Simulation Modeling and Charge–Discharge Characteristics of a Zinc–Nickel Single-Flow Battery Stack

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An equivalent circuit simulation model of a zinc–nickel single-flow battery stack that considers internal resistance loss and external parasitic loss is built by MATLAB/Simulink to accurately predict the actual operation characteristics of a zinc–nickel single-flow battery stack. The dynamic internal resistance obtained by experimental fitting is used to optimize the original simulation model and subsequently improve the accuracy of the model. Then, the performance of the battery stack with different currents is predicted and analyzed. Simulation results show that the peak of the battery terminal voltage decreases, the coulomb efficiency of the battery increases, and the voltage efficiency and energy efficiency decrease with the increase in current.

Keywords: zinc–nickel single-flow battery; equivalent circuit; electrochemical reaction; Nernst equation; simulation

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