

Fraunhofer TechFlash: Solutions for Light Electric Vehicles (LEV) Batteries

Greetings from Fraunhofer Office India!

We are pleased to introduce you to our exciting technology concept-news on;

Solutions for Light Electric Vehicles (LEV) Batteries :

- Development of Reliable Batteries for Light Electric Vehicles
- Structure Integrated Battery System for Light Electric Vehicles
- Hybrid Battery System for Light Electric Vehicles
- Hybrid Powertrain for Light Electric Vehicles
- Hard- and Software-based Diagnosis and Safety Functions for Batteries

Fraunhofer offers services in the entire value chain of battery technology starting from materials, cell production, components up to systems - processes including simulation, analysis, testing and certification, Technology interventions [[Fraunhofer Battery Alliance](#)] - [[Brochure](#)]

[Fraunhofer](#) headquartered in Germany, is the world's leading applied research organization. With its focus on developing key technologies that are vital for the future and enabling the commercial exploitation of this work by business and industry, Fraunhofer plays a central role in the innovation process. As a pioneer and catalyst for ground-breaking developments and scientific excellence, Fraunhofer helps shape society now and in the future. Its research activities are conducted by 75 Institutes and Research units across locations in Germany. The Fraunhofer employs a staff of 29,000; who are qualified scientists and engineers working with an annual outlay more than 2.8 billion Euros. Of this sum, 2.4 billion euros is generated through contract research.

Our global footprint is very strong with offices and research centres in the USA, Europe and Asia. Some of our renowned innovations are the MP3 format, the white LED, the smallest of cameras. In the field of renewable, Fraunhofer holds the world record in solar cell efficiency, battery storage, and cover the entire spectrum of energy (Grid, Renewables, Storage, etc) across the value chain from materials to testing and certification. Fraunhofer has been active in India since the past several years, bringing innovative technologies and research competence to India. Fraunhofer in India is the chosen R&D and innovation technology partner of some of the major players in the field of Energy, Environment, Automotive, Electro-mobility, Materials, Production Technology and Smart Cities working with Industry, Government and Public Sector.

We look forward to hearing of your interest to discuss this exciting technology.

[>>CLICK HERE<<](#) to receive more info on this TechFlash.

Thanks & Regards,

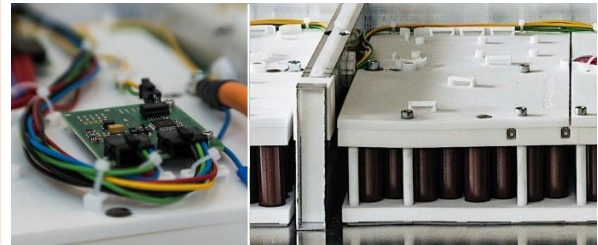
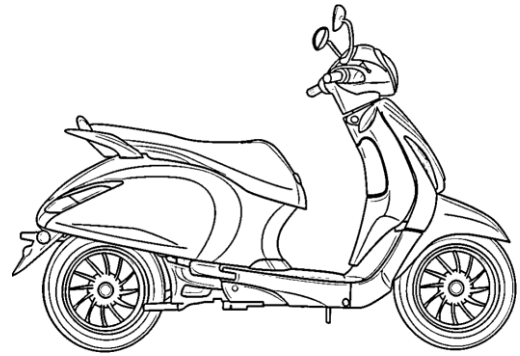
Ms. Anandi Iyer
Director - Fraunhofer Office India

Mr. Sanmati Naik
Sr. Manager - Energy (RE), Fraunhofer Office India
Tel: +91 (0)80 40965008
Mob: +91 7996425980
Email: sanmati.naik@fraunhofer.in
www.fraunhofer.de
www.fraunhofer.in

Development of Reliable Batteries for Light Electric Vehicles

Small and light electric vehicles (LEV) have a very large potential for **climate-friendly traffic** and can help improve the quality of life in cities. However, the **success** of such vehicles in the market **depends heavily on costs, reliability, and safety**. In this context, the service life and operational safety of the **battery** is a valuable and important aspect of the vehicles.

Fraunhofer LBF helps its partners and customers to **improve technical safety and reliability of batteries** while keeping costs to a minimum low.



Battery Safety

- hardware and software-based diagnosis and safety functions
- identify low-cost hardware and software monitoring strategies

Battery Design

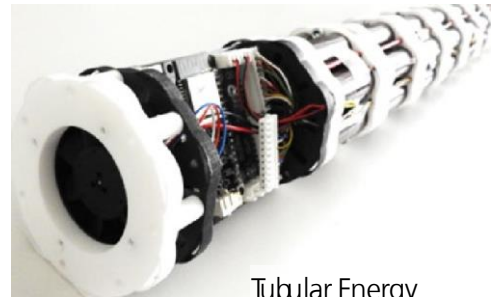
- assessment of consumer behavior and trends to identify typical usage scenarios
- cell selection strategies according to ascertained usage scenarios
- development of customized batteries

Battery Validation

- development of customized battery test benches for realistic validation
- reliability design review

Structure Integrated Battery System for Light Electric Vehicles

Batteries for electrically powered vehicles are often relatively large, heavy and expensive. The **tubular energy system** is a Li-ion-based energy storage system developed particularly for **energy- and mass-critical applications**. This eliminates the need for components such as housing and connection structures to the vehicle structure and ensures theft protection. The complete integration of the energy storage unit into the cylindrical / profiled tube provides **excellent conditions for effective air-cooled** solutions exploiting the internal tube flow with a small cooler-fan combination.



Tubular Energy



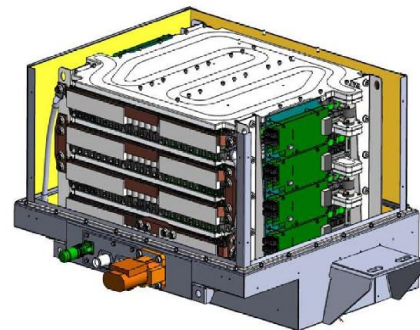
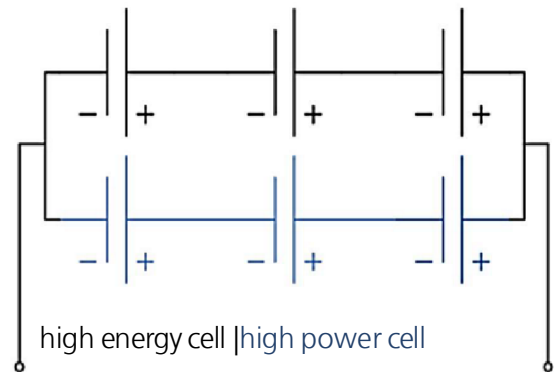
tested in heavy cargo

Fully Frame-Integrated Lightweight Battery System

- **No requirement for extra housing:** omission of all housing components as well as the structural connection to the vehicle structure
- **fuse-like current connectors** allow for deformation of the supporting structure and ensure overcurrent protection
- **active convective cooling** offers weight advantages and additional protection for the cells
- **concept adaptable** to suit other frameworks and structures

Hybrid Battery System for Light Electric Vehicles

For Li-ion batteries, **performance and energy content cannot be designed separately**, which usually leads to a less optimal battery design in terms of installation space and weight. Here, a **hybrid battery** offers a **promising** solution. By directly interconnecting high-performance and high-energy storage Li-ion cells, the **advantages of both cell types can be combined cost-effectively**. With that approach, high power can be obtained from the high-capacity storage with low thermal losses, and lower power levels can be obtained from the high-energy storage unit.



hybrid battery tested in a car

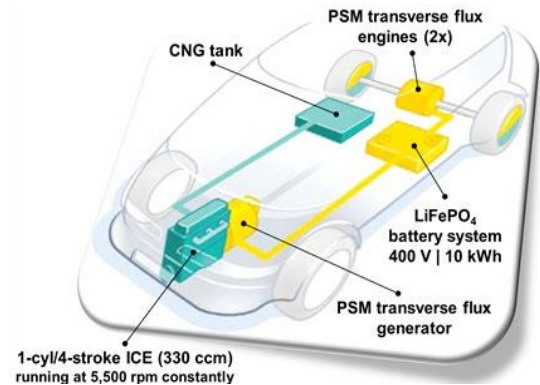
Hybrid Battery for high power and long duration applications

- one storage that **perfectly adapts** to the user's needs
- **increased cell lifetime**
- **simple, cost-efficient and robust architecture** through directly interconnected high-energy and high-performance cells
- no DC-DC converter necessary
- concept validated for application in cars **and is readily adaptable to 2- or 3-wheelers application**

Hybrid Powertrain for Light Electric Vehicles

Zero-emission vehicles today still lack the ability to **operate long distances** because of the cost and capacity of Li-ion battery systems. The energy storage technology is still comparably expensive, and has issues concerning the duration of re-charging, as well as the limited number of public charging stations.

A **low emission generator-electric powertrain** can help overcome the shortcomings of limited range of purely battery electric vehicles.



Powertrain concept and realisation for car



New hybrid low emission generator- electric powertrain increases the availability of electric driven vehicles while keeping emissions low

- **increased operation range** due to generator powered by compressed natural gas (CNG)
- **low local emissions** due to downsized gas engine
- **all benefits of electric driving**, e.g. low maintenance powertrain, low noise emission
- based on **off the shelf components**
- **concept validated for application in cars and readily adaptable to 3- wheelers**

Hard- and Software-based Diagnosis and Safety Functions for Batteries

The success of light electric vehicles highly **depends on the reliability and safety of its battery system**. Therefore, battery monitoring, diagnosis and protection are extremely important to ensure safe and effective battery operation.

Fraunhofer LBF has **developed smart and cost-efficient hardware and software solutions** to improve the lifetime of batteries and to protect users while operating electric vehicles.

lightweight high current contactor circuit based on IC

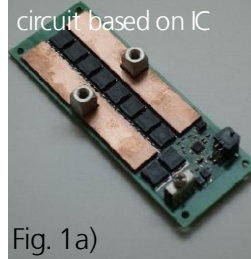


Fig. 1a)

state of art bulky mechanical contactor



Fig. 1b)



Fig. 2)

Extend Battery Lifetime

- Use case-based monitoring strategies based on impedance, voltage and current to prevent overload or overheating
- Lightweight, efficient, and minimum circuit solutions (e.g., IC-contact or circuit, see Fig. 1)

Safety and Protection

- **lightweight plastic battery cases** with venting and fire-retardant properties (see Fig. 2)