THERMAL MANAGEMENT OF LI-ION BATTERY PACKS

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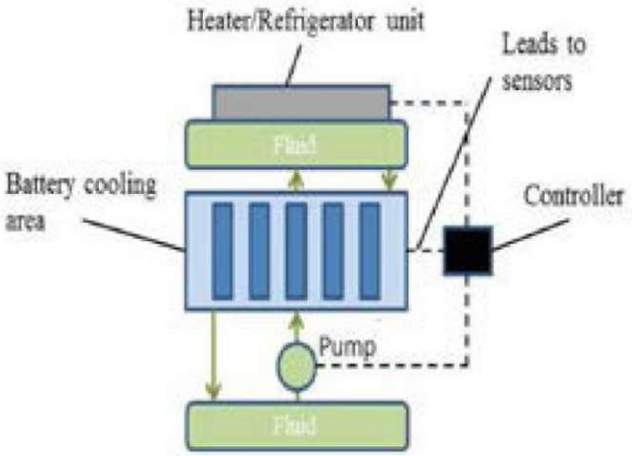
Introduction. A design for the thermal management of Lithium-ion battery packing as used in hybrid and electric vehicles has been developed. The design satisfies all thermal and physical issues relating to the battery packs used in vehicles including operating temperature range and volume, and, should increase battery cycle life, and, charge and discharge performances. Particular attention was devoted to the thermal management of batteries operating in extreme temperature conditions.

Design considerations. The aim of a thermal management system is to maintain a battery pack at an optimum average temperature, as dictated by life and performance trade-off. It is important that an even temperature, perhaps with small variations, is maintained between the cells and within the pack. However when designing such a system, regard must also be paid to the fact that the battery pack should be compact, lightweight, have low cost manufacture and maintenance, and, have easy access for maintenance. The management system should also have low parasitic power, allow the pack to operate under a wide range of climatic conditions and provide ventilation if the battery generates potentially hazardous gases.

Thermal management. The thermal management control strategy is enacted using an electronic control unit. A general schematic of the proposed thermal management system is given on Figure below. The method employed is fundamentally to surround the cells with a conducting material, that is, a form of heat sink, and remove or add heat using fluid.

Results. A series of simulations were conducted using computational fluid dynamics (CFD) on the battery pack which had, in addition to initial temperatures of 313.15 K and 349.15 K, an internal heat source for each cell of either 0.25, 0.5 or 1 W. Results for the temperature distribution of the pack with cells each having an internal heat sources of 1 W were obtained, and what was important was the control of temperature between acceptable limits, and a good uniformity of temperature across each cell.



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