Chemical Pre-lithiation Methods and Uses for Li-Ion Batteries

OTT1582

Applications

Electric Vehicles (EV), smart electronics, low-cost batteries for consumer electronics, sensors

Target Problems

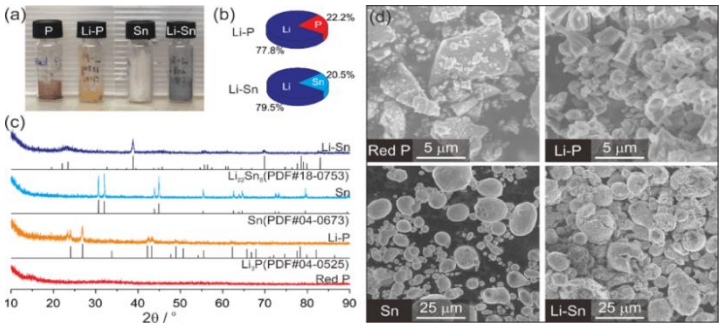
An important goal of the battery industry is extending battery lifetime. Conventional LIBs are primarily based on graphite negative electrodes (NE) and lithium metal oxide (LMO) positive electrodes (PE) and their energy densities are typically 150 ~ 200 Wh kg-1, which struggle to fulfill the increasing demand.

Key Benefits

- **Reduces Initial Capacity Loss –** compensates for the initial capacity loss during SEI formation
- **Easier to Manufacture –** can be prepared in ambient conditions without a dry room
- **Retrofit –** can be easily fit into existing manufacturing process without substantial capital expenditure
- **Strong Performance** – increase in capacity per unit volume to enable longer driving distance and usage time
- **Reduces SEI** – pre-lithiation compensates for active loss through SEI
- **Improves** - available energy densities of Li-Ion Batteries

Technology

Inventors at the University of Wisconsin, Milwaukee (UWM) have created a family of chemical additives to mitigate lithium-ion losses during solid electrolyte interphase (SEI) formation in Lithium-Ion Batteries (LIB) to meet the ever-growing performance requirements. These chemical additives and methods make extra lithium ions available during charge discharge cycles thereby slowing capacity fade. This new additive addition process easily integrates with existing manufacturing processes and can also be used with sodium-ion batteries.



Intellectual Property

- US Issued Patent: US12206087B2
- China Issued Patent: CN113039675B

About the Inventor Deyang Qu, Ph.D., Prof. and Department Chair of Mechanical Engineering

Publications

ZHANG, X. et al., "Fast and Controllable Prelithiation of Hard Carbon Anodes for Lithium-Ion Batteries," *ACS Applied Materials & Interfaces* **2020** *12* (10), 11589-11599

WANG, G. et al., Chemical Prelithiation of Negative Electrodes in Ambient Air for Advanced Lithium-Ion Batteries, *ACS Applied Materials & Interfaces* **2019** *11* (9), 8699-8703

LI, F. et al., Controlled Prelithiation of SnO2/C Nanocomposite Anodes for Building Full Lithium-Ion Batteries, ACS *Applied Materials & Interfaces* **2020** *12* (17), 19423-19430

ZHANG, X., et al., "An electrode-level prelithiation of SiO anodes with organolithium compounds for lithium-ion batteries," *Journal of Power Sources,* Volume 478, 19 Oct 2020, 0378-7753,

WANG, G., et al., "High performance lithium-ion and lithium-sulfur batteries using prelithiated phosphorus/carbon composite anode," *Energy Storage Materials*, Volume 24, 2020, 147-152, 2405-8297

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