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Cooling performance of battery system with different cell arrangement and air flow rate

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The lithium-ion battery has several advantages such as high energy density, high electromotive force, no memory effect, and less power loss by self-discharge. Nonetheless, the durability, safety, and lifespan of the lithium-ion battery are damaged above the certain high temperature. The operating temperature within the safe range of lithium-ion battery is an important factor. For chilling the battery, the cooling technology should be important. The air-cooled structure of battery pack is numerically simulated with 3-dimension turbulence model calculated by Reynolds number. The battery pack is designed with 56 cells as 7 parallel and 8 series, and the cell to cell gap is 3 mm. The inlet/outlets are designed by intersecting at the side wall. We have numerically investigated the temperature distribution and the cylindrical lithium-ion batteries that are staggered with different cell configurations. The cell arrangements are adopted that can be designed in a limited rectangular pack. The temperature distributions are calculated with four cases of air flow rates and cell arrangements. Additionally, the experiments are conducted to validate the numerical simulations. Therefore, we have found the correlation of cooling performances between cell configurations and air flow rates. We suggest that the effects of cell arrangements and air flow rates on the battery cooling performance are extremely important consideration factors. Thus, the optimal battery pack structures can be designed.

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