MODIFIED CARBON MATERIALS FOR ENERGY STORAGE AND CONVERSION

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The development of technology and civilization have led to significant increase of interest in Renewable Energy Sources (RES) and portable electronics. These systems requires efficient power sources. The great attention has paid to Li-ion batteries, fuel cells and electrochemical capacitors. Electrochemical capacitors are the systems consisted of two electrodes (carbon electrodes) immersed in the electrolyte. Electrochemical capacitors are characterized by high power density, long cycling stability and quick charge/discharge. On the other hand, this system has low energy density. The increase in energy density can be realized by proper modification of the electrode material in order to increase the capacity of the capacitor. The increase in capacity can be achieved by the use of the pseudocapacitive effects which are the faradaic reactions occuring at the electrode/electrolyte interface.

The occurrence of these reactions is possible due to the presence of transition metal oxides or conductive polymers. A very good effect of increasing capacity can also be achieved by the presence of heteroatoms in the carbon material such as nitrogen and oxygen, which are part of the functional groups.

The aim of this research was to develop functional groups with nitrogen and oxygen on the surface of carbon materials as a result of the ozonation and ammonia treatment.

Commercial activated carbon was modified in order to introduce the oxygen and nitrogen functional groups. The process of modification was performed by ammonia treatment followed by the reaction with ozone. The modified and unmodified carbon materials were used as electrode materials of an

electrochemical capacitor. In order to determine the processes occurring at the electrode/electrolyte interface the broad physicochemical and electrochemical analysis were performed. The electrochemical research was carried out in a two- and three-electrode cell assembled in a Swagelok® system using a BioLogic VMP3 potentiostat/galvanostat. The electrochemical properties were examined by galvanostatic charge/discharge, cyclic voltammetry and electrochemical impedance spectroscopy.

Based on the conducted measurements it can be concluded materials after being modified are rich in functional groups responsible for the pseudocapacitive effect. Based on the obtained results, it was found that appropriate modification of the electrode surfaces improves cell parameters such as capacity and cycling stability.

Acknowledgments

The authors acknowledge the financial suport from the Ministry od Science and Higher Education (Poland) – subvention 2024