Nickel-Metal Hydride Battery

European Association for Storage of Energy

Electrochemical Energy Storage

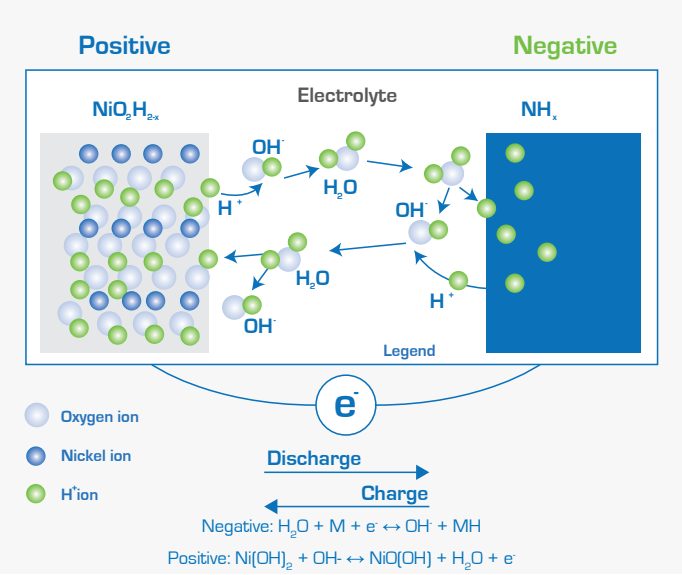
1. Technical description

A. Physical principles

A Nickel-Metal Hydride (NiMH) battery system is an energy storage system based on electrochemical charge/discharge reactions that occur between a positive electrode (cathode) that contains nickel oxyde-hydroxide as the active material and a negative electrode (anode) that is composed of a hydrogen-absorbing alloy.

The electrodes are separated by a permeable membrane which allows for electron and ionic flow between them and is immersed in an electrolyte that is made up of aqueous potassium hydroxide that undergoes no significant changes during operation.

Illustration: Charging principal of NiMH



B. Important components

The main components are the following:

- Elementary cell composed of an assembling of electrodes, electrolyte and separators
- Modules composed of serial assembling of cells
- Battery systems composed of a large assembling of cells or modules and of a control system
- Power Conversion System (PCS)

C. Key performance data

Power range	Some kW - some
Energy range	< some 10 MWh
Discharge time	Some min – some h
Cycle life	1,000 - 5,000 cycles
Life duration	10 - 15 years
Reaction time	Some millisec
Efficiency	60-70 %
Energy (power) density	75 – 80 Wh/kg
CAPEX: energy	400 - 700 €/kWh
CAPEX: power	500 – 1,500 €/kW

D. Design variants (non exhausitive)

The following design variants are available:

- Different intermetallic compound for the negative electrode
- Different electrode thickness according to the power/energy ratio
- Different cell size from 1 Ah up to 200 Ah
- Different cell shapes: cylindrical (small cells) or prismatic (large cells)
- Different battery systems according to the size and the application: stationary or transport

Avenue Lacombé 59/8 - B - 1030 Brussels - tel: +32 02.743.29.82 - fax: +32 02.743.29.90 - info@ease-storage.eu - www.ease-storage.eu

2. State of the art

In the field of small rechargeable batteries, the NiMH technology once replaced the Ni-Cd technology for many applications but is now itself being replaced by the Li-Ion technology. The Ni-MH technology represents the reference technology for the Hybrid Vehicles, but is expected to be replaced by the Li-Ion technology in the future. In the industrial battery market, the NiMH technology complements the Ni-Cd technology when higher performances and no maintenance are required.

Some large Ni-MH systems has been developed for grid applications :The Recycling technologies and collection circuits are established and operational.

Inside the container

3. Future developments

The NiMH technology is rivalled by other technologies such as Li-ion. No further developments are expected for this technology.

4. Relevance in Europe

Due to its similarity to the Ni-Cd technology, the NiMH technology is able to easily replace the Ni-Cd technology in order to provide better performances.

5. Applications

Automotive: hybrid vehicles

Railways

Reliable networks where access is difficult: off-grid PV, ...

6. Sources of information

- EASE Members
- EUROBAT
- Saft

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