実験番号：2020D6005（3時間）

BL5S1

Observation of Mn in Manganese composite

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Keywords: electrode, composite

1. Background

Rechargeable aqueous zinc batteries (RAZBs) are highly promising candidates for large-scale energy storage because of the intrinsic safety, cost effectiveness, and the rich abundance of zinc. However, the lack of high-capacity cathodes and the operating voltage limitation imposed by the electrochemical stability window of water greatly restrict the attainable energy density of RAZBs. Metal–organic frameworks (MOFs) are built by metal centers and organic/inorganic ligands through coordination bonds, which have been well studied in many fields, such as in biochemistry, catalytic chemistry, and porous materials, have the advantages of tunable structures and versatile functionalities, and so on. MOFs derived materials with adjustable composition, morphology and structure can be obtained through hydrothermal reaction or calcining, which can not only maintain the structural diversity and porosity of MOFs, but also effectively improve their conductivity and stability. Therefore, one-step synthesis of MnO@C composite was designed by carbonized MOFs as a high-performance cathode for RAZBs. [1]

2. Experiments

X-ray absorption fine structure (XAFS) analyses of the composite with Mn were performed at Aichi Synchrotron Radiation Center (BL5S1). Each powder sample pressed as pallets were analyzed.

3. Results and Discussion

Recently, element-selective XAFS, including X-ray absorption near-edge spectroscopy (XANES) and extended X-ray absorption fine structure (EXAFS) spectroscopy, has been known as a important characterization for the MOF-derived composite, which can demonstrate the atomically dispersed metal atoms via verifying the absence of metal-metal bonds in the spectra. Thus, XAFS analyses were performed to investigate the local environment of Mn in composite. As shown in **Figures 1**, the obtained Mn K-edge XAFS spectra and k^3-weighted $\chi(k)$-function of the corresponding EXAFS spectra in R space, demonstrating that our samples are in accordance with that of the reference MnO sample with the valence state of Mn^{2+}. In addition, the strong peak located at 1.7 Å is attributed to the Mn-O. The peaks at 2.7 Å are assigned to Mn-Mn. Further analysis will be combined with other characterization.

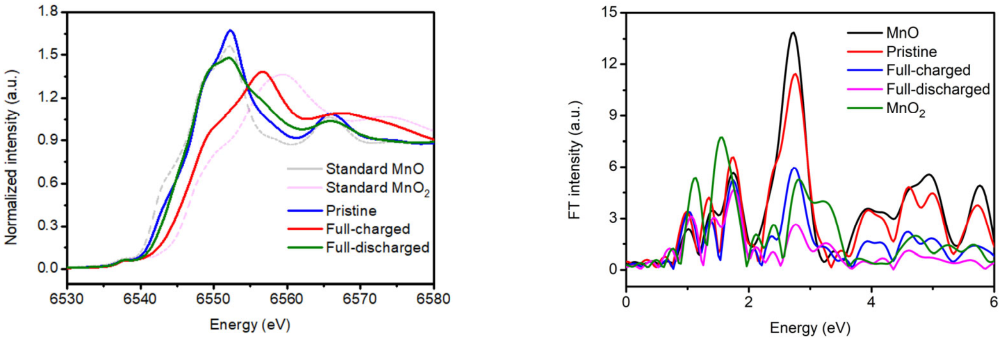

Figure 1. Mn K-edge XAFS spectra and k^3-weighted $\chi(k)$-function of the corresponding EXAFS spectra.

4. References

1. S. Dang; Q.-L. Zhu; Q. Xu, Nanomaterials derived from metal–organic frameworks. *Nat Rev Mater* 2017, 3 (1), 17075.