Nowadays, with the increase of ecological awareness, societies are increasingly paying attention to the energy problems of the world around us. Focusing on moving away from the use of conventional energy sources such as coal, oil or natural gas, and replacing them with ecological renewable sources, e.g. wind or solar energy in photovoltaic systems. However, the use of new technologies entails the need to change the approach to the electricity storage and conversion problem. Because renewable energy sources cannot be stored, and the efficiency of wind and solar power plants depends on the weather to ensure continuity of supply, this energy must be processed and stored. Currently, the large scale energy storage is mostly done by converting it into physical form, e.g. compressed air, pumped hydro systems. However, it is also possible to store energy in chemical form in electrochemical cells or capacitors. Energy storage in chemical form is currently used on a small scale mainly in vehicles and energy backup systems (UPS). The main advantage of currently used solutions of this type is fast response time and high volumetric capacity (Ah/m^3). However, the use of electrochemical cells carries high maintenance costs associated with their limited lifetime and safety.

The problem of stability of electrochemical cells can be solved by using additional electrochemical capacitors, which can significantly reduce the operating costs. In theory, the cyclic stability of electrochemical capacitors accumulating charge in the form of an electrical double layer is unlimited. However, in practice due to the interaction between the electrolyte and the carbon electrode material their cyclic stability is finite. When the capacitor ages, the positive electrode degrades, significantly reducing its capacity and applicability.

The cognitive goal of the proposed research is to determine the impact of the physicochemical properties of activated carbon, in particular, the role of individual surface carbon functional groups on the positive electrode oxidation process. An additional goal is to introduce into the solution redox ions that will protect the positive electrode from degradation during charge/discharge cycling.

The planned tests will include tracking changes in the composition and type of functional groups present on the carbon surface during electrochemical aging of the positive electrode in organic electrolyte solutions. The obtained results will allow a better understanding of the impact of the function group on the degradation process of the carbon electrode.

The results of these studies will have cognitive and developmental significance. Knowledge and understanding of phenomena occurring at the electrode/electrolyte interface will allow electrochemical capacitors being more effectively used, e.g. in energy storage processes.