The effect of different enclosure materials and NePCMs on performance of battery thermal management system

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A B S T R A C T

A battery thermal management system (BTMS) with nano-enhanced phase change material (NePCM) is a favorable system because of its sustainable lifespan and high-latent heat in the absence of needing any external pumping power like air/liquid cooling in electric vehicles. However, some improvements and investigations are needed to improve the system. Hence, this current study has been conducted numerically to analyze the effect of different materials of the enclosure including copper (Cu), aluminum (Al), and acrylic (Acr) on thermal performance of a cylindrical lithium-ion BTMS by utilizing CuO nanoparticles and *n*-eicosane PCM. Additionally, the impact of various CuO nanoparticles volume fractions of NePCM (2 % and 4 %) on battery surface temperature and Nusselt number have been investigated. The battery is considered under the full discharge condition at a 3C current rate within 20 min. Furthermore, two different initial and ambient temperatures (300 K and 305 K) have been considered to study the thermal performance of BTMS in solid and solid/liquid phases of NePCM. The numerical results presented that using Cu enclosure in BTMS keeps the battery surface temperature at the lowest level and also causes to delay in melting the NePCM. Moreover, with the addition of CuO nanoparticles to pure *n*-eicosane and an increase in nanoparticles volume fraction, the battery surface temperature and onset melting time of NePCMs decreases and increases, respectively. Finally, the Nusselt number investigation illustrates that by adding nanoparticles to pure *n*-eicosane and increasing the nanoparticles volume fraction, the Nusselt number decreases slightly.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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