

# Synthesis and Electrochemical test of Li-rich ( $0.5\text{Li}_2\text{MnO}_3\text{-}0.5\text{LiNi}_{1/3}\text{Co}_{1/3}\text{Mn}_{1/3}\text{O}_2$ ) doped with Ba cathode material by using the Anodic Aluminum Oxide Template (AAO).

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## Abstract

The Li rich cathode material is promising material. Because it provides large specific capacity more than 200 mAh/g when they are charged over 4.6V are promising cathode materials.

However, Li-rich materials have low rate capability. To solve this problem, many strategies have been proposed to change the structures and morphologies of the Li-rich materials through nano-architecture and ion-doping [1].

And the 1<sup>st</sup> key-point is to solve the kinetic problem associated with solid state diffusion of lithium ion intercalation and electronic conductivity. Recently, Xiao Xia et al. reported that the diffusion length becomes shorter as the particle size is smaller and as a result faster kinetics are expected [2].

2<sup>nd</sup> point is to solve the structure stability. Ion-doping is used to improve structural stability. So, barium substitution has also been considered to enhance the stability of structural properties. Because,  $\text{Ba}^{2+}\text{-O}$  (563eV ( $\pm 42$ )) has a high binding voltage than  $\text{Ni}^{2+}\text{-O}$  (391.6eV ( $\pm 38$ )). So, Li-rich material can be structurally stabilized.

In recent times, anodic aluminum oxide(AAO) templates have attracted considerable attention to the growth of adjustable self organized, highly ordered nano-rods. Also, it used to make higher surface to volume ratio nanostructure from the capillary phenomenon.

In this study, we put the intention to effect of  $x\text{Li}_2\text{MnO}_3\text{-}x\text{LiNi}_{1/3-x}\text{Ba}_x\text{Co}_{1/3}\text{Mn}_{1/3}\text{O}_2$ . To make the nano-rods, we synthesized by the template method with AAO template. To observe the nano-rod, we analyzed by scanning electron microscope(SEM) and atomic force microscope(AFM). The nano-rod was analyzed by X-ray diffraction patterns (XRD) to observe the structure stability. And we analyzed electrochemical test such as charge-discharge curve, cycle performance, EIS, etc.

## References

- [1] W. HE, D. Yuang, J. Qian, X. Ai, H. Yang and Y. Cao\*, *J. Mater. Chem. A*, 1, (2013), 11397.  
[2] P. Lv, H. Zhao, J. Wang, X. Liu, T. Zhang and Q. Xia, *J. Power Sources*. 237, (2013), 291-294.

## Figures

