BMS

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Nanomaterial and its applications

Rechargeable Lithium-ion (Li-Ion) battery technology has come a long way since its introduction in the early 1990s. Over the last two decades, they have become the technology of choice for powering portable electronic devices such as cellular phones and laptop computers. Currently, Lithium-ion batteries are steadily replacing Nickel-Cadmium (NiCd) and Nickel-Metal Hydride (NiMH) battery technologies in portable power tools. In the future, Lithium-ion batteries are poised to power a new generation of hybrid electric vehicles (HEV), plug-in hybrids (PHEV) and electric vehicles (EV). Another emerging application for Lithium-ion technology is in battery electrical energy storage systems for smart grids that are powered by traditional energy sources like coal, as well as intermittent renewable energy sources like solar and wind.[1]

The optimum combination of long run time (high energy density at the desired power) and long life (recharge characteristics) sets Lithium-ion battery technology apart from the competition. Needless to say, safety and cost expectations of the application also have to be satisfied. While all of these requirements are being met for portable electronics, the technology is just beginning to move up the optimization curve for emerging applications such as electric automotives, power tools and storage systems. For example, one factor that distinguishes the portable electronics and the electric vehicle application is power density. The latter requires much higher charge and discharge rates compared to the former. While higher power can be achieved to some extent by redesigning the way the battery cell is constructed, nanomaterials are also expected to play a key role in the achievement of high-power capability. Nanomaterial strategies are also being employed to provide better strain accommodation in high-capacity electrodes so that this storage capacity can be extracted reversibly with minimum compromise in cycle life. Alternatively, the stable cycle life and storage life characteristics of “zero-strain” electrode materials can be improved even further by utilizing nanosized versions of these electrodes, thereby providing a new generation of electrical energy storage options for smart grids and back-up power systems.