

Preventing thermal runaway and heat propagation using PCM and microchannel cooling plate cooling system in battery module during nail penetration

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The Lithium-ion (Li-ion) battery has widely applied to electric vehicles and hybrid electric vehicles due to its higher energy density and lower self-discharging rate. However, the significant challenge is that fire and explosions can be triggered by the mechanical damage causing the thermal sensitivity of Li-ion battery. To relieve this situation, the battery cooling system is required to prevent inexorable thermal runaway in battery module. The paper has proposed that the battery cooling system using phase change material (PCM) and micro-channel cooling plate pertain to the nail penetration of three cells in battery module. The number of cooling plates, flow direction and flow rate are examined to achieve more effective cooling performance using computational fluid dynamics (CFD). In the conclusion, the developed system can prevent the heat propagation of the second-most influenced cells by the thermal runaway being caused by the nail penetration of three cells, not including the boiling process of water.