Ag/Biochar Composite for Supercapacitor Electrodes

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Abstract - The development of new electrical energy storage devices and the improving of existing ones e.g. batteries and supercapacitors (SC) has become extremely important due to increased application of these devices in transportation and in renewable energy storage. Among them, SC are more capable of generating higher power density than are batteries, and are gaining particular interest. They are used for recovering brake energy in electrical vehicles and locomotives and for enhancing the energy efficiency of instruments requiring a peak power source. They can eliminate idling and consequently reduce fuel consumption, emission of harmful pollutants and maintenance cost and prolong engine life. However, SC store significantly less energy than batteries. One way to increase the energy storage capacity of SC without compromising their cost is to enhance the performance of electrodes. Low-cost and high-performance materials for the electrodes have been extensively investigated. The most utilised material for SC electrodes is carbon (from different sources and in different forms). Canada is rich in biomass, which is one of the potential sources of carbon for these applications. Biochar (BC) from woody residue has unique pore morphology. Its potential as a carbon source for the SC electrodes has been reported in many recent studies [1-5]. It has been observed that the physical and electrochemical properties of the BC highly depend on the source of biomass, its carbonization conditions and any subsequent activation methods. One of the key criteria for utilizing activated BC (a-BC) as an electrode material is its electrical conductivity. In this work, a potential method has been proposed for the impregnation of Ag ions into the a-BC to prepare a composite material with high electrical conductivity.

The results obtained from electrochemical measurements showed that electrodes composed of Ag/(a-BC) have higher electrical conductivity and better performance compared to a-BC based electrodes (Fig.1). The highest specific capacitance of 475 F g^{-1} in aqueous 3M $LiN((SO_2CF_3)_2)$ electrolyte was achieved which is almost 42% higher than the previously reported value (335 F g^{-1}) for electrodes composed with of a-BC [1].

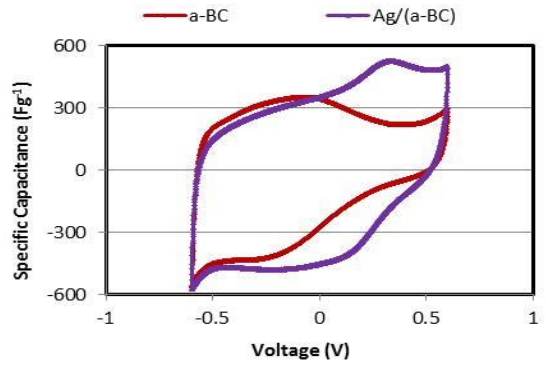

Fig.1. CV curves at 5mV s-1 scan rate

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