Short summary

Thesis title: Fully electrospun flexible poly(styrene-co-acrylonitrile) supercapacitor electrodes

The aim of this thesis was to produce novel electrospun poly(styrene-co-acrylonitrile) and carbide-derived carbon composite membranes which could be used as flexible and free-standing supercapacitor electrodes.

The prepared supercapacitor electrodes were nanofibrous composite membranes of poly(styrene-co-acrylonitrile) and carbide-derived carbon that could be bent, folded and twisted without any visual damage, and in addition possessed high specific capacitance and sufficient tensile strength. The electrospinning solutions and dispersions were prepared via two different methods. Solution and dispersion properties such as rheology and electric conductivity were evaluated to compare the different preparation methods, different dispersions and study their influence on the membrane's properties.

The electrospun membranes were characterised by various techniques and their properties, including morphology, conductivity, porosity, specific surface area, tensile strength and specific capacitance were determined. These results were analysed to find correlations between the different properties and to evaluate the application of prepared membranes as the supercapacitor electrodes. Finally, the produced electrodes were compared to other flexible supercapacitor electrodes described in scientific literature.

Overall, the best specific capacitance result obtained in this work (72 $F \cdot g^{-1}$) is comparable to the capacitance results of other flexible electrodes reported in scientific literature, but their exact comparison is difficult due to the different electrolytes used in the measurements. However, only very few of these flexible electrodes were also foldable and twistable similarly to the membranes obtained in this work, rendering these properties of EDLC electrodes quite unique. After some further improvement of the specific capacitance of the prepared membranes, they could be potentially used as supercapacitor electrodes in wearable and portable electronics.