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Numerical investigation of parallel microchannels on a battery pack in the buildings with the aim of cooling by applying nanofluid- optimization in channel numbers

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Highlights

- Simulation of parallel microchannels on a battery pack is performed.
- Nanofluid- optimization in channel numbers are employed.
- The impacts of Reynolds number and nanofluid concentration are investigated.
- Battery surface temperature declines with the rise of Reynolds number.
- Increasing the nanofluid concertation to 0.1% boosts the heat transfer up to 12.1%.

Abstract

Background

In the present study, a parallel microchannel system is attached to the battery pack to decrease the temperature of the plate that the battery pack install on it. In fact, battery cooling is critical for electronic devices as the increasing temperature has a negative effect on performance.

Methods

The impacts of several parameters like Reynolds number, and volume fraction of nanofluid are investigated on the battery surface.

Significant findings

The numerical results demonstrated that the temperature of the battery surface declines dramatically up to 4° as the Reynolds number increases. Moreover, the increasing volume fraction of the present nanofluid to 0.1% boosts the heat transfer up to 12.1% and decreases the thermal and viscous entropy generations up to 5.37% and 23.2%, respectively. However, increasing the Reynolds number from 400 to 2200 resulted in a 253.71% and 389.80% increase in the thermal viscous generations. optimization revealed that the best channel number is 39 in which the Nusselt number and pressure ratio intensified by 17% and 24%, respectively.