MANGANESE-OXIDE-BASED ELECTRODE MATERIALS FOR ENERGY STORAGE APPLICATIONS

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Supercapacitors are identified as the bridge between lithium-ion batteries and conventional dielectric capacitors. They exhibit higher power density and longer cycle life than lithium-ion batteries, while possessing higher energy density and smaller size by comparison to traditional dielectric capacitors, leading to the gradual emergence in many high-tech fields as promising energy storage devices [1].

The performance of the electrode material plays an important role to determine the energy storage characteristics of supercapacitors [2]. Manganese-oxide-based electrode materials $LaMnO_3$ have been regarded as prospective materials for electrodes of supercapacitors application owing to their structural and chemical stability at high temperature, as well as the high electrical conductivity.

Therefore, this study is dedicated to exploring the crystal structure and electrochemical properties, charge-discharge characteristics, and the capacity of the $La_{0.7}Mn_{1.3}O_3$ electrode.

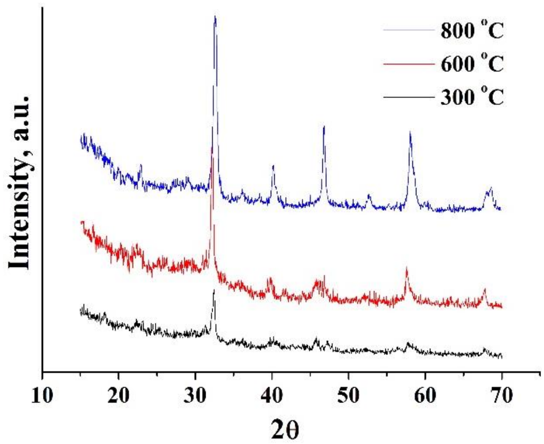

Figure 1 – XRD pattern of $La_{0.7}Mn_{1.3}O_3$ at 300°C, 600 °C and 800 °C

According to experimental X-ray diffraction data (fig. 1), it was established that synthesized $La_{0.7}Mn_{1.3}O_3$ by sole-gel method is monophasic sample after 800 ^{o}C for 3 hours have been obtained.

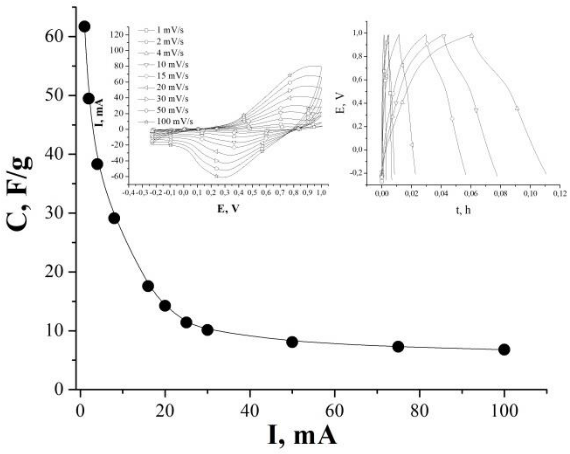

Figure 2 – The specific capacity, CV and the GCD curves of the $La_{0.7}Mn_{1.3}O_3$ samples 800 °C (insert)

Figure 2 show the obtained results value of specific capacity, cyclic voltammetry (CV) and galvanostatic charge-discharge (GCD) of $La_{0.7}Mn_{1.3}O_3$, samples. The perovskite-type $La_{0.7}Mn_{1.3}O_3$ stores energy through the oxygen-vacancy tailored redox pseudocapacitance, and the ion diffusion along the oxygen octahedral edges confirms the high diffusion rate and full utilization of the internal structure. Studies have shown that $La_{0.7}Mn_{1.3}O_3$ nanoparticles greatly improve the transfer kinetics of charge carriers and structural stability during discharge/charge cycle. The redox reaction of $La_{0.7}Mn_{1.3}O_3$ in charging and discharging process can be expressed as following: $Mn^{2+}\leftrightarrow Mn^{3+}+e^{-}$ and $Mn^{3+}\leftrightarrow Mn^{4+}+e^{-}$.

Funding: This work was funded by the NATO Partnerships and Cooperative Security Committee in the framework of the Science for Peace and Security Programme (G6166)

References:

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