

The In Situ Images of the Electrodes in $\text{LiFePO}_4/\text{MCMB}$ Cells under Various Conditions

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The $\text{LiFePO}_4/\text{Li}$ cell exhibits a good cycle performance, whereas the $\text{LiFePO}_4/\text{MCMB}$ cell suffers an unwilling fading at elevated temperatures. We have done a lot of efforts to figure out a fading mechanism of $\text{LiFePO}_4/\text{MCMB}$ cells at temperature higher than 50°C by analyzing the cycled cathodes and anodes with SEM, EDS, micro-FTIR, and XPS. We also found that the iron dissolved from the cathode in the 1M LiPF_6 in EC/DEC ($v/v = 1/1$) electrolyte and deposited on the anode after charge/discharge cycling. The amount of Fe dissolved increases with increasing amount of cathode moisture content, such that the Fe dissolution is suggested to be caused by the formation of the HF as the spinel LiMn_2O_4 .

The X-ray image of $\text{LiFePO}_4/\text{LiPF}_6$ in EC/DEC ($v/v = 1/1$)/ MCMB cell cycled with C/5 at 30°C with cathode containing 4.5×10^3 ppm water during the charging state was shown in Fig. 1. It shows the bubbles formed on anode as that had been reported by Gozdz. Et al. [1], whereas no bubbles are observed on the cathode. Furthermore, the formed rate of the bubbles on the anode increased with C-rate.

In Fig. 2 shows the X-ray image tests of the $\text{LiFePO}_4/\text{LiPF}_6$ in EC/DEC ($v/v = 1/1$)/ MCMB cell cycled with C/3 at 55°C comprising cathode containing 4.5×10^3 ppm water was shown. Bubbles are observed on anode during charged state whereas they are observed on cathode during both of charge and discharge states. That might be due to different mechanism for bubbles formation. One is the solvent oxidation on cathode during the charge process no matter under what ever operation temperature. The other may be attributed to the existence of HF that will react to the cathode at elevated temperatures. That will be confirmed in the future.

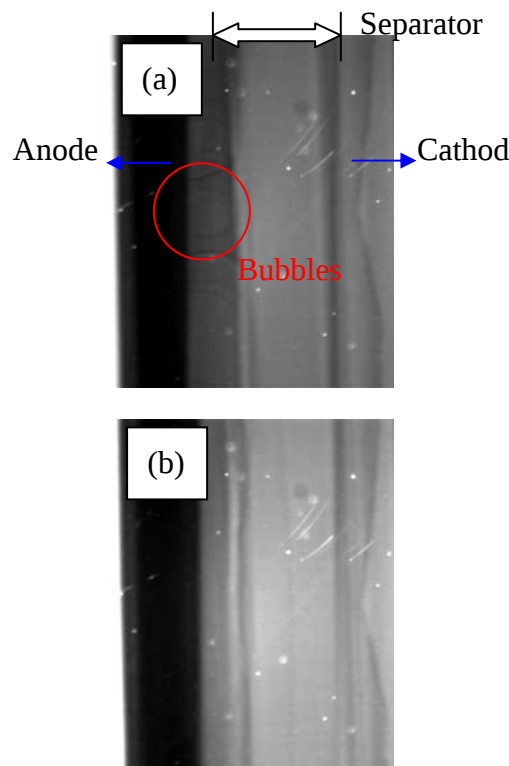


Figure 1. In-situ semi-white X-ray image of Li-ions cell comprised LiFePO_4 as cathode, MCMB as anode, and 1.0 M LiPF_6 in EC/DEC ($v/v = 1/1$) as electrolyte in (a) charge and (b) discharge process at 30°C .

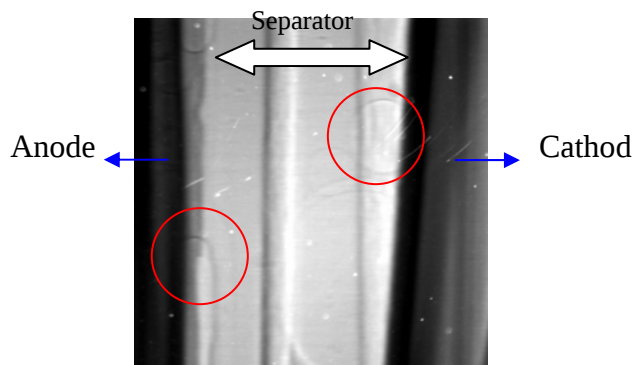


Figure 2. In-situ semi-white X-ray image of Li-ions cell comprised LiFePO_4 as cathode, MCMB as anode, and 1.0 M LiPF_6 in EC/DEC ($v/v = 1/1$) as electrolyte in (a) charge process at 55°C .

Reference

[1] A. S. Gozdz and R. K. Jaworski, Abstract 43, p. 52, The Electrochemical Society Meeting Abstracts, Vol. 96-1, Los Angeles, CA, May 5-10, 1996.