

Preparation and Electrochemical Properties of Millimeter-order-thick Air Electrodes for Lithium Air Secondary Batteries

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Millimeter-order-thick air electrodes for lithium air secondary batteries (LABs) were prepared by loading electrode materials containing Pt₁₀Ru₉₀ electrocatalyst/KetjenBlack-EC600JD(KB) [1, 2] and PVdF binder into a nickel foam sheet support with 95% voids. The way of stacking the nickel foam sheet was investigated to improve the areal discharge capacity of the air electrode.

Figure 1 shows discharge capacities of air electrodes with a single-layer nickel foam sheet (3 mm x 1) and a multi-layer sheet (1 mm x 3) loaded with KB and PVdF. The total thickness is 3 mm. The cell with the three-layer sheet showed a rather large areal discharge capacity of about 80 mAh/cm² compared to about 30 mAh/cm² for the cell with single-layer sheet even though the thickness of these air electrodes was the same. This significant difference in areal capacity might result from the filling state of the electrode materials in each air electrode.

Figure 2 shows first discharge/charge curves of the LAB cell incorporating an air electrode with a three-layer nickel foam sheet loaded with Pt₁₀Ru₉₀/KB and PVdF under the condition of large cut-off capacity of about 50 mAh/cm². The charge curve shown in this figure is very similar with one obtained in our previous work [1] on micrometer-order-thick air electrode composed of Pt₁₀Ru₉₀/KB. This result suggests that this LAB cell can be charged even though severe problem of long diffusion of oxygen and slow penetration of electrolyte solution in the millimeter-order-thick air electrode.

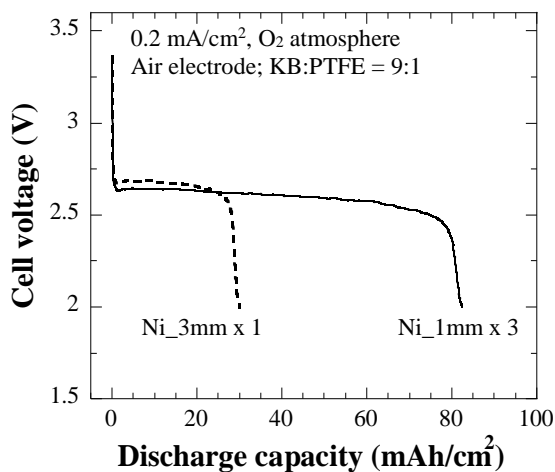


Fig. 1. Discharge curves of LAB cell incorporating air electrodes with single-layer and three-layer nickel foam sheet in 1 mol/l LiTFSa/TEGDME.

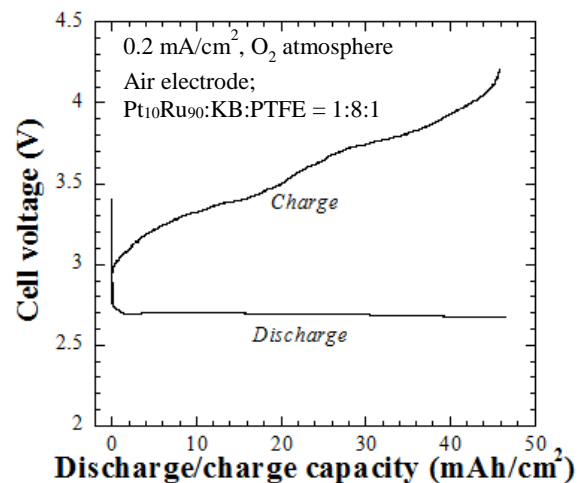


Fig. 2. First discharge/charge curves of LAB cell incorporating air electrodes with three-layer nickel foam sheet (1 mm x 3) in 1 mol/l LiTFSa/TEGDME.

References:

- [1] Y. Yui, S. Sakamoto, M. Nohara, M. Hayashi, J. Nakamura, T. Komatsu, J. Power Sources, 340, 121 (2017).
- [2] Y. Yui, S. Sakamoto, M. Nohara, M. Hayashi, J. Nakamura, K. Suzuki, M. Hirayama, R. Kanno, T. Komatsu, Electrochemistry, 85, 128 (2017).