Structural Characterizations Of Thermally Treated DNA-Dispersed Double Walled Carbon Nanotubes

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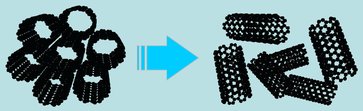
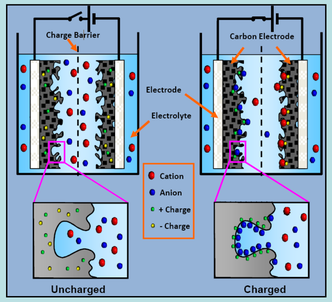
Background

Carbon Nanotubes:
- High specific surface area
- High electrical conductivity
- Ideal material for supercapacitor electrode



Dispersed nanotubes have a larger surface area to store charge

Supercapacitors:
- Defined by ability to store charge which translates to EVERLASTING battery

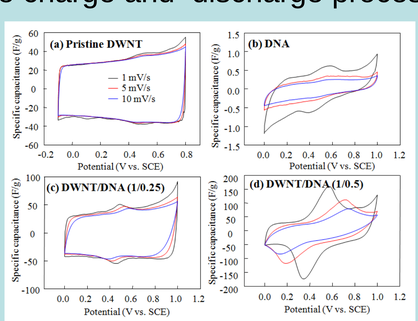


Purpose

Objective: Analyze physical changes during heating of DNA-DWNT films and evaluate its effects during the charge and discharge process

Importance:

ENHANCED ENERGY STORAGE



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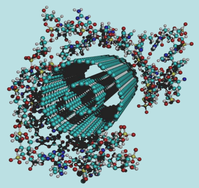
Method

Thin Film Fabrication:
- Disperse DWNTs with ssDNA and sonification
- Filtrate into film
- Heat to 600°C



ssDNA wrapped around DWNT

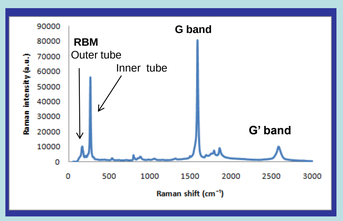
Analysis:
- In-situ Raman
- TEM
- SEM
- TG-DTA
- XPS

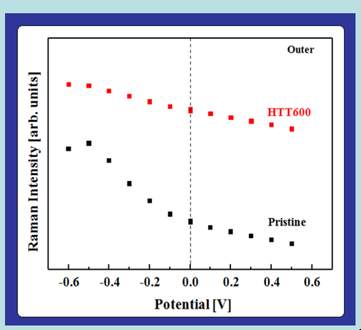
TEM

Filtration apparatus

Results

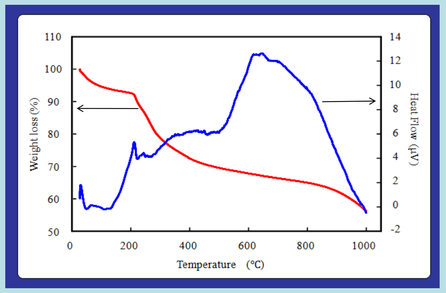
In-Situ Raman:
The outer tube of the heated DNA-dispersed DWNT accepts electrons less readily during the charging process than the non-heated sample





Results…

TG-DTA:
During the heating process, the film decomposes and looses 30% of its weight due to the decomposition of DNA

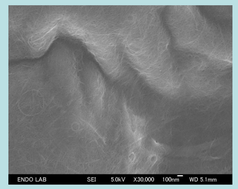


XPS:

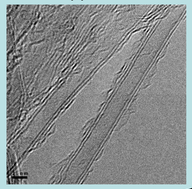
Sample I.D.	Na 1s [At.%]	O 1s [At.%]	N 1s [At.%]	C 1s [At.%]	P 2p [At.%]
Pristine	4.928	26.600	7.670	59.050	1.749
HTT600	2.459	8.486	2.586	85.350	1.124

SEM and TEM:
Single stranded DNA disperses DWNT

SEM-DNA/DWNT film



TEM-DNA wrapped around DWNT



Conclusion

During the heating process, the DNA-dispersed DWNT film decomposes to expose more carbon on the surface leading to a decreased electron acceptance rate during the charge process.

Future Work:
- In-situ Raman at different potentials
- Heat sample to different temperatures
- Look into further applications

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