The SOH and the SOC assessment of NCR18650 PANASONIC cylindrical battery through the entropymetry

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As the demand for the li-ion batteries increases in various areas, the precise and reliable assessment of the state of health (SOH) and the state of charge (SOC) of the battery become more important in the battery management system (BMS). The main goal of this research work is to create the model for the assessment of the SOH and SOC of the NCR18650 PANASONIC cylindrical battery based on thermodynamics parameters such as, enthalpy and entropy.

There are a lot of the SOH and SOC assessment methods in the market such as, the electrochemical, the equivalent circuit, and the machine learning models based methods. In this research work, it was used the Universal Battery SOC Theory proposed by Rachid Yazami in which α, β, γ coefficients depend on the SOH and nature of the battery.

$$SOC = \alpha + \beta(K*mol)/ J\ \Delta S + \gamma mol/J\ \Delta H$$

The mode of aging of the battery is divided into a calendar and cycling aging. Calendar aging is the decreasing the SOH of the battery without applying current. Cycling aging is the decreasing the SOH of the battery by charging and discharging of the battery. In this research work, the influence of the calendar aging was neglected by a continuous cycling of the battery. Cycling aging depends on the various parameters of cycling such as, the number of cycles, C-rate, the depth of discharge (DOD) , and the temperature.

To determine the dependence of the SOH of the battery to α, β, γ coefficients, it was analyzed the thermodynamics parameters of the NCR18650 PANASONIC cylindrical battery at various C-rate, DOD, and the number of cycles. But the influence of the temperature to the aging was extracted by cycling the battery at ambient temperature.

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