DEVELOPMENT OF NOVEL SULFUR/CARBON CATHODE COMPOSITES USING SPRAY PYROLYSIS AND STUDY OF THEIR ELECTROCHEMICAL PERFORMANCE IN LITHIUM-SULFUR BATTERIES

N. Umirov[1], N. Yesibolati[1], D. Batyrbekuly[1], A. Mentbayeva[1,2], E. Sugurbekov[1,2], A. Konarov[1], I. Kurmanbayeva[1], T. Hara[1,2], Zh. Bakenov[1,2]*

1) Institute of Batteries LLC, Technopark, Astana, Kazakhstan; 2) School of Engineering, Nazarbayev University, Astana, Kazakhstan; *zbakenov@nu.edu.kz

Introduction. The eminent global energy crisis and growing ecological concerns in the past two decades have led to intensive development in the fields of green transportation such as electric and hybrid electric vehicles (HEV), as well as clean energy sources such as wind and solar power. These technologies demand low cost, safe, and environmentally friendly energy storage systems. Therefore, development of novel economically feasible and ecologically friendly high performance batteries is crucial. Lithium/ sulfur (Li/S) batteries have the highest energy density (2600 Wh/kg) and theoretical capacity (1672 mAh/g) among all known systems [1,2].

Materials and methods. In our investigation, Sulfur/Carbon cathode composites were successfully synthesized by a novel synthesis route, i.e., a combination of ball-milling and spray pyrolysis. Ultrasonic spray pyrolysis is thought to be an effective production technique for short production times and homogenous particle composition in a single-step. This technique allows for narrow particle size distribution compared with other common techniques, with controllable composition and sizes from micrometer to nanometer range, and high purity of the product.

Results and discussion. The final product was characterized using XRD and *scanning electron microscopy* (SEM) and transmission electron microscopy (TEM). It was shown that the final composites have the average particle size less than 100 nm. Electrochemical performance will be presented at the poster session of the Research Week.

Conclusions. Sulfur/Carbon cathode composites were successfully synthesized by spray pyrolysis technique and characterized using various techniques.

Acknowledgments. This research was supported by Grant of the Ministry of Education and Science Republic of Kazakhstan, N 110/4-2012, 2012-2014 and by a Subproject supported under the Technology Commercialization Project by the World Bank and the Government of Kazakhstan.

References.

1. Y. Zhang, Y. Zhao, Z. Bakenov, Nanoscale Res. Lett., 2014, 137,
2. Y. Zhang, Y. Zhao, Z. Bakenov, D. Gosselink, P. Chen, J. Solid State Electrochem., 2014, 18, 1111¬ 1116.