Modeling of thermal behavior of a VRLA battery for an automotive electrical system

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There is an urgent need for the automotive industry to adopt a higher voltage for the electrical system due to the increase of the total electrical power required by vehicles from the current 12-V level. The introduction of a 36-V technology will enable new power-train to serve as a drive-train hybrid functions such as boost and regenerative braking, as well as various safety and comfort functions. A VRLA (valve-regulated lead-acid) battery is commonly applied to a 36-V electrochemical storage system. It enables high-rate start, deep discharge and recharge cycle, and high-rate partial-state-of-charge. Also, it has a very long life span. Due to the favorable characteristics of the VRLA, it is ideal for high-power applications.

In this work, a three-dimensional modeling was performed to investigate the effects of operating conditions, ambient conditions, and design factors on the thermal behavior of the VRLA battery for an automotive electrical system.