

Active Cell Balancing increases effective battery capacity and reduces capacity variance.

Active Cell Balancing alleviates a number of problems associated with the efficient use of multi-cell, Lithium chemistry batteries.

Cell Manufacturer

Lithium Ion cell manufacturers experience variations in individual cell capacities as a result of the cumulative effect of inconsistencies in the production processes and materials. This results in differences in individual cell capacities ranging from fractions of percent into double digits. Capacity variations are further exacerbated by variations in internal cell impedance which at high rates of discharge can effectively prevent access to capacity. In addition, operational factors such as charge/ discharge cycles, depth of discharge and environmental conditions as the cell ages cause further variations in cell capacity and impedance changes.

In an attempt to reduce the problems caused by cell mismatch in multi cell battery packs, cell manufacturers employ screening at the end of the process and batch cells according to their capacities. The outcome is that although individual cells are closely matched to other cells of a similar capacity, the overall variation follows a normal Gaussian distribution. When assembled into multi cell battery packs of a nominal capacity the packs will also follow a normal distribution.

Cell capacity screening alleviates the problems of cell mismatch within an individual battery pack however it does not address the overall capacity distribution of battery packs. This is illustrated below by the blue curve in the graph. The distribution of battery capacities, vehicle range in miles, follows that of their component cells.

By using Active Cell Balancing technology cells of varying capacity can be randomly mixed in battery packs thus eliminating the need for a screening process. Active Cell Balancing evenly distributes capacity across the cells within a battery and significantly lowers the variance in overall capacity, vehicle range in miles. This is illustrated by the green curve in the graph and when compared with the standard variance indicated by the blue curve shows a significant improvement.

Battery Pack Manufacturer

A battery pack is only as good as the weakest cell. During charge and discharge the battery management and protection circuitry will disable the battery when the weakest cell reaches its upper or lower operational limits. By using energy from the cell stack to support weaker cells during discharge or moving energy away from weaker cells during charge, cell balancing is achieved. A balanced pack overcomes the problems of cell mismatch interacting with the electronic management and protection system. This enables maximum energy to be stored in a battery pack, permits maximum energy delivery, increases time between charges and improves overall battery lives. Current state of art balancing systems are passive and only function in charge mode. Active Cell Balancing functions in both charge and discharge and the technology can also function as an integral charger.

Overall Active Cell Balancing provides higher effective battery capacities with significantly lower variance, extended battery life, extended time between recharges and incorporates an integral charger. In an electric vehicle context this provides greater vehicle range and lower variance

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