MnO_2 Nanowire Electrode Materials for Supercapacitors

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Electrode materials for electrochemical capacitors can be divided into carbon based materials, metal oxides, and conducting polymers. The last two kinds of systems involve faradaic reactions unlike carbon systems, which use the double-layer capacitance arising from the separation of charge at the interface between the solid electrode and an electrolyte.

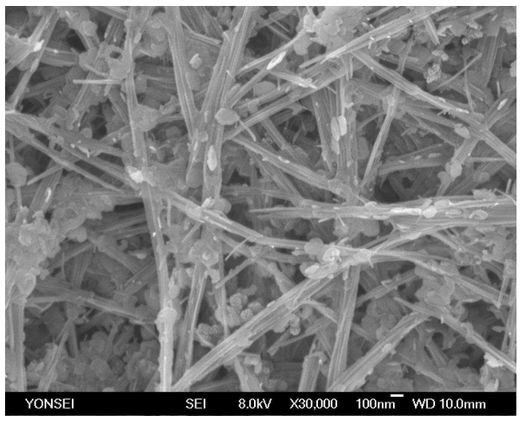
Among several transition metal oxides for electrode materials for supercapacitors, hydrous ruthenium oxide shows a high capacity of over 700F/g and excellent cyclability in aqueous H_2SO_4. Because of its high cost, alternative metal oxide electrode materials are being developed to replace ruthenium oxide. MnO_2 appear to be a promising electrode material because of its low cost, electrochemical reactivity and environmental friendly nature.

Use of high capacity materials having a highly porous structure would effectively combine high energy with high power characteristics. Materials characterized by a bicontinuous structure of a solid phase surrounding pores in the range of 10 to a few tens of nanometers, would be excellent candidate electrode materials for high-performance supercapacitors. Porous structure of such materials would allow the electrolyte to deeply penetrate within the solid phase. And very thin solid phase of the material would further reduce the length of the ionic paths for the ions participating in electrochemical reaction. In addition, increased conductivity of the active material in the electrode is very important to improve rate capability of a supercapacitor.

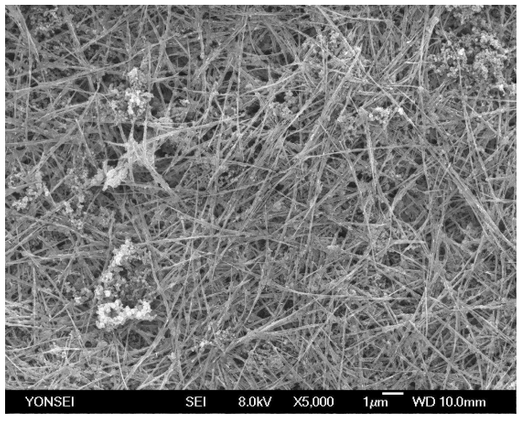
In this study, MnO_2 nanowires with diameter of 50nm and length 5μm range, were prepared by refluxing.

These nanowires were investigated in terms of their structural and electrochemical properties as electrode materials for supercapacitors.

Morphological, thermal, and electrochemical properties of MnO_2 nanowire electrode materials will be discussed in the meeting.



(a)



(b)

Fig. 1. SEM image of MnO_2 nanowire/Carbon composite; (a) 30,000 and 5000 magnifications.

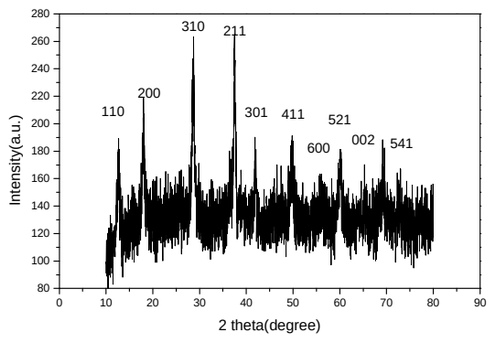


Fig. 2. XRD pattern of MnO_2 nanowires.