

## Artificial Intelligence-Based Thermal Management of Battery System for Electric Vehicles

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**Abstract :** The escalating adoption of electric vehicles (EVs) across the globe has underscored the critical importance of advancing battery system technologies. This has catalyzed a shift towards the design and development of battery systems that not only exhibit higher energy efficiency but also boast enhanced thermal performance and sophisticated multi-material enclosures. A significant leap in this domain has been the incorporation of simulation-based design optimization for battery packs and Battery Management Systems (BMS), a move further enriched by integrating artificial intelligence/machine learning (AI/ML) approaches. These strategies are pivotal in refining the design, manufacturing, and operational processes for electric vehicles and energy storage systems. By leveraging AI/ML, stakeholders can now predict battery performance metrics—such as State of Health, State of Charge, and State of Power—with unprecedented accuracy. Furthermore, as Li-ion batteries (LIBs) become more prevalent in urban settings, the imperative for bolstering thermal and fire resilience has intensified. This has propelled Battery Thermal Management Systems (BTMs) to the forefront of energy storage research, highlighting the role of machine learning and AI not just as tools for enhanced safety management through accurate temperature forecasts and diagnostics but also as indispensable allies in the early detection and warning of potential battery fires.

**Keywords :** EVs, battery thermal management, artificial intelligence, neural network

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