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Application of Bipolar Type Nickel Metal Hydride Batteries to Electrified Vehicle

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The world's concentration of CO_2 has been increasing since the Industrial Revolution. There is no time to lose when it comes to reducing, in all aspects, the amount of CO_2 emitted by humankind. In the case of the automotive industry, promoting electrification of vehicles is one of the most effective ways to inch closer to carbon neutrality. Toyota is preparing a full lineup of electrified vehicles. We want to provide sustainable and practical products that reduce CO_2 emissions while considering the convenience of our customers in each region. As part of our efforts, we co-developed the bipolar nickel metal hydride battery focused on providing instantaneous power with Toyota Industries Corporation (Fig.1), and we commercialized it as an onboard battery for driving last year (Fig.2).

In bipolar nickel metal hydride batteries, a cathode is applied to one side of the current collector, and an anode to the other; several of these structures, which are known as "bipolar electrodes", are stacked together to form a battery.
Compared to non-bipolar nickel metal hydride batteries, bipolar versions consist of fewer current collectors and other parts, enabling them to be made more compact. It is possible to stack a larger number of cells in bipolar nickel metal hydride batteries than in non-bipolar nickel metal hydride batteries of the same size. (Fig.3)

In addition, since bipolar batteries have a greater active surface area and a simpler construction, there is lower resistance within the battery itself. This enables the flow of larger currents, leading to increased output. Compared to the nickel metal hydride battery equipped to the previous-generation compact car, the new battery realizes approximately twice the output. (Fig.4)

This new battery delivers improved accelerator responsiveness, and enables smooth, linear acceleration from low speeds. In addition, the speed range at which the compact car can operate on electrical power alone has been expanded, allowing the vehicle to run on electricity alone, without engaging the engine, in a wide variety of urban scenarios.

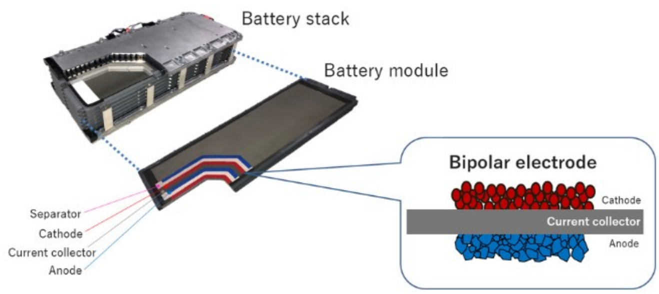

Fig.1 Bipolar type nickel metal hydride battery

Fig.2 Onboard battery for driving

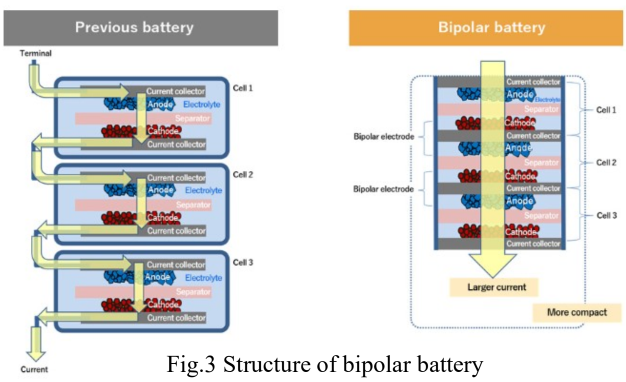

Fig.3 Structure of bipolar battery

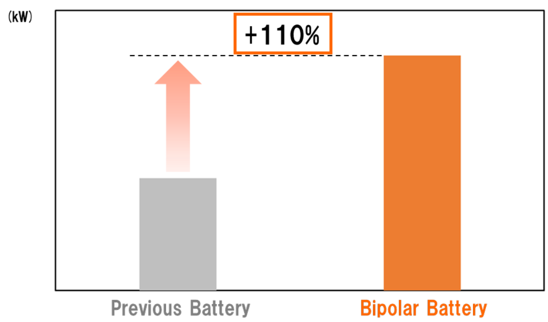

Fig.4 Comparison of output

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