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Study of Aging Behavior of Parallel-Series Connection Batteries

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Abstract : For lithium-ion batteries with multiple cell configurations, some use scenarios can cause uneven aging effects to each cell within the battery because of uneven current distribution. Hence the focus of the study is to explore the aging effect(s) on batteries with different construction designs. In order to systematically study the influence of various factors in some key battery configurations, a detailed analysis of three key battery construction factors is conducted. And those key factors are (1) terminal position; (2) cell alignment matrix; and (3) interconnect resistance between cells. In this study, the 2S2P circuitry has been set as a model multi-cell battery to set up different battery samples, and the aging behavior is studied by a cycling test to analyze the current distribution and recoverable capacity. According to the outcome of aging tests, some key findings are: (I) different cells alignment matrices can have an impact on the cycle life of the battery; (II) symmetrical structure has been identified as a critical factor that can influence the battery cycle life, and unbalanced resistance can lead to inconsistent cell aging status; (III) the terminal position has been found to contribute to the uneven current distribution, that can cause an accelerated battery aging effect; and (IV) the internal connection resistance increase can actually result in cycle life increase; however, it is noteworthy that such increase in cycle life is accompanied by a decline in battery performance. In summary, the key findings from the study can help to identify the key aging factor of multi-cell batteries, and it can be useful to effectively improve the accuracy of battery capacity predictions.

Keywords : multiple cells battery, current distribution, battery aging, cell connection
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