



NASA ARC Innovation Fund Award 2010

Novel Graphene based Ultracapacitors for Energy Storage

M. Oye, D.Niemann, C.V. Nguyen, J.E. Koehne, and M. Meyyappan

Project Description and Objectives

An ultracapacitor is a hybrid between a battery and a capacitor, capable of both high power density and energy density.

Goal is to develop a novel graphene based ultracapacitor for energy storage

NASA Applications: Energy storage from solar and wind sources, operation of rovers, robots

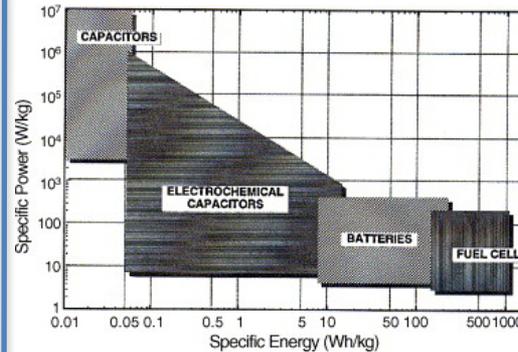
Motivation

We have previously fabricated carbon nanotube (CNT) based ultracapacitors with a record capacitance of 550 F/g.

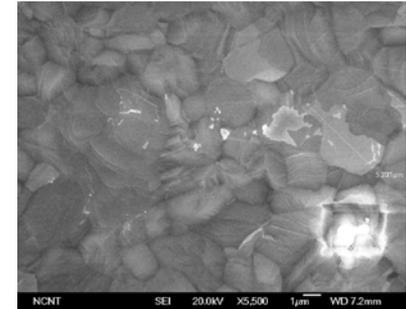
Lightweight graphene may offer higher performance per unit weight.

Mass production of graphene may be relatively safer than CNT production

Inherent resistivity of graphene is lower than other materials.



Various energy storage devices



Graphene layer from this work

Significance and Specific Tasks

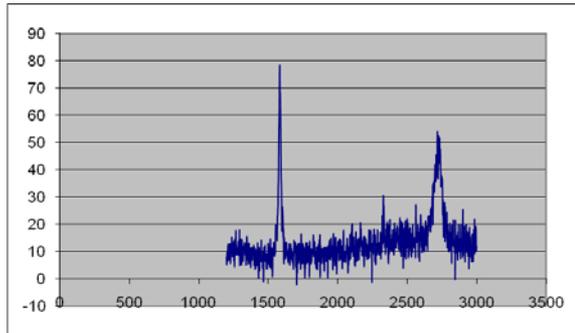
Energy storage technology is a critical national and global need. Commercial applications: consumer electronics, power tools, hybrid vehicles...

Tasks include

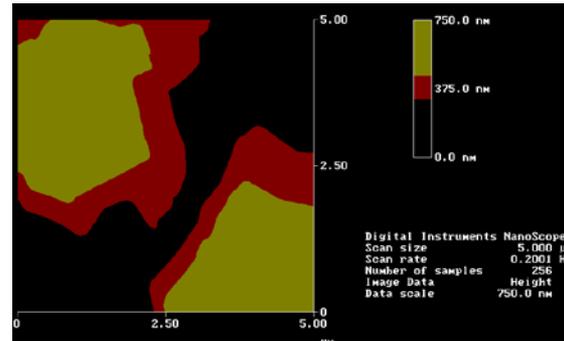
- Graphene growth by CVD
- Construction of an ultracapacitor
- Device testing

Accomplishments

- High quality single layer and bi-layer graphene has been synthesized by CVD and quality verified by Atomic force microscopy and Raman spectroscopy

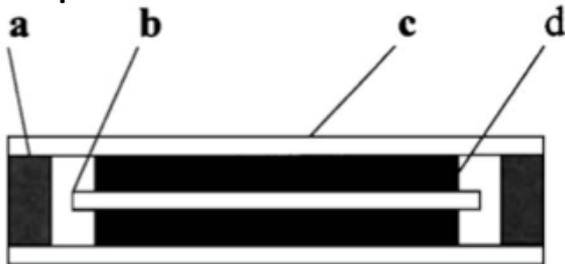


G' / G ratio of 0.7 indicating bi-layer



AFM showing single layer

- Test Capacitor Cell was constructed



Our test cell. (a) gasket, (b) separator, (c) collector metal, and (d) graphene electrode

- First test device shows a capacitance of ~ 10 F/g. Further work and optimization in progress.