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Surface modification of carbon nanomaterials with organic coatings for electrochemical capacitor electrodes

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Electrochemical capacitors (ECs) are energy storage devices with characteristics of high power and energy density, fast charging and discharging and long cycle life. Significant efforts have been invested to develop new electrode materials to meet the fast-growing demands in energy storage. Numerous strategies have been explored, including tuning the properties of porous carbon electrode to improve pore accessibility, using conductive polymers and developing transition metal oxide electrodes to achieve higher performance. However, these materials still have some limitations such as structural instability and high cost. Here, an alternative approach is employed and uses composite electrode materials for improved energy density and electrode stability. This study aims to develop electroactive organic coatings such as luminol on carbon nanotube (CNT) via simple chemical deposition and to understand the structure, reactivity and stability of the composite material. The surface of CNT films is chemically modified with polyluminol (CpLum) via an oxidative *in-situ* polymerization reaction. Electrochemical analysis and surface characterization techniques were used to evaluate the performance of the developed composite and compare to that of bare CNT. The optimal polymerization condition was identified for the surface modification of polymerized luminol on CNT. The thickness of the polymer reached a saturation of 6.5nm with small polymer chains wrapped around CNTs. CpLum contributed to the charge storage via pseudocapacitance with multiple redox reactions on the surface and demonstrated a four times increase in area-specific capacitance. This work demonstrates that the surface engineering of CNT can be achieved using electroactive organic coatings as surface modifiers for EC electrodes. *In-situ* polymerization is a simple and effective way to deposit and polymerize luminol molecules on CNT with good surface coverage. Overall, the composite electrode exhibited improved charge storage capability with increased capacitance and high electrode stability.

Biography

Jeanne N'Diaye Received her B.Sc. and M.Sc. degrees in chemistry from the University of Quebec in Montreal and is currently pursuing her PhD in materials science and engineering at the University of Toronto. Her research focuses on the development and characterization of new nanomaterial composites based on organic compound for energy storage.

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