

## ELECTROCHEMICAL EXFOLIATION OF GRAPHITE INTO GRAPHENE WITH BLACK TEA

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Graphene is a monolayer of carbon atoms, bound in a hexagonal honeycomb lattice, and layers of graphene from graphite. It has attracted attention due to its wide range of possible applications and academic interests on its unique properties. However, graphene is not a rare substance, and there are over four million graphene layers in a 1 mm thick graphite sheet. Several methods, such as mechanical exfoliation, chemical vapor deposition, carbon dioxide reduction and chemical exfoliation, have been used to produce graphene. In this work, vein graphite found in Sri Lanka was successfully exfoliated to graphene using an electrochemical exfoliation and prolonged sonication. Raw vein graphite pieces were used directly as both electrodes along with aqueous K<sub>2</sub>SO<sub>4</sub> electrolyte for the electrochemical exfoliation process. The suspension for the sonication was prepared by mixing the yield of electrochemical exfoliation and a black tea solution. The replacement of toxic and costly solvents, such as dimethylformamide (DMF) and dichlorobenzene, by black tea is an advantage. Scanning electron micrographs were utilized to study the morphology of intermediates and yields of the process. X-ray diffraction patterns of graphene prepared were used to calculate the number of layers. This study confirmed that the resulted graphene had less than seven layers highlighting the successful exfoliation. Further, conductive graphene sheets (32 Ω sq<sup>-1</sup>) were fabricated by painting a suspension of graphene (10 mg mL<sup>-1</sup>) in DMF. A flexible supercapacitor (SC) was assembled by sandwiching a separator between two graphene-coated sheets (2×2 cm) using KOH as the electrolyte and stainless steel as current collectors. The gravimetric capacitance of the flexible SC prepared using exfoliated graphene is determined to be ~2.2 F g<sup>-1</sup>.

**Keywords:** Black tea, Electrochemical exfoliation, Graphene, Gravimetric capacitance, Supercapacitor