometers to micrometers when electrostatic forces act on solutions or melts. The general installation of electrospinning consists of three main components: a high voltage power supply, in the form of a metal needle and a grounded collector. In a typical electrospinning process, high voltage is used to dissolve or melt. After this, a droplet forms depending on the voltage. When the electrostatic force overcomes the surface tension of the conical droplet, in the end, a charged polymer jet is released from the tip. The interaction between the electric field and the surface tension of the liquid draws the jet stream and forces it to whip, leading to the evaporation of the solvent. This leads to the fact that the jet stream continuously lengthens, since the long and thin fiber and its fibers are compacted and ultimately deposited on a grounded collector, which leads to the formation of a homogeneous fiber.

So, electrospun carbon nanofibers from polymer precursors (polybenzimidazole, polyacrylonitrile and polyimide) have triggered ruling consequent. These electrospun carbon nanofibers can be utilized as electrode for electrical double layer capacitors after undergoing the process of stabilization, carbonization and activation, in which the surface area and porosity of the nanofibers can be improved.

In [3] pure lignin based carbon fibers were successfully synthesized by carbonizing a pure lignin precursor at varying temperatures ranging from 800°C to 1700°C. A specific capacity of over 310 $mAh*g^{-1}$ and a first coulombic efficiency of 89% was obtained showing a high potential of using lignin carbon fibers in sodium ion batteries. The results from the high precision coulometry study indicate that the capacity loss is affected by the carbonization temperature.

Currently, at the laboratory "Synthesis of carbon nanomaterials in flame" synthesized lignin based fibers from pine wood with polyacrylonitrile polymer and dimethylformamide. Obtained electrospun lignin fibers were further investigated with the usage of scanning electron microscope, optical electron microscope and infra-red analysis.

The acquired fibers have sufficiently low diameter (few hundreds nanometers) that should become even smaller after the carbonization, which induces that the parameters used in the process of electrospinning are close to being optimal (or even being best possible). Thus, synthesized fibers will be used as an electrode for an energy storage device.

References

1. D.M. Chapin, C.S. Fuller, G.L. Pearson. A new silicon p-n junction photo cell for converting solar radiation into electrical power. Journal of Applied Physics, V. 25, №5, P. 676–677. – 1954.

2. Kevin Peuvot, Omid Hosseinaei, Per Tomani, Dan Zenkert, Göran Lindbergh. Lignin Based Electrospun Carbon Fiber Anode for Sodium Ion Batteries. Journal of The Electrochemical Society, 166 (10) P. A1984-A1990. – 2019.