SYNTHESIS OF CARBON-SUPPORTED MANGANESE (IV) OXIDE NANOCOMPOSITES FOR SUPERCAPACITORS APPLICATION

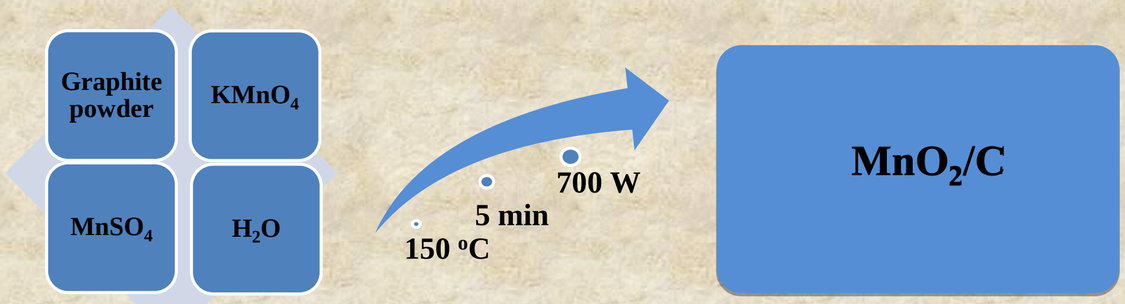
Jolita Jablonskienė*, Dijana Šimkūnaitė, Jūratė Vaičiūnienė, Giedrius Stalnionis, Audrius Drabavičius,

Vitalija Jasulaitienė, Vidas Pakštas, Loreta Tamašauskaitė-Tamašiūnaitė and Eugenijus Norkus

jolita.jablonskiene@ftmc.lt

Center for Physical Sciences and Technology, Sauletekio ave. 3, Vilnius, LT-10257, Lithuania

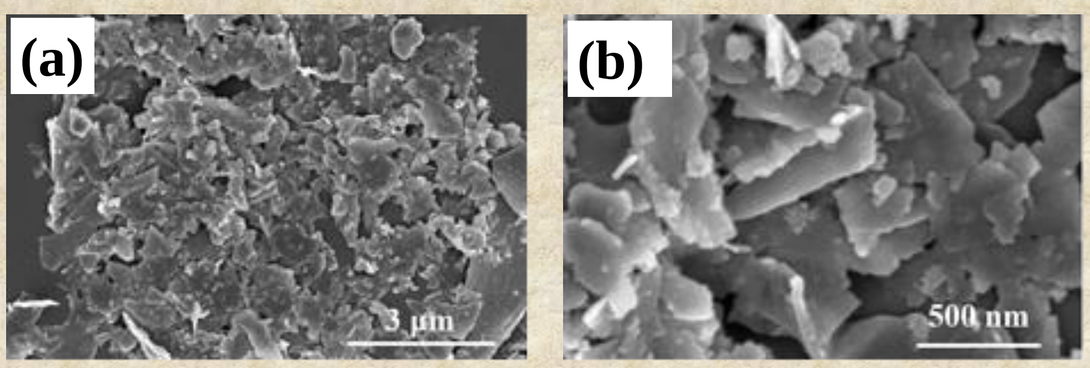
FORMATION OF NANOCOMPOSITES



INTRODUCTION

In this study, the carbon-supported MnO_2 nanocomposites (MnO_2/C) by the rapid and simple microwave-assisted heating method by employing manganese (II) sulfate ($MnSO_4$) or potassium permanganate ($KMnO_4$) and carbon powder as the microwave absorbing material. The electrochemical properties of the prepared MnO_2/C nanocomposites have been studied to evaluate the possibility of using these nanocomposites as potential supercapacitor electrode materials.

CHARACTERIZATION



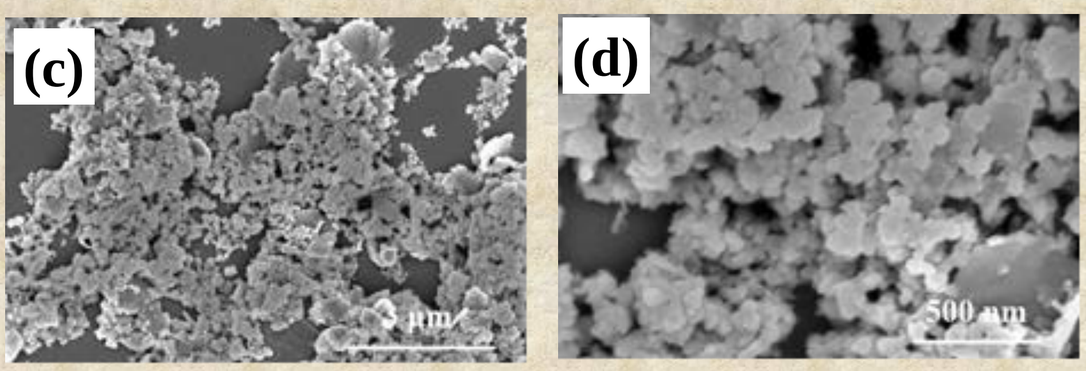


Fig. 1. SEM images of MnO_2/C: (a, b) sample S1; (c, d) sample S2 under different magnifications.

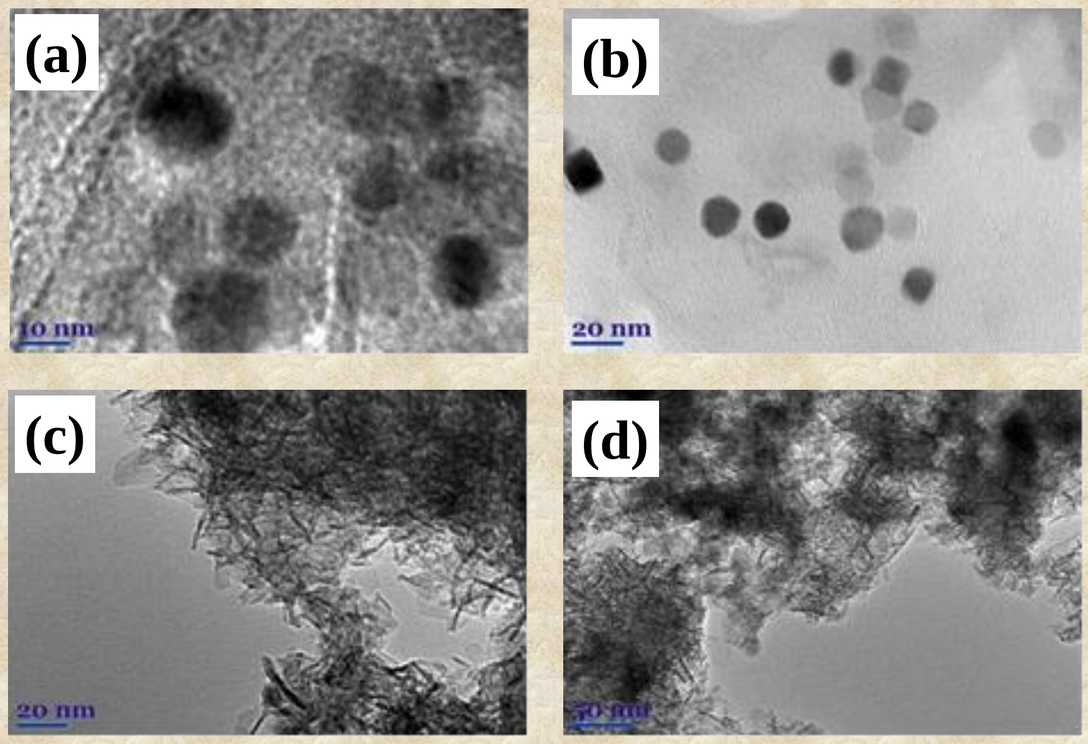


Fig. 2. TEM images of MnO_2/C: (a, b) sample S1; (c, d) sample S2 under different magnifications.

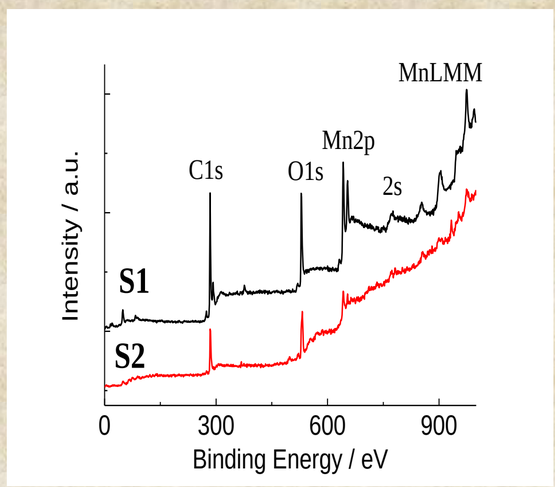


Fig. 3. Survey spectra for samples S1 and S2.

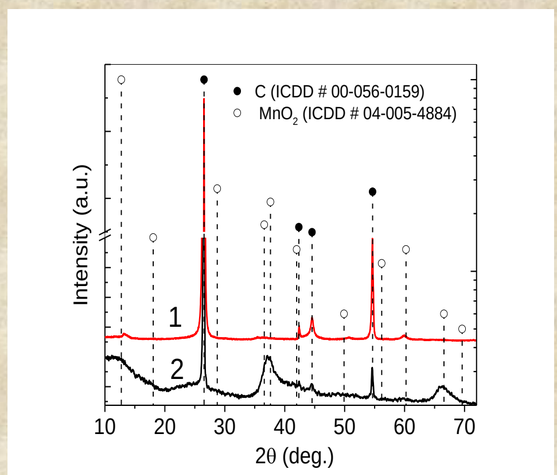


Fig. 4. XRD patterns of samples S1 (1 pattern) and sample S2 (2 pattern).

ELECTROCHEMICAL PROPERTIES

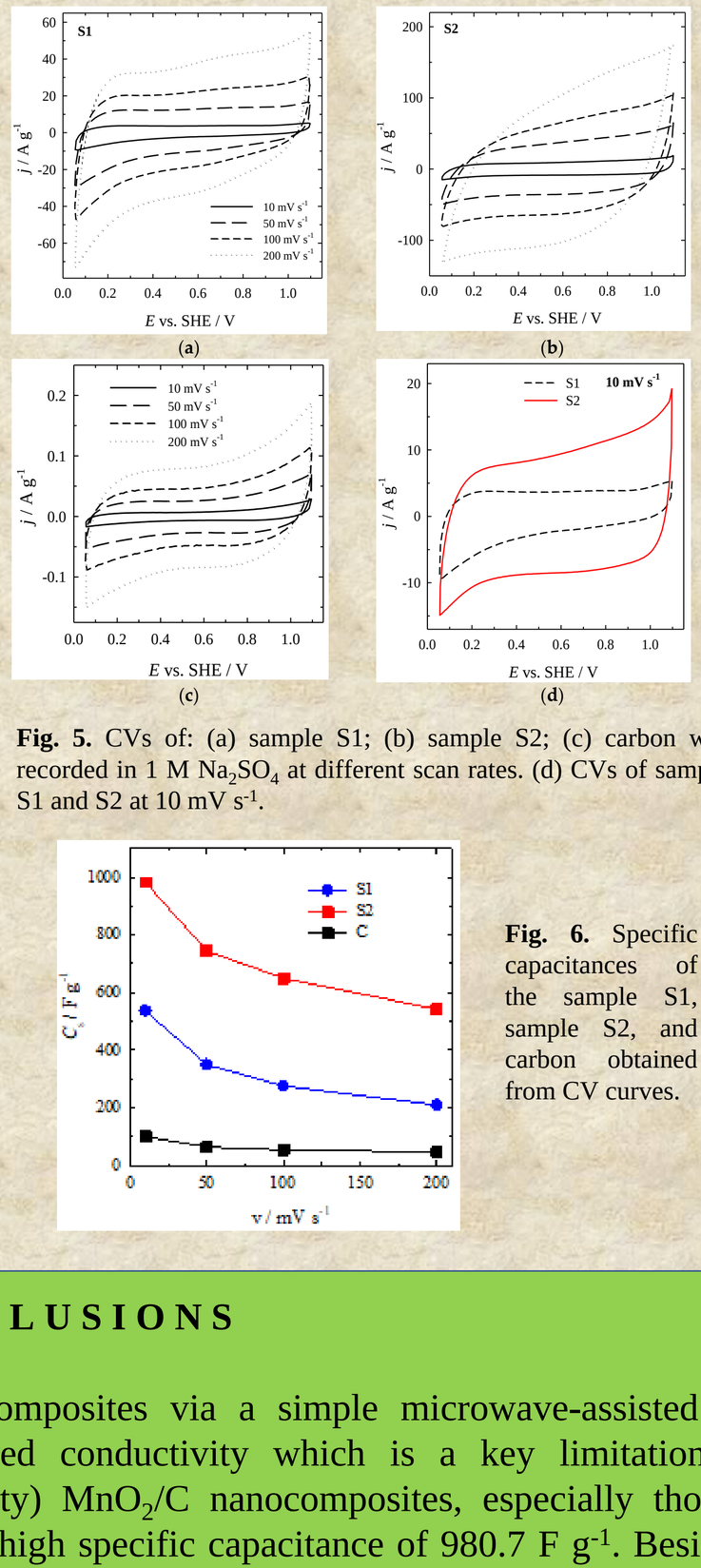


Fig. 5. CVs of: (a) sample S1; (b) sample S2; (c) carbon were recorded in 1 M Na_2SO_4 at different scan rates. (d) CVs of samples S1 and S2 at 10 mV s^{-1}.

Fig. 6. Specific capacitances of the sample S1, sample S2, and carbon obtained from CV curves.

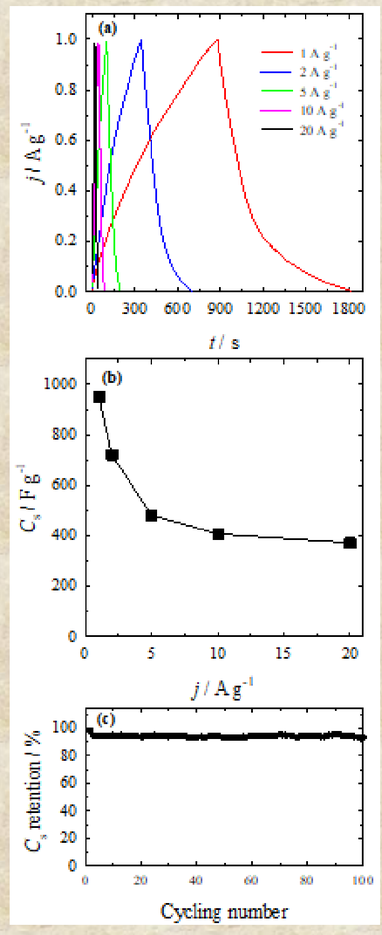


Fig. 7. (a) Galvanostatic charge / discharge curves of the sample S2 measured at different constant current densities of 1-20 A g^{-1}; (b) Specific capacitance obtained from galvanostatic charge / discharge curves with different current densities.

CONCLUSIONS

We have successfully fabricated carbon-supported MnO_2 nanocomposites via a simple microwave-assisted heating method. Different architecture containing MnO_2 nanocomposites demonstrate improved conductivity which is a key limitation in pseudocapacitors. The electrochemical measurements revealed that (due to this conductivity) MnO_2/C nanocomposites, especially those prepared via a two-step procedure, exhibit excellent electrochemical performance, including a high specific capacitance of 980.7 F g^{-1}. Besides, the specific capacitance retention was 93% after 100 cycles at 20 A g^{-1}, indicating good electrochemical stability. The obtained results demonstrate that the prepared MnO_2/C nanocomposites should be a promising electrode material for supercapacitor applications and could be further extended to fabricate other materials for supercapacitors.