

The project “Study of electrode/electrolyte interface of high stability and quick charge response” is a significant step towards finding new materials able to supply capacitive charge over 100 F/g with an ultrafast propagation.

The high capacitance values (C) might be achieved if the electrodes with well-developed surface area (S) and appropriate electrolytic solutions are implemented. Electrodes based on dichalcogenides, carbon nanotubes, graphene and their composites will be used. Conductivity as well as mesoporous character will play a crucial role in charge storage. Taking into account environment approach our investigations are limited to aqueous electrolytic solutions. Especially, neutral salts as less corrosive will be applied. Redox active species added to electrolytes or immobilized in the electrode bulk will greatly increase capacitance values. Among various redox couples only highly reversible and stable during cycling will be selected.

It has been found that choline (a popular nutrient for poultry and animals) can serve as a beneficial electrolytic component. Very high capacitance values can be reached by porous electrodes soaked with such electrolyte.

Furthermore, high capacitance values accompanied by wide operational voltage window (U) ensure high energy (E) accumulated according to formula ($E=0.5CU^2$). Nevertheless, there is a limit of ca. 1.6V for the aqueous electrolyte stability which is difficult to overcome if the electrode is made of the material with the well-developed surface area.

In this project materials with capacitive as well as photoactive properties will be investigated. Taking into account a great interest in photovoltaics, this topic is presently very actual. Synergetic effect of capacitive and photo-active functions at the designed interface are expected.