World Academy of Science, Engineering and Technology
International Journal of Chemical and Materials Engineering
Vol:10, No:03, 2016

Temperature Control and Thermal Management of Cylindrical Lithium Batteries Using Phase Change Materials (PCMs)

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Abstract : Lithium-ion batteries (LIBs) have shown to be one of the most reliable energy storage systems for electric cars in the recent years. Ambient temperature has a significant impact on the performance, lifetime, safety and cost of such batteries. Increasing the temperature degrade the lithium batteries more quickly while working at low-temperature environment results reducing the power and energy capability of the system. A thermal management system has been designed and setup in laboratory scale for controlling the temperature at optimum conditions using PEG-1000 with the melting point in the range of 33-40 oC as a phase change material. Aluminum plates have been installed in the PCM to increase the thermal conductivity and increasing the heat transfer rate. Experimental tests have been run at different discharge rates and ambient temperatures to investigate the effects of temperature on the efficiency of the batteries. The comparison has been made between the system of 6 batteries with and without PCM and the results show that PCM with aluminum plates decrease the surface temperature of the batteries that would result better performance and longer lifetime of the batteries.

Keywords : lithium-ion batteries, phase change materials, thermal management, temperature control
Conference Title : ICLB 2016 : International Conference on Lithium Batteries
Conference Location : Miami, United States
Conference Dates : March 24-25, 2016