PREPARATION AND CHARACTERIZATION OF MANGANESE DIOXIDE FOR ELECTROCHEMICAL SUPERCAPACITORS.

Thierry Brousse, Mathieu Toupin and Daniel Bélanger[1].

Département de Chimie, Université du Québec à Montréal, Case Postale 8888, succursale Centre-Ville, Montréal (Québec) Canada H3C 3P8.

1. belanger.daniel@uqam.ca

Electrochemical supercapacitors are energy storage devices that can store more energy than traditional capacitors and discharge this energy at higher rate than rechargeable batteries [1]. In addition, the cycle life of electrochemical capacitors should far exceed that of battery systems. The three classes of materials that have been investigated for active electrode of electrochemical supercapacitors include conducting polymers, carbon and metal oxides [2-4]. In the latter category, ruthenium oxide is one of the preferred materials due to its very high charge capacity. However, its high cost limits its use in most applications and less expensive materials are required.

Along those lines, manganese dioxide has been recently prepared and characterized for application as active electrode materials in electrochemical capacitor [5-7]. In the first study, thin films of manganese dioxide were formed on nickel foil by electrodeposition and by dip-coating with manganese dioxide sols and their subsequent gelation and calcination [5]. These films were cycled in unbuffered Na_2SO_4 and differential specific capacitance of 698 F/g was reported. Lee and Goodenough have prepared manganese dioxide by reaction between potassium permanganate and manganese acetate and have shown that the resulting material yielded specific capacitance of ca. 200 F/g [6]. On the other hand, we have recently reported the chemical synthesis of manganese dioxide by a simple method and have shown that specific capacitance of about 150 F/g were obtained for a potential window of 0.9 V with composite electrode [7].

In this paper, the chemical synthesis of manganese dioxide by simple methods will be reported and the characterization of this material by various techniques as well as its electrochemical behavior in composite electrode for application in electrochemical capacitor.

ACKNOWLEDGMENTS

This work was funded by the Fonds pour la Formation de Chercheurs et l'Aide à la Recherche (FCAR) of the Québec government. The financial contribution of UQAM is also acknowledged.

REFERENCES

[1] Conway, B.E., Electrochemical Supercapacitors, Scientific Fundamentals and Technological Applications, Kluwer Academic/Plenum Press, New York, 1999.

[2] Fusalba, F.; Ho, H.A.; Breau, L.; Bélanger, D., Chem. Mater., 2000, 12, 2581.

[3] Bonnefoi, L.; Simon, P.; Fauvarque, J.F.; Sarrazin, C.; Sarrau,. J.F.; Dugast, A., J. Power Sources, 1999, 80, 149.

[4] Zheng, J.P.; Jow, T.R., J. Electrochem. Soc., 1995, 142, 2699.

[5] Pang, S.-C.; Anderson, M.A.; Chapman, T.W., J. Electrochem. Soc., 2000, 147, 444.

[6] Lee, H.Y.; Goodenough, J.B., J. Solid State Chem., 1999, 144, 220.M.

[7] Toupîn, M.; Bélanger, D., Extended Abstracts of the 4th International Symposium on New Materials for Electrochemical Systems, July 9-13, 2001, pp. 485-486.