



Uniform and thin gel-like polymer separator for three-dimensional (3D) lithium-ion batteries

Akylbek Adi^{1,2}, Almagul Mentbayeva^{1,3}, Kuralay Korzhynbayeva^{1,3}, 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

The 25th anniversary of the implementation of lithium-ion batteries as energy sources for portable electronic devices and electric vehicles was celebrated last year by Sony Corporation and the battery industries. Since its discovery, lithium-ion battery systems have been studied and attracted much attention due to its high energy and power densities. Moreover, it has been expected that the battery system will continue to be improved in safety, energy and power capabilities [1]. In this regard, there have been many research works dedicated to developing lithium-ion batteries. One of such approaches is changing the battery architecture from conventional two-dimensional (2D) into three-dimensional (3D) architecture to create lithium-ion microbatteries [2]. However, there are many challenges that restrict an assembling of 3D microbatteries, and one of the obstacles comes from the design of its separator. An electropolymerization method has been widely applied to prepare separators for 3D lithium-ion batteries, but this method is expensive and complicated [3].

In our work, a layer-by-layer (LbL) deposition technique was implemented to conduct polymer coatings of the electrode. A tin-based 3D negative electrode was uniformly covered by the layers of polyethyleneimine and polyacrylic acid from aqueous solution and electrochemically studied. The uniformity of polymer coating was confirmed by scanning electron microscopy (SEM).

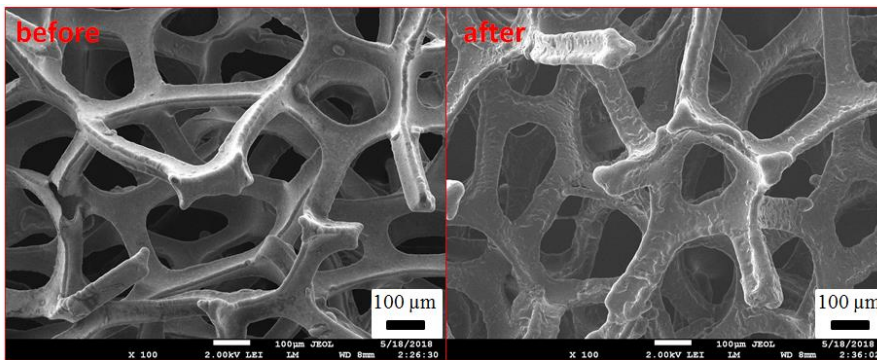


Fig. 10 SEM images of Sn-based electrode: before and after LbL coatings

- [1] Blomgren, G. E. (2017). *Journal of The Electrochemical Society*, 164(1), A5019-A5025
- [2] Johnson, D. C., & Prieto, A. L. (2013, May). IV (Vol. 8728, p. 872805) *International Society for Optics and Photonics*
- [3] Salian, G. D., Lebouin, C., Demoulin, A., Lepihin, M. S., Maria, S., Galeyeva, A. K., & Djenizian, T. (2017). *Journal of Power Sources*, 340, 242-246