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Thermal Management of Lithium-Ion Battery using Heat Pipes

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Extended Abstract

This study presents the heat transfer characteristics of U-shaped heat pipes with asymmetric channels, which improve a non-uniform temperature distribution in a battery. An lithium-ion battery system generally adopts a forced convection cooling method using a fan owing to low power consumption and cost. The forced convection cooling can reduce a temperature increase in the battery. However, the non-uniform distribution of the temperature on the surface of the battery is inevitable, which affects battery life and performance [1,2]. The proposed heat pipes are made of aluminum plate with grooved wick. The U-shape consists of three types of channel designs with different asymmetric ratios. The asymmetric ratios of the channel lengths are 0.4: 1, 0.5: 1, and 0.6: 1. Through CFD simulations, the non-uniform temperature distribution of the battery in the 'fan alone' condition and the 'fan + duct' condition are investigated, and the experiment under the condition of the 'fan + heat pipe' is carried out. The results shows that the ratio of the asymmetric channel and the heat pipe position in the battery critically affect the non-uniform temperature distribution. In addition, it is concluded that the fan air flow rate can be controlled by the asymmetric channel structure of the heat pipe.

References

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