International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI)

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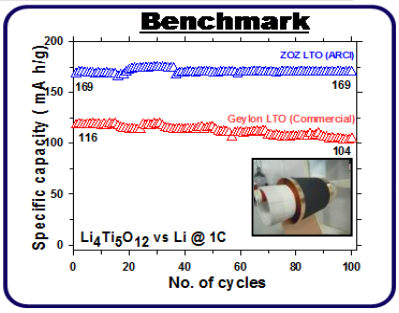
Large Scale Production of Lithium Titanate ($Li_4Ti_5O_{12}$) Electrode Materials by Cost-effective & High Energy Milling Process

Overview

Lithium ion batteries play an important role in the field of electric vehicle (EV) industries due to their high energy density and power density in comparison to other secondary batteries. As there is a great demand for large quantities of electrode materials for EV application, ARCI is working on development of nano-structured electrode materials in large scale by cost-effective processes. LTO was synthesized by High energy milling process. Bench mark studies revealed that the specific capacity of the synthesized LTO is higher than commercial LTO. Prototype LTO electrodes of 30 m length was prepared with the thickness 90 µm thickness using this indigenous LTO materials. Further, when it was tested as anode in combination with $LiFePO_4$ as cathode to validate its efficiency in full cell configuration, the full cell delivered a capacity of 0.47 mAh at 1C rate with 99% columbic efficiency with good cyclic stability (700 cycles).

Key Features

- Large scale production (2.5 Kg/batch) of lithium titanate (LTO) by high energy milling process
- Simple, economic and scalable processing method.
- Electrochemical performance of LTO is higher than commercial LTO material
- Capable of deliver high power performance
- Prototype LTO electrodes of 30 m length was prepared using LIB plant facility.
- Full cell performance of LTO with C-LFP is promising



Large scale synthesized anode ($Li_4Ti_5O_{12}$)

Potential Applications

- High energy density cathode for electric vehicles
- High power density and thermally stable anode for electric hybrid vehicles
- Other portable devices where LIB s are used.

Technology Readiness Level (TRL) : 5

- Performance and stability are validated at laboratory scale
- Scale-up has been carried out successfully
- Prototype testing is under process using pilot plant facility.

Benchmark studies of $Li_4Ti_5O_{12}$ with commercial anode at 1C and prototype electrode (inset).

IPDI*	1	2	3	4	5	6	7	8	9	10
Activities	*Basic concepts and understanding of underlying scientific principles*	*Short listing possible applications*	*Research to prove technical feasibility for targeted application*	*Coupon level testing in stimulated conditions*	*Check repeatability/ consistency at coupon level*	*Prototype testing in real-life conditions*	*Check repeatability/ consistency at prototype level*	*Reassessing feasibility (IP, competition technology, commercial)*	*Initiate technology transfer*	*Support in stabilizing production*
Status	**60 %**									

Major Patents / Publications

1. A method of producing high performance lithium titanate anode material for lithium ion battery applications, **PCT International Application No. PCT/IN2018/050080** dated 17.02.2018.
2. A method of producing high performance lithium titanate anode material for lithium ion battery applications, **Japan Patent Application No. 2019-520394**.
3. A method of producing high performance lithium titanate anode material for lithium ion battery applications, **Indian Patent Application No. E-2/1972//2017/DEL** dated 27th December, 2017.

Centre For Nano materials

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