



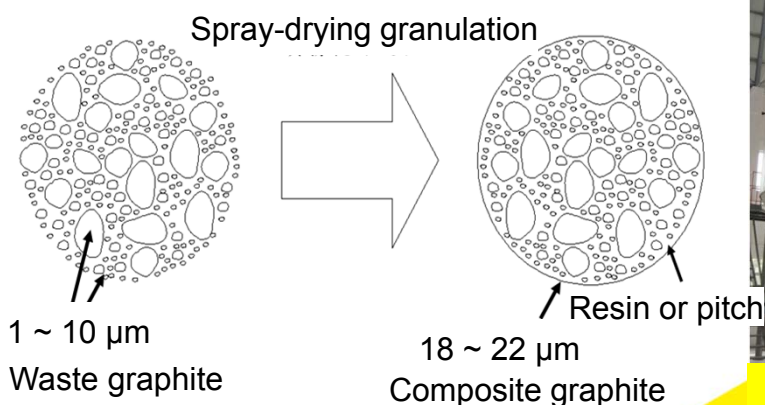
# Low cost and high rate of anode material as lithium ion battery

U.S.A. Pat. No. : US 8524113  
China Pat. Apl. No. : 201110079820.0  
Taiwan Pat. Apl. No. : 100108866



## ◎ Innovation

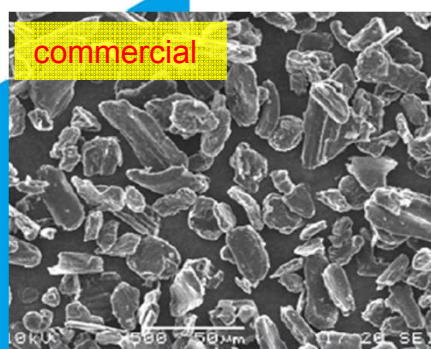
This technology uses small natural or artificial graphite powder 1~10 μm mixed with the resin or pitch by spray drying method to produce the composite material 18~22 μm. Then, the composites go to graphitization process that can exhibit higher compress density and electrochemical capacity. The raw fine graphite powder from the waste will effectively reduce production cost of anode.



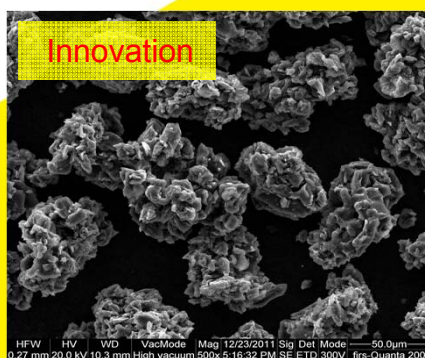
Spray-dryer



Anode material



SEM of commercial graphite



SEM of mixed with graphite powder and resin

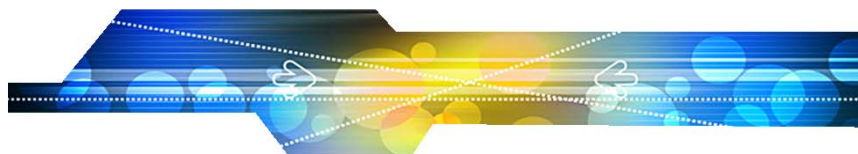


Good coating on copper foil

## ◎ Technical Index

- (1) Particle size (D50): 18~22 μm
- (2) Compaction density:  $\geq 1.65 \text{ g/cm}^3$ , Fe  $\leq 50 \text{ ppm}$
- (3) Fixed carbon:  $\geq 99.95\%$
- (4) Specific surface area: 1.5~2.5 m<sup>2</sup>/g
- (5) First Capacity:  $\geq 350 \text{ mAh/g}$
- (6) First efficiency:  $\geq 93\%$





## ◎ Production process

This Invention uses small natural or artificial graphite powder 1~10  $\mu\text{m}$  mixed with the resin or pitch by spray drying method to produce the composite material 18~22  $\mu\text{m}$ . Through carbonization or graphitization, the composite anode exhibits the buffering function in volume expansion/contraction during charging and discharging. The anodes are more difficult to crack on the copper foil that shows better conduction and capacity. Cycle life and discharging capacity are also significantly higher than of commercial graphite. The raw fine graphite powder from the waste will effectively reduce production cost of anode.

## ◎ Commercialization and market

(1) Electric vehicles. (2) Power tools. (3) Energy storage system. (4) 3C products.

## ◎ Industry related output value

- (1) Estimate annual production value of US \$ 5 million.
- (2) Reduce more than 25% of the cost.
- (3) Increase more than 5% of the power capacity, 20% of the cycle life performance.

## ◎ Application field



## ◎ 「2013 ITEX Malaysian In'l Invention, Innovation & Technology Exhibition」 Gold Medal Award !



## ◎ Cycle life test

