고에너지 밀도 리튬이온 배터리 모듈의 내부저항 편차가 열적 성능에 미치는 영향

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Effects of Internal Resistance Deviation on Thermal Performance of High Energy Density Lithium-ion Battery Module

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Key Words : Battery Module(배터리 모듈), Internal Resistance (내부저항), Thermal Performance (열적 성능), CFD (전산유체역학)

ABSTRACT

A number of lithium-ion battery cells (LIBs) are composed of the battery modules for urban air mobility (UAM) that are capable of high discharge of 8 C-rate and have over 300 Wh/kg high energy density. A battery module configured with multiple battery cells inevitably has an internal resistance deviation between cells, and in particular, the UAM battery module uses large-capacity cells, so the internal resistance deviation between cells is relatively large. Since the amount of heat generated varies depending on the internal resistance, different heating characteristics affect the output power between cells. This result causes a degradation in the output power of the entire battery module, and thus research is needed to determine the effect of the internal resistance deviation between cells on the exothermic characteristics for stable battery thermal management. This study used a 90 Ah pouch type lithium-ion battery of the HMC series. The maximum charging voltage is 4.2V and the cut-off voltage is 2.5V. Considering the electrical characteristics of the entire module, two semi-modules consisting of two cells were connected in series to form a total of 4S. Between the two battery cells in the semi-module, an insulation pad for preventing fire transition and buffering due to volume change was mounted and fixed with an external aluminum case. The deviation of the internal resistance of the prototype sample of the LIB was set to a maximum of 1 mΩ, and the welding resistance between the tabs was also considered. A commercial CFD code of AVL FireM was used. Considering the operating environment of UAM for semi-battery modules, the temperature deviation between cells was analyzed according to the change in battery discharge conditions and -23℃~40℃.

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