# Electrodeposited Thin Films of Carbon for Use in Electrical Double Layer Capacitors

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Electrical double layer capacitors (EDLCs) are currently the focus of significant research due to their potential as an efficient, high-grade energy source. The performance of EDLCs is predominantly determined by the electrode, and as such, optimizing the electrode materials is a research priority.

Commercially available EDLCs typically use powdered activated carbon due to its extremely high surface area (>2500 $m^2/g$) and its relatively easy and inexpensive production process. High surface area powdered materials are commonly used in electrochemical capacitors because they can be used in bulk quantities to create devices with very high capacitance.

Thin film electrodes are however another option, offering some advantages over powdered materials. Thin films are electrodes that are in the order of tens of nanometers thick. They are often prepared via electrodeposition which means that the material can be deposited easily and directly onto the required substrate and hence have low resistance and good electrical conductivity. For metal oxides such as $MnO_2$, this has resulted in thin films with extremely high specific capacitance per unit area, compared to powdered materials [1]. Powdered materials, by comparison, are more difficult to prepare and require additives to be used as an electrode.

This research is focused on examining electrodeposited thin films of carbon as a potential electrode material for electrochemical capacitors. In this work, carbon was electrodeposited onto a graphite substrate from a molten $Li_2CO_3/Na_2CO_3/K_2CO_3$ eutectic under varying electrochemical conditions. The resulting material was characterized using TEM, SEM and XRD. The electrodeposited carbon was also examined using cyclic voltammetry to determine its electrochemical behaviour and specific capacitance.

1. Cross, A., et al., *Journal of Power Sources*, 196 (2011) 7847-7853.