The wettabilty in porous electrode of lithium ion batteries

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Lithium-ion batteries (LIBs) are widely used in information technology (IT) applications and preferred system for electrical energy storage (EES) in electrical vehicles (EVs) and hybrid electrical vehicles (HEVs) because of their high power and energy densities [1]. The LIB electrode is composed of porous electrode, liquid electrolyte and separator. Through the impregnation process, liquid electrolyte permeates the pore space of porous electrode to constitute the transport paths for lithium ion. The wettability of porous electrode by the electrolyte is one of the critical factors that affect the battery performance and cycle life. Insufficient wetting of electrolyte can cause poor utilization of the electrode capacity and increasing electrolyte resistance, resulting in degradation of performance and cycle life [2].
In this study, the electrolyte transport dynamics in the two-dimensional electrode structure of LIB numerically investigated using the multiphase lattice Boltzmann method (LBM). The LBM is a promising computational fluid dynamics (CFD) tools for simulation of multiphase and immiscible flow and successfully simulates the complicated microscopic behavior of a liquid electrolyte in a porous electrode of LIBs. It is shown that LBM approach is an effective tool to investigate electrolyte transport phenomena in porous electrode with wettability taken into consideration [1]. Using the LB model, we studied the wetting mechanism in the cathode and anode. The effect of material properties, such as porosity, particle size and contact angle, on the electrolyte wettability are investigated. The electrolyte distributions in the electrode and the electrolyte saturation profiles are presented to evaluate the wetting capability.

References:

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