COMPOSITE CATHODE FOR Li/Na-ION BATTERIES

Shigeto Okada

Research and Education Center for Advanced Energy Materials, Devices, and Systems, Kyushu University, Japan

s-okada@cm.kyushu-u.ac.jp

For rechargeable batteries for portable devices, energy density is the most important parameter. On the other hand, for large-scale rechargeable batteries, cost performance is more important than energy density. In order to realize the high cost performance rechargeable battery, iron-base conversion-type cathodes such as FeF_3 [1], FeOF [2] and FeS_2 [3] must be promising. However, these cathodes has no Li/Na in initial composition. So, they cannot use in Li/Na-ion batteries with carbonaceous anode. To dissolve this problem, composite type cathodes with sacrificial salt such as LiF/NaF were tried. FeF_2 + LiF composite cathode was first reported by Kang [4]. According to his report, the charge/discharge profile after initial charge is actually similar to that of FeF_3 cathode and he proposed the reaction as follows;

$$LiF + FeF_2 \rightarrow Li^+ + e^- + FeF_3 \rightleftarrows LiFeF_3$$

In this presentation, as the other interesting examples, 3 kind of composite cathodes such as NaF + FeF_2, LiF + FeO, and LiF + Fe are introduced. They are corresponding to $NaFeF_3$, LiFeOF and 3LiF+Fe, respectively.

For example, rocksalt-type LiFeOF was obtained by the dry ball-milling of LiF and FeO at room temperature. The reversible capacity was 290 mAh/g with an average voltage of 2.5 V and the energy density over 720 mWh/g is the highest energy density among iron-based insertion-type cathode materials. In addition, the electrochemical activity of Li in LiFeOF was confirmed by the charge and discharge reactions in the full cell with LiFeOF cathode and $Li_4Ti_5O_{12}$ anode.

References

[1] M. Nishijima, I. Gocheva, S. Okada, T. Doi, J. Yamaki, and T. Nishida, *J. Power Sources*, **190** (2009) 558-562.
[2] A. Kitajou, H. Komatsu, R. Nagano, and S. Okada, *J. Power Sources*, **243** (2013) 494-498.
[3] A. Kitajou, J. Yamaguchi, S. Hara, and S. Okada, *J. Power Sources*, **247** (2014) 391-395.
[4] S. W. Kim, K. -W. Nam, D. -H. Seo, J. Hong, H. Kim, H. Gwon, and K. Kang*, Nano Today,* **7** (2012) 168.

□Profile□

Prof. Shigeto Okada

Present Appointment

Professor of Research and Education Center for Advanced Energy Materials, Devices, and Systems, Kyushu University.
Professor of Graduate School of Integrated Frontier Sciences, Kyushu University.
Professor of Institute for Materials Chemistry and Engineering, Kyushu University.
Professor of Interdisciplinary Graduate School of Engineering Sciences, Kyushu University.
Professor of Center for the Promotion of Interdisciplinary Education and Research, Kyoto University.

Previous Appointments

1998-2103	Associate Professor, Institute of Advanced Material Study, Kyushu University.
1996-1997	Executive Engineer, Customer Equipment Technology Department, NTT Mobile Communications Network Inc.
1995-1996	Senior Research Engineer, Supervisor, NTT Integrated Information & Energy Systems Laboratories.
1993-1994	Visiting Scholar, Center for Materials Science and Engineering, The University of Texas at austin.
1981-1993	Researcher, Ibaraki Electrical Communication Laboratory, Nippon Telegraph & Telephone Corporation.

Education

1992	D. Science, Osaka University, Supervisor: Prof. Shichio Kawai.
1981	M. Science, Hokkaido University, Supervisor: Prof. Takashi Sambongi.

Awards

2013	The 11th Minister Award of MEXT.
2013	International Battery Material Association Battery Technology Award 2013.

□Chairman, the Organizing Committee of the 58th Battery Symposium of Japan.
□Member, the Selection Committee for the prizes of the Committee of Battery Technology.
□Board Member, the Electrochemical Society of Japan.
□Board Member, Society of Advanced Battery Technologies, Japan.