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Electrochemical properties of MOF anode materials for rechargeable Na ion battery

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1. Introduction

According to the rapid spread of the HV, Plug-in HV, EV, low cost, high power and high capacity rechargeable batteries are required. To meet these demands, Na ion secondary batteries were focused recently because of the infinite Na sources and wide selectivity of the active materials. Concerning about the anode materials, it is well known that typical graphite materials are not active for Na ion cell and quite a few anode materials for Na ion cell have been reported so far. It has been reported that hard carbon[1-2], alloys[3] and the transition-metal based materials[4-7] were acceptable anode materials for Na ion batteries. Furthermore, the metal-organic frameworks: MOFs[8,9] were reported as the organic type anode materials[10-13]. In this work, we investigate the electrochemical properties of MOFs anode materials for Na ion battery.

2. Experiment

MOF material ($Na_2C_8H_4O_4$) was synthesized by reacting the terephthalic acid with NaOH. Morphology and crystal structure were analyzed by SEM and XRD, respectively. The electrochemical properties of MOF materials as anode of Na ion battery were investigated by the coin type cell with Na metal as counter electrode in non-aqueous electrolyte, and working electrodes that were mixtures of synthesized MOF material, conductive carbon and binder.

3. Results and Discussion

From the result of XRD analysis as shown in Fig.1, the crystal structure of synthesized MOF material was confirmed as $Na_2C_8H_4O_4$ and it has an orthorhombic structure and indexed as space group $Pbc2_1$ (Fig.2). The electrochemical performance of $Na_2C_8H_4O_4$ material in Na cell was shown in Fig.3. The insertion potential plateau around 0.3V *vs.* Na/Na^+ was observed and the coulombic efficiency was good at first electrochemical reaction. From these experimental results, it is confirmed that MOF materials have potential as anode materials for Na ion rechargeable battery. Electrochemical properties of MOF materials and its derivatives will be presented.

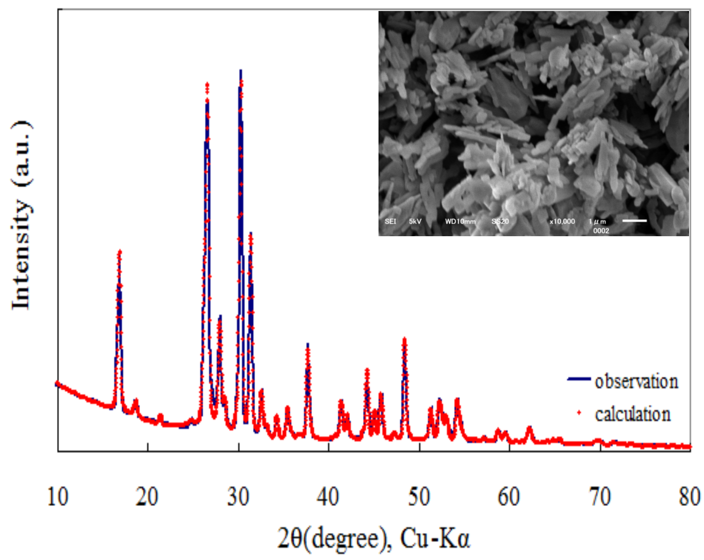

Fig.1 XRD pattern and SEM image of $Na_2C_8H_4O_4$ powder

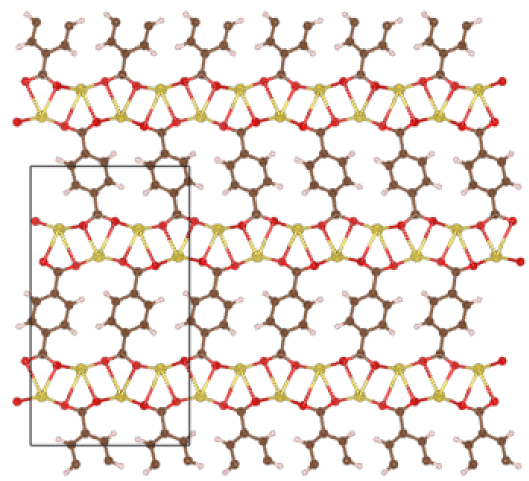

Fig.2 Crystal structure of $Na_2C_8H_4O_4$ material

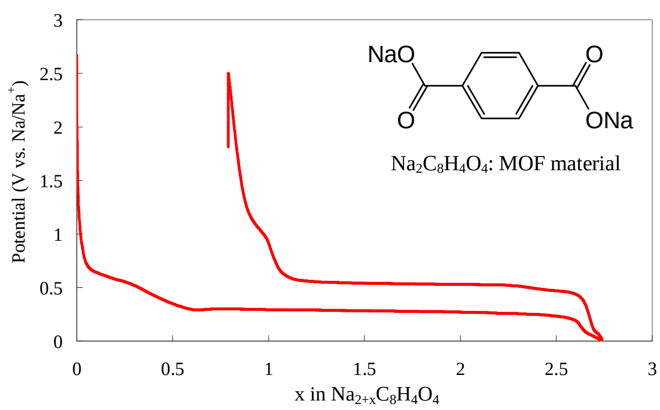

Fig.3 Initial potential profile of $Na_2C_8H_4O_4$ /Na cell

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