Sri Lankan Natural Rubber based Electrolyte for Electrochemical Double Layer Capacitors

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Energy storage devices have received a global interest today to satisfy the increasing thirst for power. Solid polymer electrolytes (SPEs) play an important role being the ion conduction medium between the two electrodes of those devices. One crucial problem with many SPEs is their high cost due to use of commercial polymers. Recently, natural rubber (NR) has been recognized as a very suitable substitute for such expensive polymers. As NR is an insulator, several modification methods have been adopted to make it suitable for SPEs. Main objective of the present investigation was to check the suitability of NR based SPE to be used for an EDLC. This paper reports about a SPE prepared using methyl grafted NR (MG 49) and a Li salt with tetrahydrofuran following solvent casting method. A thin, bubble free film could be obtained. Samples were prepared varying the salt concentration. Impedance data were gathered at room temperature and the ionic conductivity was calculated for each sample. For the sample that showed the highest conductivity, impedance data were collected varying the temperature. For the electrochemical double layer capacitors (EDLCs), electrodes were prepared using Sri Lankan natural graphite. Performance of EDLCs were monitored using cyclic voltammetry and galvanostatic charge discharge tests. The highest ionic conductivity at room temperature was 3.62×10^{-5} S cm^{-1} at the salt concentration of 40 wt%. Single electrode specific capacity was depending on the potential window and the scan rate use for cycling. An initial single electrode specific capacity of 0.94 F g^{-1} was observed from EDLC. It reached a value of 0.55 F g^{-1} during 500 cycles. Single electrode specific discharge capacity dropped very fast at the beginning and then was constant around 0.05 F g^{-1}. Investigations are in progress to improve the ionic conductivity of SPE and to improve the performance of EDLC.

Keywords: Natural rubber, Electrochemical double layer capacitors, Cyclic voltammetry, Galvanostatic charge discharge test