

# Autogenic Pressure Reactions for Battery Materials Manufacture (ANL 09042)

A unique method for anode and cathode manufacture.

## The Invention

A lithium- or lithium-ion electrochemical cell of the present invention comprises a lithium-containing cathode, an anode, and a non-aqueous lithium-containing electrolyte there between; wherein one or more of the anode and the cathode comprises at least one particulate carbon-containing material selected from the group consisting of one or more carbon-coated metal oxide or metal phosphate particles, carbon-containing metals that alloy with Li, carbon-containing metalloids that alloy with Li, or rounded carbon particles such as carbon spheres, prolate-shaped spheroids, oblate-shaped spheroids, and carbon nanotubes. In a preferred embodiment, the particulate carbon material is prepared by reacting one or more solid, solvent-free chemical precursor materials comprising the elements making up the material in an enclosed autogenic pressure reactor in which the precursor materials are dissociated and reacted at elevated temperature, thereby creating self-generated pressure within the reactor.

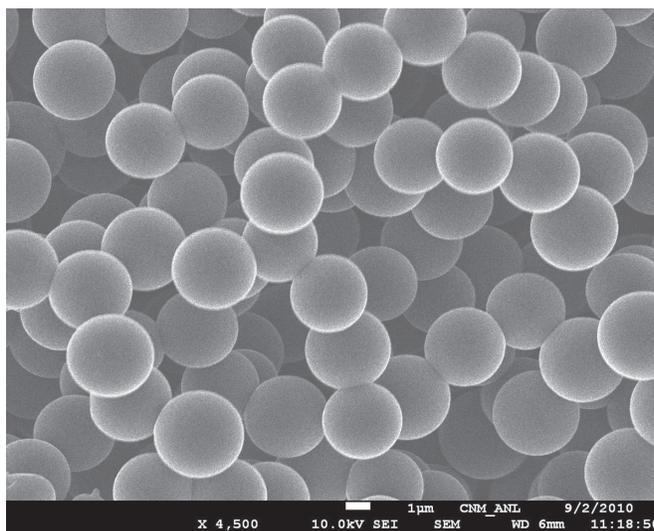
## Benefits

- ▶ Resulting core-shell electrode materials can be prepared where insulating cathode and anode products, such as  $\text{LiFePO}_4$ ,  $\text{SnO}_2$  and  $\text{TiO}_2$ , are coated with conducting carbon layers.
- ▶ Autogenic reactions are usually one-step and solvent-free, and produce unique electrode materials, which do not need any further chemical processing treatments.
- ▶ Spherical carbon particles offer the possibility of smoothing the current distribution at the anode surface during charging of Li-ion batteries, thereby reducing the risk of lithium dendrites, short circuits and fire.

## Applications and Industries

Electrodes used in batteries for:

- ▶ Electric and plug-in hybrid electric vehicles,
- ▶ Portable electronic devices, medical devices, and
- ▶ Space, aeronautical, and defense-related devices.



*Spherical carbon particles prepared in an autogenic reaction*

## Developmental Stage

Lab-scale evaluation

## Availability

Available for licensing

## Patent Information

US Patent Application 12/915,395, PCT 054625

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