3D Morphology Studies of $LiFePO_4$/Bacterial Cellulose Cathode Material by X-ray Microscopy

Yun-Chih Lin (林允智)[1], Shin-Hong Chang (張士淙)[1], Bing-Joe Hwang (黃炳照)[1,2], Yen-Fang Song (宋豔芳)[2], and Gung-Chian Yin (殷廣鈐)[2]

[1]Department of Chemical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan
[2]National Synchrotron Radiation Research Center, Hsinchu, Taiwan

Introduction

$LiFePO_4$ was a novel cathode material that exhibited high electrochemical stability, high performance and low cost for Li-ion secondary battery. However, the electric conductivity and Li-ion diffusivity of olivine structured $LiFePO_4$ is still far from satisfactory levels. Therefore, the electric performance of conductive carbon and dispersion of $LiFePO_4$/carbon hybrid cathode material played the most important roles.

The bacterial cellulose of NATA film was an excellent carbon source for $LiFePO_4$/carbon hybrid cathode material. NATA with its network and high porous structure (Fig. 1) has ability to provide good electric performance.

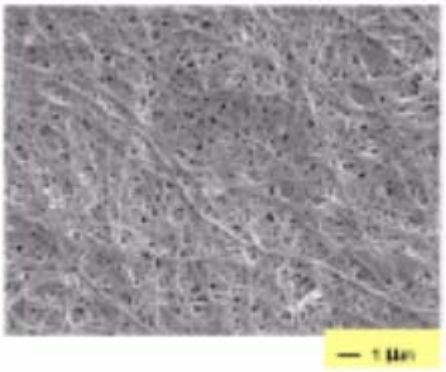

Figure 1. The surface morphology of NATA film.

In general, the carefully investigation of 3D morphology of $LiFePO_4$/carbon hybrid cathode material is difficult. Fortunatley, X-ray microscopy was a powerful tool to investigate the 3D structure of hybrid materials.

Results and Discussions

Figure 2 shows one slide of the 3D structure which was taken by X-ray microscopy for $LiFePO_4$/carbon hybrid cathode material. The black particles of $LiFeO_4$ adhered on the light matrix of carbonized NATA film can be seen. The well mixing of hybrid cathode material of $LiFePO_4$ and carbonized NATA film provided the excellent electrochemical cycling performance as shown in figure 3.

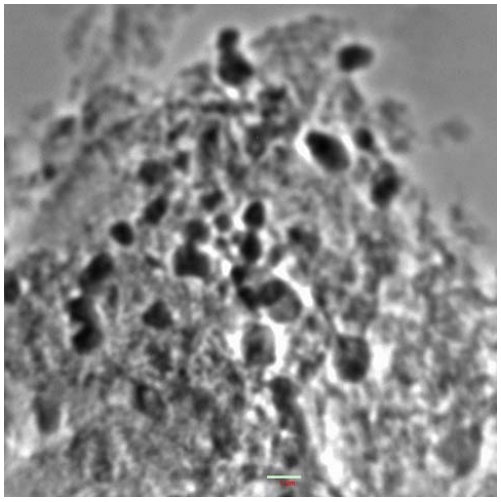

Figure 2. The 3D morphology of $LiFePO_4$/carbon hybrid cathode material

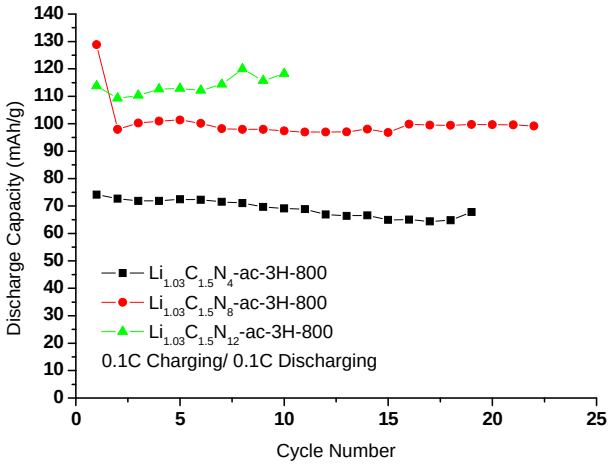

Figure 3. Cycling performance of various $LiFePO_4$/NATA carbon hybrid cathode materials