

## **Electro-exfoliating graphene from graphite for direct fabrication of supercapacitor**

### **ABSTRACT**

A facile production of graphene via electro-exfoliation is demonstrated using different types of oxidizing agent ( $\text{HNO}_3$ ,  $\text{NaNO}_3$ ,  $\text{H}_2\text{SO}_4$  and  $\text{H}_2\text{O}_2$ ) in the presence of sodium dodecylbenzenesulfonate as a surfactant. Different types of surfactant–oxidizing agent solutions in different concentrations significantly influenced the electrochemical exfoliation of graphite rod. The surface morphology, layer thickness and defects of the as-produced graphene are further evaluated. Additionally, the as-produced graphene is fabricated as a supercapacitor electrode via direct vacuum filtration. Nylon membrane and polymer gel, each containing 2.0 M of potassium hydroxide, are utilized to investigate the influence of the electrolyte type on the capacitance performance. Upon 1000 charge/discharge cycles, the nylon membrane electrolyte recorded capacitance retention of 94%, whereas the polymer gel electrolyte recorded an impressive capacitance retention that exceeded 100%. The potential of the fabricated supercapacitor for real applications is manifested by its ability to light up a light-emitting diode upon charging.

**Keyword:** Graphene; Surfactant; Oxidizing agent; Electrochemical exfoliation; Supercapacitor