

A Natural Rubber based Electrolyte to be used in Electrochemical Double Layer Capacitors with Sri Lankan Graphite

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Abstract

In the modern technology based world, it has become a great challenge to seek solutions for fulfilling the enormous demand for energy efficiently and effectively. Renewable energy sources have been identified as viable candidates for this purpose due to their safety and low cost. Automatically this has highlighted the importance of energy storage devices. Batteries and capacitors have been used as energy storage devices but, the present demand exceeds their supply. Supercapacitors have emerged as a new link to bridge the gap between batteries and capacitors. In the present study, an electrochemical double layer capacitor (EDLC) which is a type of supercapacitor was fabricated and its performance was evaluated. The novelty of the investigation is use of Sri Lankan natural rubber (NR) and natural graphite (NG) as the electrolyte and electrode respectively. Electrolyte was prepared using solvent casting method. Graphite was used with polyvinylidene fluoride as the binder. Cyclic voltammetry and electrochemical impedance spectroscopy were the characterization techniques used in the study. Single electrode specific capacity increased with widening the potential window of cycling. But, some additional reactions were observed with wider potential windows. When increasing the scan rate, single electrode specific capacity showed a decreasing trend. At the scan rate of 2 mV/s, it was about 740 mF/g whereas at the scan rate of 100 mV/s, the value was 85 mF/g. EDLC withstood continuous cycling with low capacity degradation. An initial specific capacity of 300 mF/g reduced to 122 mF/g with continuous cycling for 500 cycles. Charge storage mechanism is taken place electrostatically only. Capacitive properties became dominant at low frequency regions. This EDLC showcases the suitability of using NR and NG for energy applications while adding value to the raw materials.