

## Development of Advanced Nickel Metal Hydride Batteries for Large Scale Energy Storage

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Wind and photovoltaic power outputs fluctuate with weather at every moment. Batteries could help the grid connection of such power sources by stabilizing the rapid output fluctuations. It is expected that batteries with larger capacity and higher charge/discharge rates will be developed for making renewable energies more usable.

An advanced nickel metal hydride battery has been developed with large storage capacity enabled by its bipolar three-dimensional structure, high rate charge and discharge ability, and long cycle durability. The battery developed is an environment-friendly one without toxic metals such as lead, mercury, cadmium and so on. Nickel hydroxide is used as the positive electrode and metal hydride is used as the negative electrode. Still more, it is easily recycled because it has no welding connection at all. Adjacent cells are connected with a bipolar partition plate between them, as shown in Fig.1.

Voltage of a stack is easily changed in accordance with the number of connected cells in the stack. Capacity of each cell (Ah) is easily expanded by changing the size and the number of electrodes in the cell. The number of cells is ten in the standard stack for stationary use. Table 1 shows the specifications of the unit cell.

Fig.2 shows an example of the rate dependence of the charge curves between 0.2CA and 2CA and discharge curves between 0.2CA and 3.5CA. These measurements were taken at 25 degree centigrade. The flat charge and discharge curves were observed at the capacity range between 20% and 90% at the conditions of under 1CA.

Fig.3 shows an example of the smoothing tests of a wind power generation. Tests were conducted at a scale of 1/10 to 1/20 output power of the wind power generation. Its maximum power was 1500kW, the output power of the inverter was 200kW, and the capacity of the battery was 28kWh. It has been verified to smooth fluctuations in the wind power output.

The advanced nickel-metal hydride battery presented here is a promising next generation battery with wide applications such as stabilizing wind and photovoltaic power outputs, demand cutting, micro grid systems, uninterruptible power supply and so on.

### Acknowledgements

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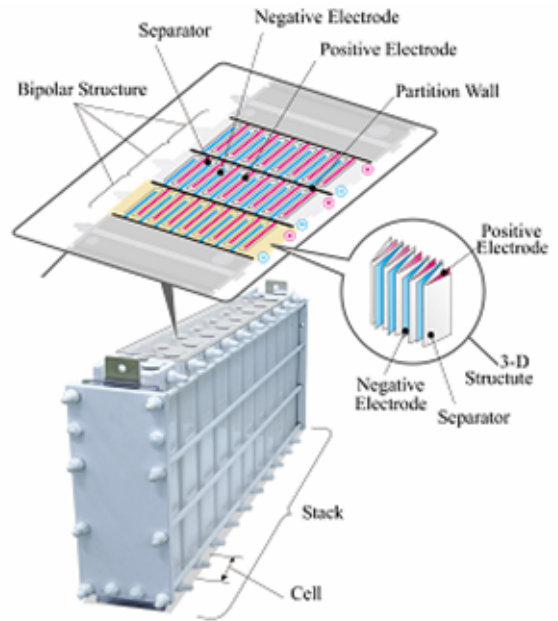


Fig.1 Structure of advanced NiMH battery

Table.1 Specifications of unit cell

Number of cells	10
Current capacity(Ah)	208
Voltage ( V )	12
Size ( mm )	L680×W270×H340
Weight ( kg )	118

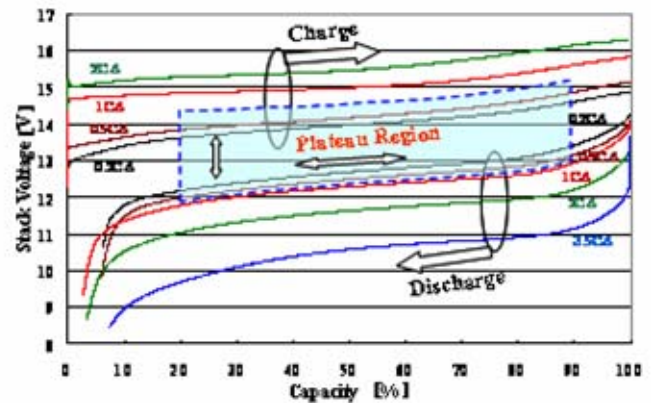


Fig.2 Charge and discharge characteristics

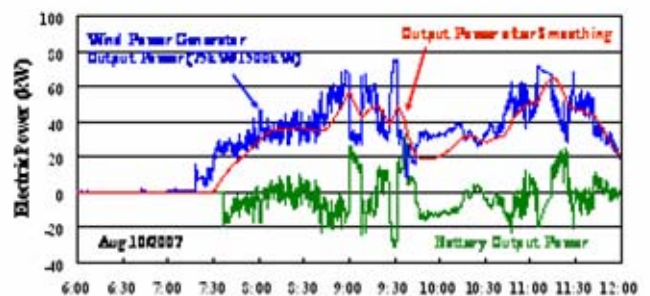


Fig.3 Smoothing of fluctuations of wind power output