Electrochemical impedance of an alkaline organic flow battery

Flow batteries have in recent years been recognised as a technology with high potential for use in grid-scale electrical energy storage. However, the system costs are currently impeding widespread utilisation of the technology in the energy grid. A price reduction could be achieved by changing from vanadium-based to organic-based electrolytes [1], and by increasing the system performance. The latter requires identification and quantification of the processes that contribute to voltage losses in the system. This can be done using electrochemical impedance spectroscopy (EIS), a technique that enables the resolution of the different contributions to the internal resistance within an electrochemical system. The resistance contributions are identified and resolved by fitting a model to the experimentally obtained spectra, which takes into account the various electrochemical and physico-chemical processes occurring in the system. Studies of flow battery impedance have previously been done on the vanadium system [2–4] and on an organic/organometallic system [5]. In this work, we investigate the losses in the alkaline 2,6-dihydroxyanthraquinone/ferrocyanide system, originally proposed by Lin et al. [6], through EIS. The impedance response of a full cell is measured and resolved into the series, charge-transfer, and finite diffusion resistances.

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