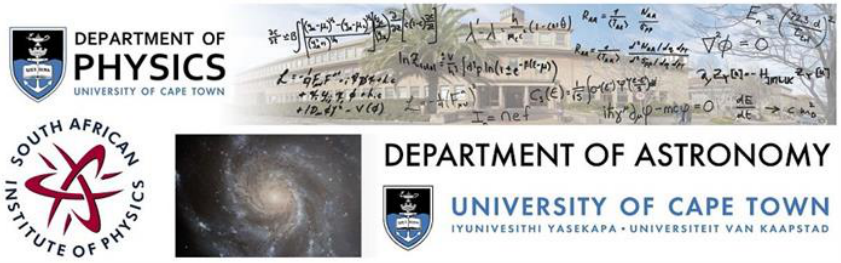

Contribution ID: **298** Type: **Oral Presentation**

Activated carbon derived from tree bark biomass for high performance electrochemical capacitors

Friday, 8 July 2016 09:40 (20 minutes)

Abstract content
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ABSTRACT
Activated carbon from tree bark (AC-B) has been synthesized by a facile and environmentally friendly activation and carbonization process at different temperatures (600, 700 and 800deg; C) using potassium hydroxide (KOH) as an activation agent with different mass loading in an attempt to optimize the activation process in obtaining a uniformly porous material. The physicochemical characteristics of the as-obtained AC-B material were studied using scanning and (SEM), N2-adsorption/desorption measurements, Raman spectroscopy, X-ray photoelectron spectroscopy etc. The microscopy results reveal an interconnected porous architecture with an ion-accessible surface required for fast ion transport. The BET specific surface area (SSA) obtained show an improved SSA with increasing carbonization temperature up to 1018 m2 g-1 and a high pore volume of 0.67 cm3 g-1 in the presence of active micro/mesopores. The electrochemical capability of the AC-B material was investigated as a potential supercapacitor device electrode in different neutral aqueous electrolytes (NaNO3, Na2SO4, and KCl) via different techniques such as cyclic voltammetry, galvanostatic charge/discharge and impedance spectroscopy in a three (3) electrode configuration. The device electrode exhibited the best EDLC behaviour with the Na2SO4 electrolyte working in both positive and negative potential range. A specific capacitance of 155 F/g at a current density of 1 A/g was obtained for the AC-B material in a 0.80 V operating potential window. The cycling stability of the device was depicted in its overall coulombic efficiency which remained relatively stable even after 2,000 cycles. The result obtained provides a means of using cheaper biomass material in the production of high surface area activated carbon with outstanding electrochemical properties for supercapacitor applications.

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Primary author: Dr MOMODU, Damilola (UNIVERSITY OF PRETORIA)

Co-authors: Mr BELLO, Abdulhakeem (Department of Physics University of Pretoria); Mr KHALEED, Abubakar (University of Pretoria); Ms UGBO, Faith (University of Pretoria); Mr OYEDOTUN, Kabir (University of Pretoria); Dr DANGBEGNON, Kouadio Julien (University of Pretoria); Mr MADITO, Moshawe (Student); Mr OLANIYAN, Okikiola (University of Pretoria); Ms MASIKHWA, Tshifhiwa Moureen (University of Pretoria); Dr BARZEGAR, farshad (University of Pretoria)

Presenter: Dr MOMODU, Damilola (UNIVERSITY OF PRETORIA)

Session Classification: Applied Physics (1)

Track Classification: Track F - Applied Physics