High Mass-Loading Sulfur-Composite Cathode for High Performance Lithium-Sulfur Batteries

Nurzhan Baikalov[2], Almagul Mentbayeva[1,3], Indira Kurmanbayeva[1,2], Zhumabay Bakenov[1,2,3]

[1] *Institute of Batteries, 53 Kabanbay Batyr Ave, Astana, Kazakhstan*
[2] *National Laboratory Astana, Nazarbayev University, 53 Kabanbay Batyr Ave, Astana, Kazakhstan*
[3] *School of Engineering, Nazarbayev University, 53 Kabanbay Batyr Ave, Astana, Kazakhstan*

E-mail: *zbakenov@nu.edu.kz*

Sulfur remains the focus of attention as a perspective candidate for the cathode material for lithium-ion batteries. First of all, sulfur is cheap and has abundant resources, and secondly, has a high theoretical discharge capacity (1675 mAh g-1). Lithium-sulfur batteries potentially can be applied in the market portable devices and for storage of electrical energy. Nevertheless, implementing Li-S batteries face several difficulties. The challenges are based on low electronic conductivity of sulfur, solubility of polysulfides in the electrolyte and low mass loading of sulfur. Conventional approaches are focused on the loading of sulfur into porous carbon hosts, coating with polymers and encapsulating into various types of carbon materials. This research is aimed to increase mass loading of sulfur in the composite, which in turn requires improvement in the electrical conductivity. The conductivity of sulfur is improved with the use of polyacrylonitrile (PAN) polymer and carbon nanotubes (CNT), while mass loading is increased with the use of carbon fiber paper as a current collector.

Acknowledgements
This research was supported by the targeted state program No.BR05236524 “Innovative Materials and Systems for Energy Conversion and Storage” from the Ministry of Education and Science of the Republic of Kazakhstan for 2018-2020.

Optimization of deposition parameters for thin film lithium phosphorus oxynitride (LiPON)

Berik Uzakbaiuly, Zhumabay Bakenov

School of Engineering, National Laboratory Astana, Nazarbayev University, 53 Kabanbay Str., 010000 Astana, Kazakhstan.

E-mail: *zbakenov@nu.edu.kz*

Thin film of lithium phosphorus oxynitride (Lipon) was successfully deposited by radio frequency (RF) magnetron sputtering technique from Li_3PO_4 target. The power on the target was 150 W and optimal deposition pressure of N_2/Ar = ~3/1 was of 2 mTorr. Analysis of the film was done by AFM, FTIR and Raman spectroscopy, which showed incorporation of nitrogen into the film as both triply, N_t, and doubly, N_d, coordinated form. The impedance spectroscopy measurements was carried out and revealed the ionic conductivity of the sample to be 8.6×10^{-8} S cm^{-1} for optimum RF power and gas flow conditions. The electrochemical properties investigations and further development of this work will be presented at the Meeting.