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Optimization on Thermal Management of Lithium-Ion Batteries Using Computational Fluid Dynamics and Air-cooling Methods

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Lithium-ion batteries are key components in cargo container-type large capacity energy system. It is essential to maintain temperature and thermal profile of the battery pack within the desired range in order to ensure its cycle life. Based on computational fluid dynamics (CFD) method, a periodic air-cooling method is proposed to improve the temperature distribution of the batteries. The effects of 3 different air-cooling method on heat dissipation and energy saving of the battery pack are compared. The results indicated that: (1) The directional air supply method can significantly restrain temperature rise of the batteries in the middle of the battery pack, but it is hard to blow to the side, which easily lead to uneven temperature distribution. (2) By changing the air supply direction, the periodic airflow can enhance the airflow disturbance, improve the heat dissipation effect and thermal uniformity of the battery. (3) With the directional airflow method, reducing the airflow temperature and increasing the airflow rate can nearly achieve the same result as periodic air-cooling method, but the latter is more energy efficient. This paper provided a new approach to the battery thermal management under energy saving conditions.

Keywords: Container, Battery Thermal Management, Periodic Airflow, Energy Saving, CFD

FULL TEXT