
Energy Storage Materials Based on Nanotechnologies

Dr. Chul Wan Park

(Korea Electronics Technology Institute)

Energy Storage Materials based on Nanotechnologies

-focused on nano carbon materials-

Chul Wan Park

*Nanotech. based Information & Energy Storage Research Center, Korea Electronics
Technology Institute, 455-6 Masan-Ri, JinWi-Myon, PyungTaek-Si, KyunGi-Do 451-865,
Korea.*

- Classification of Energy storage materials (including conversion and generation)
 - a. Fuel - Fossil and radioactive type (Disposable)
 - b. Energy storage - Battery active materials, H₂ and hydrocarbon storage materials, Chemical bonds (NADH, ATP) (Disposable and Cyclable)
 - c. Energy conversion - Solar cell materials (Cyclable)

- In 21C, The most critical energy types? ⇒ Electrical Energy
 - cf. Hydrogen originated from Fossil fuels: the most important Fuels

Electrical Energy is originated from several sources:

1. Energy Conversion (EC) from other types of energies, such as
Chemical and Solar Energies...
2. Energy Generation (EG) from fossil fuels
3. Energy Storage (ES) in Energy storage devices, such as batteries...

- Generally, In Energy Conversion, Generation and Storage Efficiency (Energy Loss) must be significantly considered.

1. Energy Conversion (EC): Lower Efficiency

cf. < ()% under control of Carnot Cycle, < ()% at conversion of Solar Energy

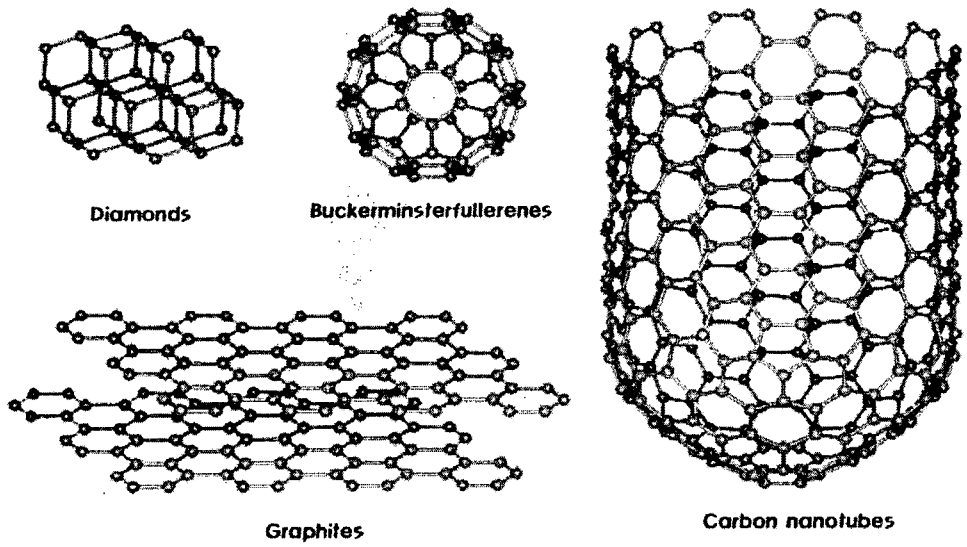
2. Energy Generation (EG): Lower Efficiency

cf. < ()% under control of Carnot Cycle

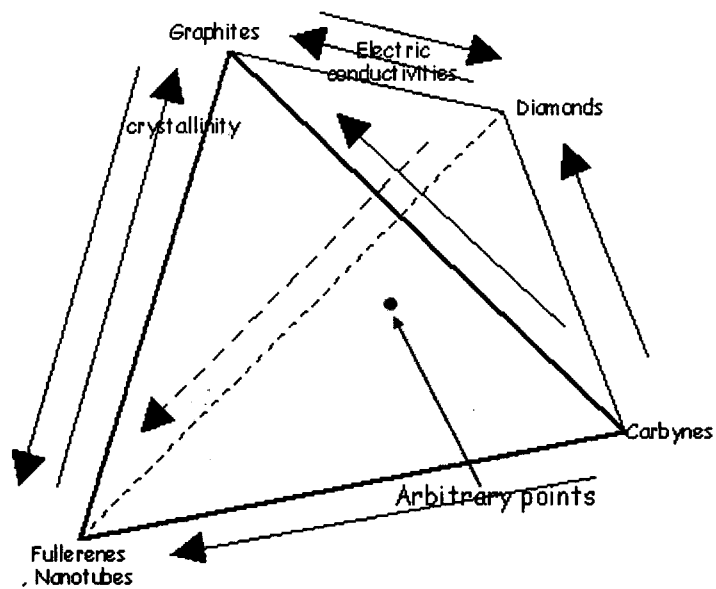
3. Energy Storage (ES): Higher Efficiency

cf. >()% in case of Li Ion Secondary Battery

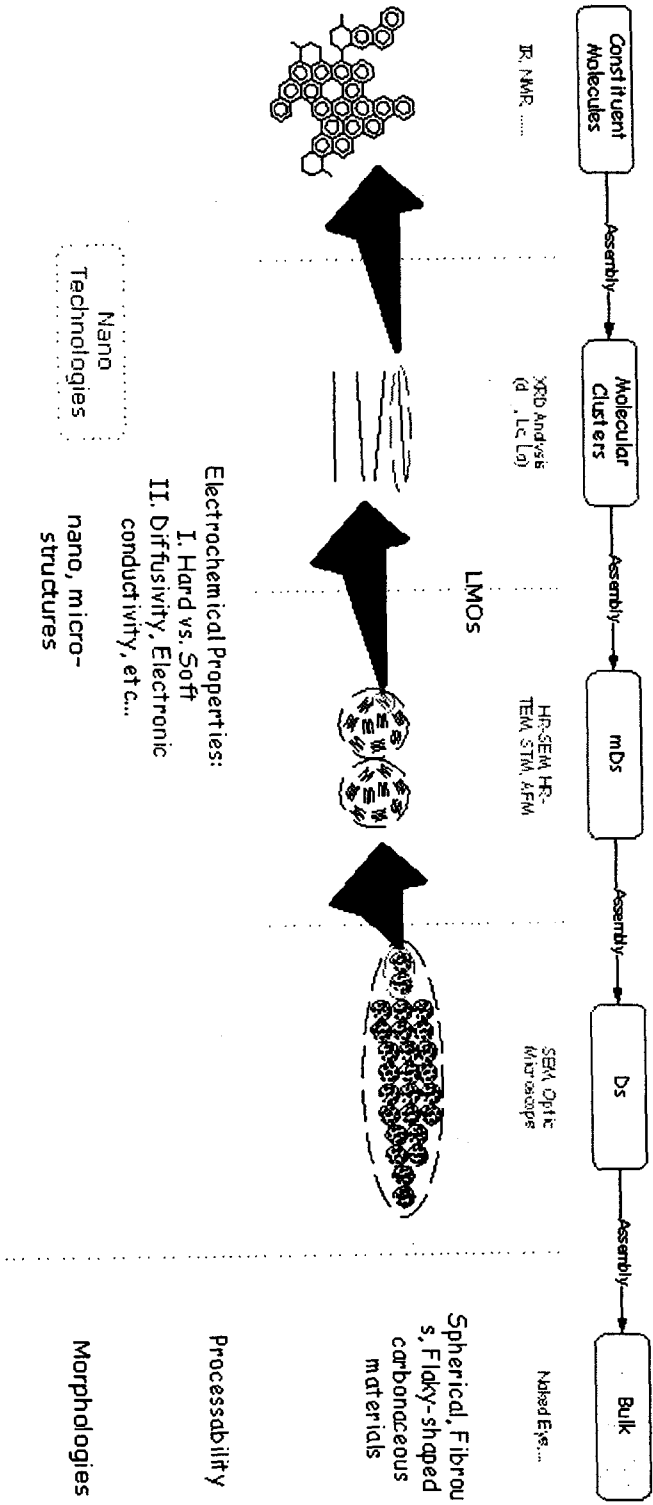
- Ideal structure of Carbonaceous materials



- Real Structure of Carbon materials

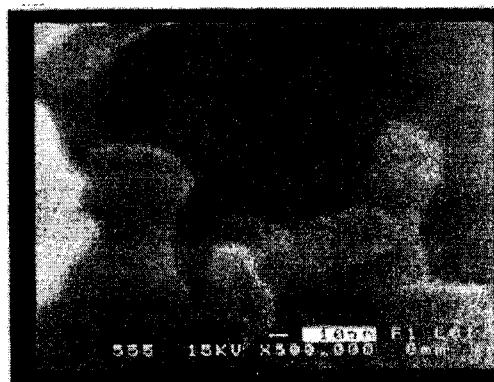


● Construction of Carbon Bulks

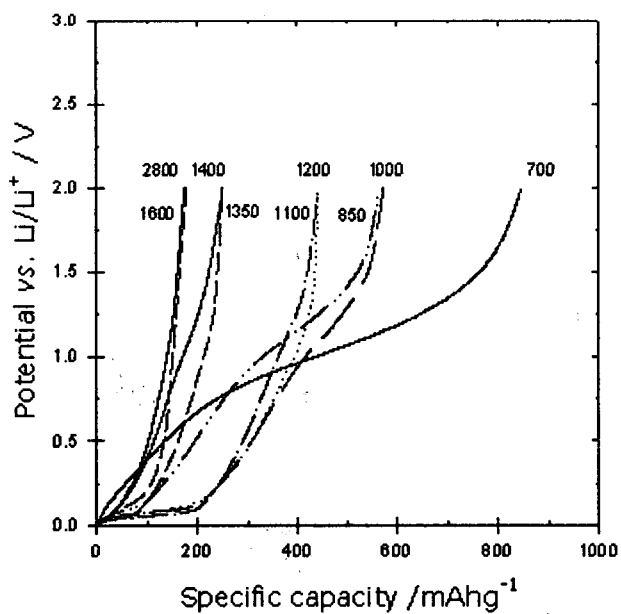


- Nano carbon materials for Energy storage

1. Nanostructured Carbons: Non-graphitizable Carbons, etc...



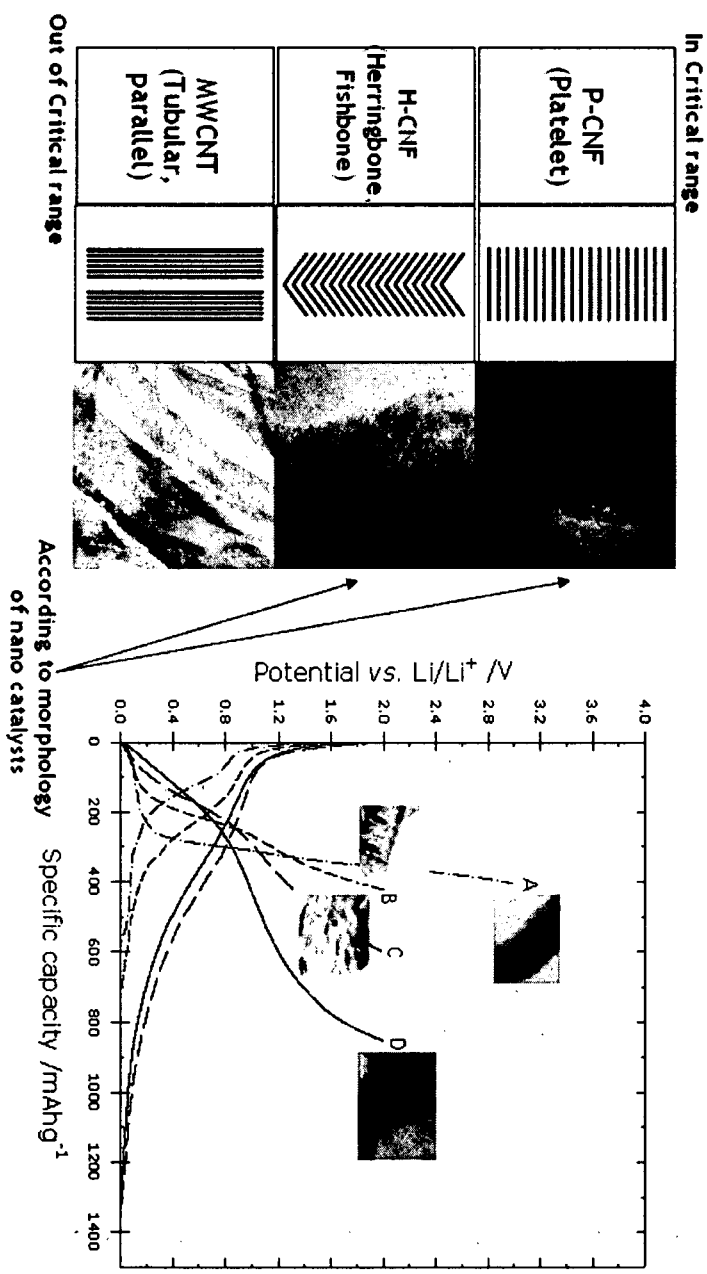
SEM Photos of non-graphitizable carbons



Discharge characteristics of non-graphitizable carbons heated at different temp.

2. Nanophased Carbons: Carbon Nano Fibers and Carbon Nano Tubes, etc...

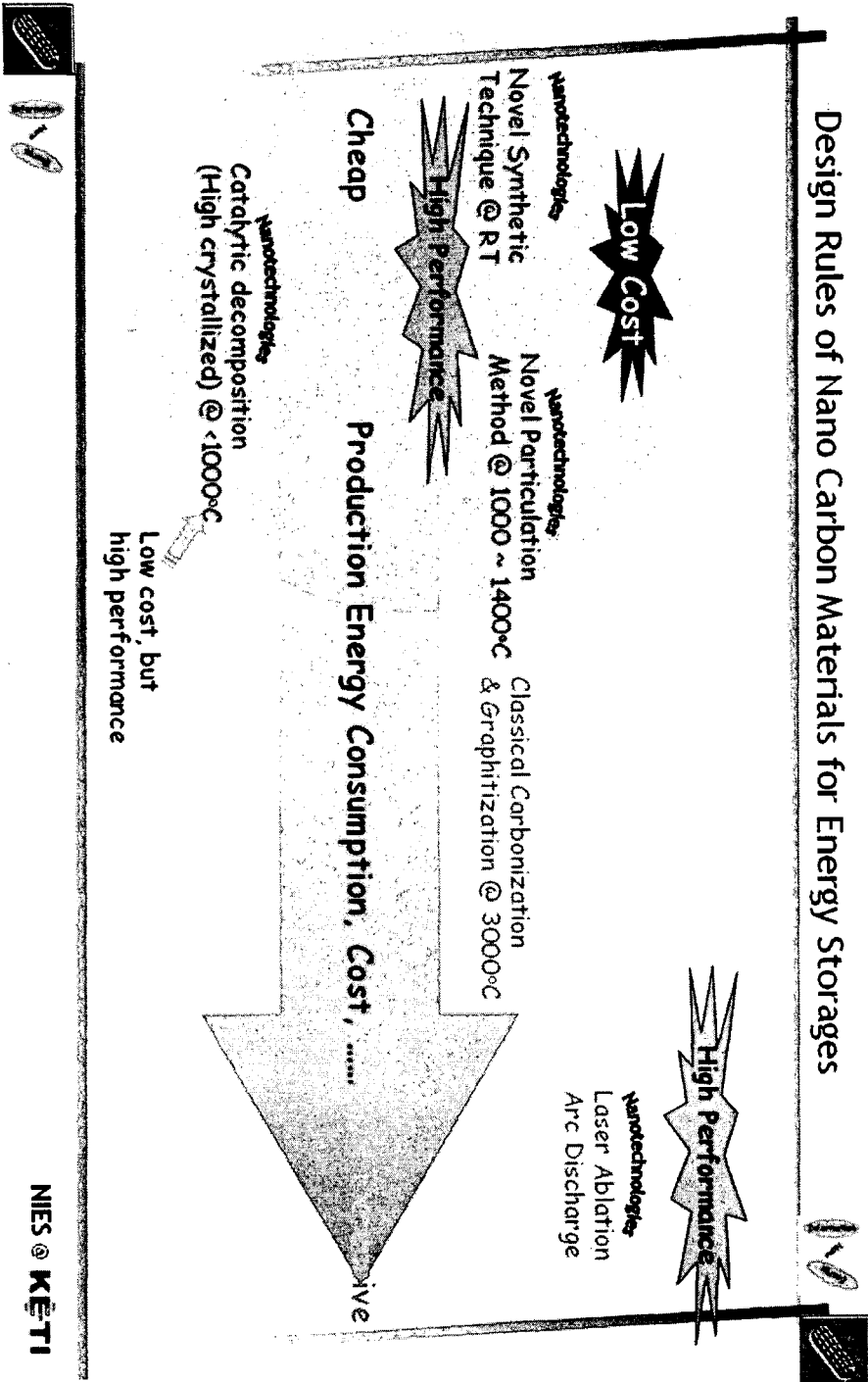
Texture control and its effect.



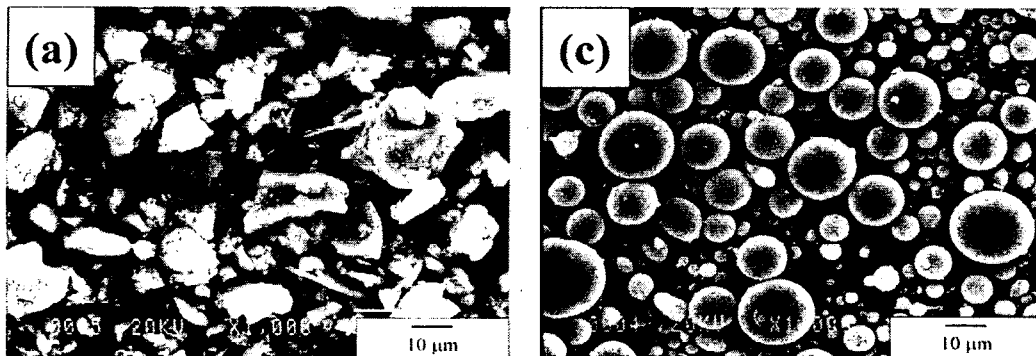
The 43rd battery symposium in Japan KEITI



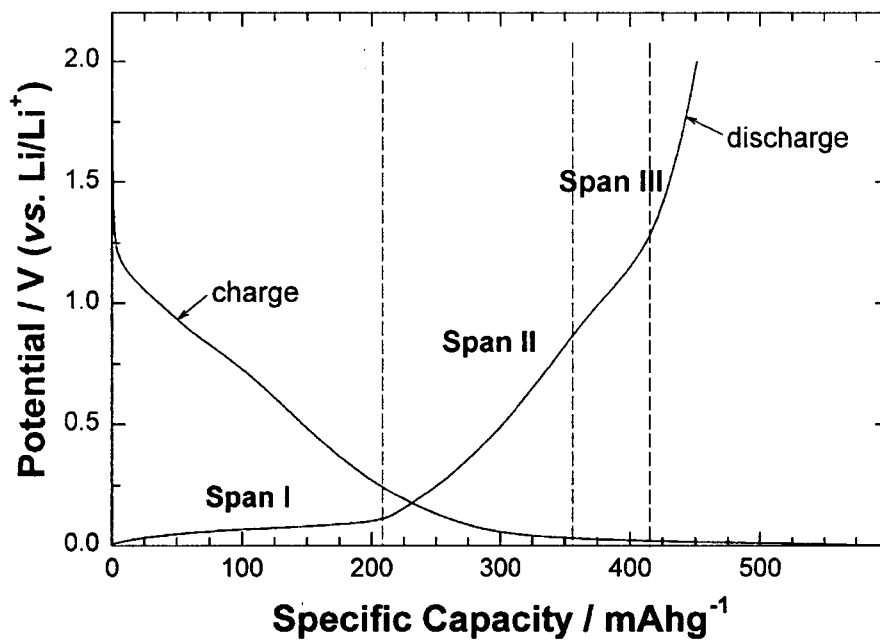
3. Design rules of Nano Carbon Materials



4. New type Spherical carbons prepared by fumed silica treatment.



SEM Photos of Hard carbons w/o and w/ silica treatment



Charge/discharge characteristics of spherical carbons.