

Technology: Molten-Salt Battery

GENERAL DESCRIPTION

Mode of energy intake and output

Power-to-power

Summary of the storage process

Na/NiCl₂ and Na/S batteries are accumulators using a Sodium-ion conducting solid-state electrolyte (Na-β-aluminate) as their core component. The cell reactions for both types are:



and



System Design

Sodium-β-aluminate high-temperature batteries (Na-β batteries for short) operate at approx. 300 °C. Energy densities range from 90 to 140 Wh/kg at an open-circuit voltage of 2.58 V (Na/NiCl₂) or 2.076 V (Na/S). A ceramic separator simultaneously acts as a Na-ion conducting solid-state electrolyte and separates a Na anode from a cathode of NiCl₂ or sulphur. The core of these batteries is the Na-β-aluminate solid-state electrolyte, which largely determines their performance and cost.

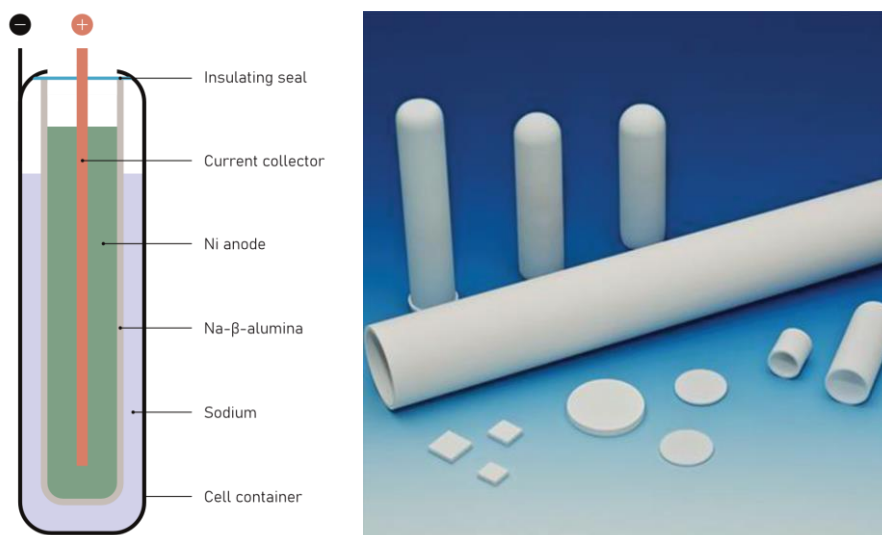


Figure 1: Schematic of a Na/NiCl₂ cell (l.), Na-β-alumina solid electrolyte (r.) (© Fraunhofer IKTS)

Focus on provision of power or energy

Energy, discharge rates range around ½ C, high cycle stability.

Suitable fields of application

Stationary electricity storage ranging from a few kWh up to MWh for home and commercial applications, storage for self-consumption, load balancing, provision of primary control energy, off-grid solutions. Insensitive to environmental conditions (climate).

State of development/commercial availability

Na/NiCl₂ systems are commercially available from FIAMM S.p.A. and General Electric, Na/S systems from NGK (Japan). Fraunhofer IKTS is further developing systems for stationary applications, some of which are in the demonstration stage with a technology readiness level of 4-5.

TECHNICAL SPECIFICATIONS

Specific energy storage density	kWh/m ³ 180-280	kWh/t 90-140
Specific power density	kW/m ³ 150-200	kW/t 200
Typical/feasible storage size	MWh _{out} 0,01-10	MW _{out} 0,005-5
System efficiency	Approx. 80 %	
Storage duration	Hours	
Response time	< 1 s	
Service life (maximum)	Cycles 4,500 (80 % DoD)	Years > 10
Loss per time in %	No chemical self-discharge	

ECONOMIC SPECIFICATIONS

Investment cost per kWh

< 300 € for targeted region (incl. system cost)

Operating and maintenance cost (based on investment/kW and kWh)

Very low, depends on use case

For further information, see

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