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Prediction of temperature behavior of a lead–acid battery by means of Lewis number

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Abstract

Temperature rise is one of the main problems of battery applications. Thus, preventing the temperature rise in lead–acid batteries is an important research topic. In the present study, the effect of Lewis number on temperature rise is investigated. Moreover, effects of the cell–length (CL), the maximum activated area ($A_{\max}$) and the newly defined parameter of maximum dimensionless volume ($A_{\max}L$) on Lewis number are studied. The governing energy equation is non–dimensionalized due to saving cost and time. A typical lead–acid cell, taken from literature, is simulated using finite volume method. The results demonstrate that Lewis number has inverse relation with temperature rise. However, the parameters of CL, $A_{\max}$ and $A_{\max}L$ have direct impact on Lewis number. In this research, the aspect of battery design is presented in which the problem of temperature rise is overcome. In fact, the temperature rise can be restricted by changing some parameters due to modification of Lewis number.

Keywords: Lead–acid battery; Temperature rise; Lewis number; Non–dimensional simulation

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