Summary

Li–sulfur secondary batteries are one of the prominent possibilities of future battery systems with a promise of better theoretic specific capacities and energy densities. In order to understand its achieved performance, it is paramount to understand the contributions to its internal resistance. This is also the stand point, from which the research in this dissertation has been conducted.

The influence of the electrolyte's physicochemical properties on battery performance was evaluated and since this study showed that the solubility of polysulfides in the electrolyte is a very important parameter, our focus shifted to electrolytes with fluorinated ether compounds, which showed sparing solubility of Li_2S_x species. Fluorinated ether electrolytes were also used to construct high-energy cells with low electrolyte amount. The origin of all the impedance contributions was distinguished using simplified model experiments using glassy carbon electrodes and symmetrical cells. This knowledge was then used to complete the understanding of the impedance spectra of a "conventional" porous cathode Li–S cell. The deposition of Li_2S, which forms electrochemically and chemically in the cell, was also described.