



EUROBAT e-Mobility Battery R&D Roadmap 2030

Battery Technology for Vehicle Applications

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SODIUM NICKEL CHLORIDE BATTERIES: OVERVIEW

Sodium Nickel Chloride Technology

Developed since middle nineteen seventies with the usage of **simple active materials** as sodium chloride and nickel and with a solid ceramic electrolyte

the Sodium Nickel Chloride Technology shows solid and proven results for **energy storage and clean powering of electric vehicles** with an experience of more than 200 million km



SODIUM NICKEL CHLORIDE BATTERIES: TODAY STATUS

Batteries

Batteries modules are available in a wide range of voltages from 48 to 650V for both stationary or mobility applications



SODIUM NICKEL CHLORIDE BATTERIES: TODAY STATUS

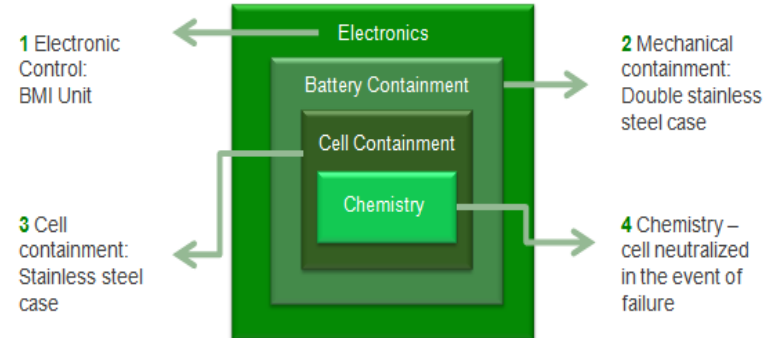
Technology highlights

High specific energy : 120 Wh/kg
on complete modules

Temperature agnostic : constant
performance and cycle life in any
operating environments

Safety : 4 pillars safety concept

Sustainability : low environmental
impact with fully recyclable materials
used for steel production



SODIUM NICKEL CHLORIDE BATTERIES: APPLICATIONS

E-Mobility Applications

Due to its characteristics the Sodium Nickel technology is mostly suitable for **energy oriented application**

In the automotive market this characteristics fit very well for professional application as delivery fleets, utility vehicles and bus operation in both pure electric and plug in hybrid application

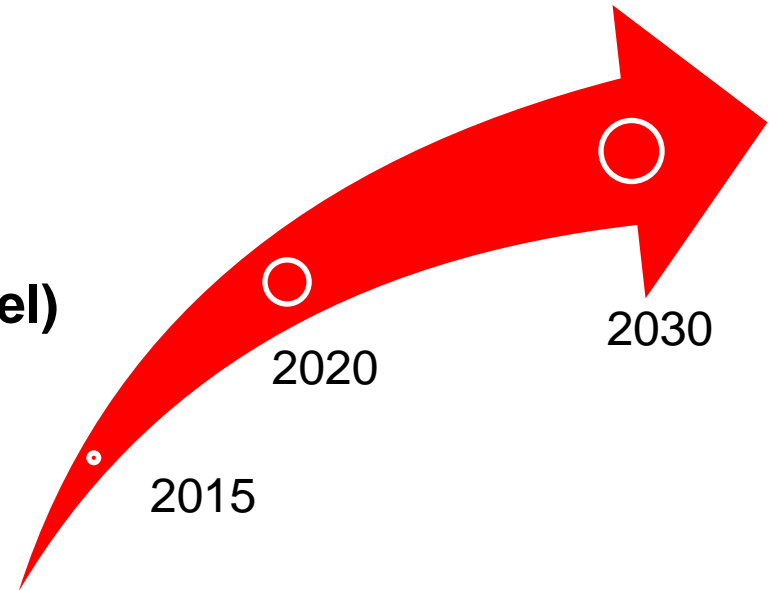


SODIUM NICKEL CHLORIDE BATTERIES: PRIORITY AREAS TO IMPROVE TECHNOLOGICAL PERFORMANCES

The customer's general demands are better performance and longer life

R&D efforts are focused on overall performance improvement with different projects that include:

- **Power density +20-25% by 2030**
- **Life cycle + 20-25% by 2030**
- **Energy density +20% by 2020**
- **Chemistry (advanced sodium-nickel)**

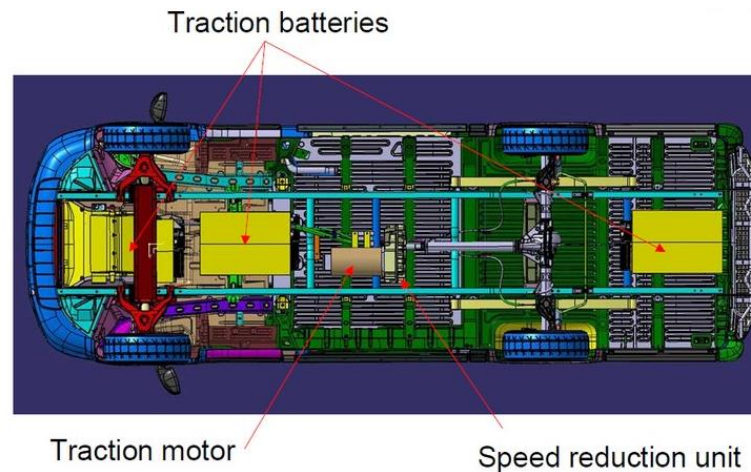


SODIUM NICKEL CHLORIDE BATTERIES: PRIORITY AREAS TO IMPROVE SYSTEM INTEGRATION

Deep integration and strong cooperation with vehicle manufactures are key elements for improving systems integration.

The focus is on

- **Co-design and standardization**
- **Mechanical integration of the battery**



SODIUM NICKEL CHLORIDE BATTERIES: PRIORITY AREAS TO LOWER COST

Cost reduction is a common, key demand from users and manufacturers in order to keep an industrial product profitable.

On-going projects to lower costs are focused

- **Improvement of production process of ceramic electrolyte**
- **Improved thermal insulation**
- **Reduced energy demand for ceramic production**

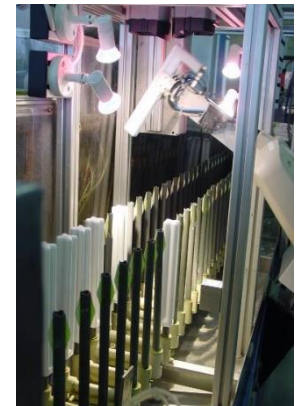
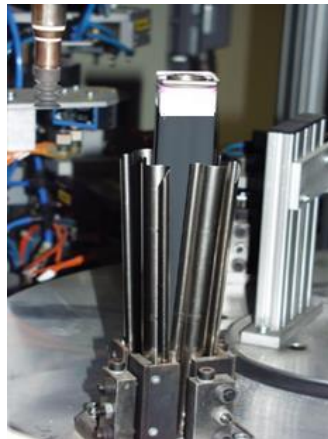


SODIUM NICKEL CHLORIDE BATTERIES: PRIORITY AREAS TO LOWER COST

Resource optimization in production lines, together with the savings that are achievable through economies of scale are classic approaches to reducing production cost and improving the total quality of a product.

The on-going projects are

- **Lean manufacturing of battery assembly process**
- **Automatic quality control for ceramic assembly**



SODIUM NICKEL CHLORIDE BATTERIES :

EUROBAT RECOMMENDATIONS

The European battery industry with its long term experience and deep know how can cover an important role in the development of e-Mobility solutions

Customer's general demands are better performance, increased life and reduced costs.

To achieve these goals the industry needs research activity, both basic and applied, human capital with qualified technical skills and a relatively stable demand to justify and sustain the investments.

Time lasting incentives schemes and funded projects for utilities fleets and advanced public transport will help to create an initial constant demand.

- Thank You -

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