

CARBON NANOCAPSULES

Def:
Synthesis
Appln - catalyst

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Since 1990, fullerene research has blossomed in a number of different directions and has attracted a great deal of attention to the area of Carbon Science. Carbon based nanomaterials like *fullerenes*, *nanotubes*, *nanocoils* have enormous potential of application due to their unique physical, chemical, mechanical, electrical and electronic properties.

Nanostructured materials are advantageous in offering huge surface to volume ratios, favourable transport properties, altered physical properties, and confinement effects resulting from the nanoscale dimensions, and have been extensively studied for energy-related applications such as solar cells, catalysts, thermoelectrics, lithium ion batteries, supercapacitors, and hydrogen storage systems. Nanostructured materials benefit these applications by (1) providing a large surface area to boost the electrochemical reaction or molecular adsorption occurring at the solid-liquid or solid-gas interface, (2) generating optical effects to improve optical absorption in solar cells, and (3) giving rise to high crystallinity and/or porous structure to facilitate the electron or ion transport and electrolyte diffusion, so as to ensure the electrochemical process occurs with high efficiency.

The term "nanocapsules" (and "nanoencapsulation") emerged in literature for carbon encapsulating materials at the beginning of 1990s. The study of structure and physical properties of the nanocapsules has become important due to the increasing relevance of the field of nanoscience and nanotechnology.

Fabrication of carbon nanocapsules

Carbon nanocapsules are usually fabricated by the carbonization of the polymeric nanocapsules. For example, Polypyrrole (PPy) hollow nanospheres could be transformed into carbon nanocapsules through the carbonization process.

A small amount of the crosslinked PPy nanocapsule was put into a quartz tube in an electric furnace under Argon flow (0.2 L min^{-1}). The sample was heated up to carbonization temperature (1000°C or 1300°C) at a heating rate 3°C min^{-1} , held for 3 hours and then naturally cooled to room temperature.

