Mechanism of Charge Transport in Quinone-Pyrrole-Polymer Materials

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There is currently a large interest in developing organic electrode materials for use in rechargeable lithium ion batteries [1]. Organic electrodes can be made from biomass in low temperature processes, leaving a smaller carbon footprint from production. Utilization of such electrodes will create batteries which are environmentally friendly during their entire life cycle.

In order to design organic electrodes with desirable high power performance, it is important to understand the kinetics of the system. By utilization of functionalized conducting polymers, it is possible to obtain electrically conductive electrodes able to withstand rapid charging and high power applications. We have previously studied a composite material comprising high surface area nano fibrillated cellulose coated with the electronically conductive polymer, polypyrrole [2]. Devices using such composite material as both electrodes were found to be stable for at least 4 000 cycles, during galvanostatic cycling [3]. By reacting pyrrole and benzoquinones it is possible to obtain a material which is redox active through both the conductive polymer and the quinone moieties. In this work, we have studied the means of electron transport in the pyrrole-quinone composites. We also present our latest effort concerning spectroelectrochemical characterization of the conducting redox polymer.

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