Mathematical modeling of lithium-ion battery in various temperature and discharge rate

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Lithium-ion batteries have attractive energy source for portable device or other eletric applications that require both high energy and power density. However, they are very sensitive in operating conditions. Especially, the temperature leads to degradation discharging properties or even possibility in exposure of explosion. In addition, during the discharge, inner overpotential affects degradation in discharging properties. This situation is dependent on temperature and discharge rate. For these reasons, mathematical modeling of lithium-ion battery is required to find out which thermodynamic variables affect the overpotential more directly. In this study, computational simulation of lithium-ion battery was implemented in various temperature and discharge rate, in which mass-transfer equation and modified Ohm's law are used. The result was confirmed that concentration overpotential caused faster in low temperature and high discharge rate due to the decrease of diffusion coefficient of solution and solid phase.

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