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Lecture Room 232, Bldg. No.2 3F

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Thermal Analysis of Li-Ion Battery for Energy Storage System

Abstract: Lithium ion batteries (LIB) have been gaining recognition as the primary technology for energy storage in motive applications due to their improved specific energy densities, charge retention capabilities and long cycling life. However, during utilization, Li-ion cells tend to self-heat due to the effects of internal resistance. In larger battery packs, where cells are typically stacked together and compressed for mechanical stability, a significant amount of heat could be generated. This could lead to an excessive rise in the temperature of the cells, potentially resulting in accelerated degradation. Therefore, the design and implementation of a thermal management system (TMS) is critical to effectively dissipate the heat generated in a battery pack and ensure that the cells are operating in the desired temperature range specific to the application. In addition, the TMS must be designed to mitigate the non-uniformities in the temperature distributions inside the pack.

The purpose of this study is to investigate the internal heat flow analysis and the characteristics of tray which is the basic structure of a large capacity ESS based on the concept of Computational Fluid Dynamics (CFD). For this purpose, heat generation rate of $LiFePO_4$ (lithium iron phosphate, LFP) battery, which has been widely used in the industry in recent years, is calculated and applied to the tray structure to perform the thermal flow analysis and compared with the experimentally measured temperature characteristics. In this study, the thermal analysis of cells in a battery rack with multiple batteries is performed for large-scale energy storage. Rack in this analysis consists of 18 trays and 12 batteries are arranged in each tray. Cold air is supplied through the air supply of the rack, and each tray is also analyzed for a general-purpose battery rack with individual fans. Based on the validated model, the design parameters such as fan power, air inlet vent position, size, and number were changed to analyze the thermal flow and the effects of each design factor on cooling was examined.

Biography: Joon Hyun Lee received his Bachelor of Engineering degree in 1983 from Pusan National University, Busan, Korea and his Master and Doctorate degree in Mechanical Engineering in 1985 and 1989, respectively from Tohoku University, Sendai, Japan. He became a Professor at Pusan National University in 1990. His research interests include failure analysis, quality engineering and reliability of mechanical materials and system, lie in the evaluation of materials system. He has published more than 400 scientific papers. He is an Editor of a book entitled "advances in nondestructive evaluation". He is a senior member of Korea Academy of Engineering. In addition, he has been both an executive member of the National Council for Science & Technology and an advisory member of National Nuclear Safety Commission of Korean government.

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