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Battery Runtime Demystified

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Battery runtime can be a mystery to some; a backup system battery's fixed runtime and life span, a mobile device's fortuitous shutoff, a car battery's limited life. Unfortunately, all good things must eventually come to an end. Luckily, many technological innovations and practices are continually working towards extending battery life by improving capacity, one of the key measurements for battery runtime. From the bottom up, battery materials, manufacturing processes, ICs and advanced technology are all currently evolving at a rapid pace to improve battery capacity. This has created a dynamic industry with increased market potentials across the globe.

Battery Materials and Components

Batteries utilize a set of raw materials and components to operate including the anode, cathode and electrolytes. These components vary by battery type, but are all comprised of naturally occurring metals and chemical combinations. Each battery cell is created with a precise quantity of the material and chemical combination. Any slight variation can affect the amount of produced electricity, voltage rate or overall ability to function properly, including negatively affecting battery runtime.

Battery material innovations have resulted in extended runtimes and nanotechnology is expected to play a big role in this advancement. By using nanotechnology in the manufacturing process, increased surface area can be created to provide high power and energy density, long shelf life and decreased manufacturing cost. For example, many start-up companies, battery suppliers, national laboratories, university research teams and other companies are utilizing nanotechnology to develop battery materials expected to extend runtime. An innovative type of anode based on silicon nanowires was recently introduced that is expected to benefit the industry.

Battery Management ICs

Primary functions of battery management ICs are battery charging, protection and monitoring. Rechargeable batteries require charge control circuits for safe, efficient and rapid recharge capabilities. In addition, lithium-ion and lithium-ion polymer battery packs require a built-in protection circuit that protects the cell from improper use. The growing need for a more accurate fuel gauging, heat dissipation reduction and related risks and gathering data on battery voltage, current and temperature has become an important trend in battery management ICs market.

Fuel gauges incorporate software packages to check data, reprocess algorithms at any point of time based on age of the battery, number of discharges and much more. This is one of the most important trends in the battery management industry and is expected to increase.

Alternative Energy Solutions

Several alternative energy solutions are being developed and a common goal is to extend application runtimes. Whether the technology supplements or replaces the existing battery, the goal remains to extend runtimes.

Ultracapacitors

An increase in automotive luxury features has spurred technology development on the power side. As existing battery chemistries are challenged to keep pace with the electrical demands of these additional features and provide the required runtime, ultracapacitors are being reviewed as a potential solution. When combined with traditional batteries, the ultracapacitor/battery combination can become an energy storage solution that can provide instant release of power and charge. Additionally, by implementing a distributed power architecture, battery strain will decrease and ultimately provide extended runtimes. Hybrid vehicles, regenerative braking and stop-and-go (ignition acceleration and starting) applications also impact the demand for ultracapacitors.

Uninterruptible power supplies (UPS), DC power systems and renewable energy applications currently use lead acid batteries. Unlike the automotive market, the industrial market largely deals with product reliability and quality issues, especially the current battery technology. The major issues identified with traditional batteries used in industrial application is poor power density, cycle life, runtime and thermal susceptibility. Original equipment

manufacturers are exploring the possibilities of enhancing power reliability by implementing ultracapacitors as an additional energy storage solution either in conjunction with batteries or fuel cells as a power conditioner, which could extend the battery life and runtime.

Although ultracapacitors initially emerged as a memory backup technology for consumer electronic devices, its discovery as an energy storage solution has expanded the possibility for diverse applications in the consumer electronic markets. Mobile devices are seen to be one of the keen areas of focus. Portable electronic devices have steadily moved toward higher performance that requires additional power, lower cost, smaller size, longer runtime and lighter weight. These technology trends impact the existing power source and put considerable strain on rechargeable batteries. Additionally, portable applications require instantaneous power to operate their various features. Ultracapacitors are a solution, as this technology has the ability to instantly charge and recharge for numerous charge-discharge cycles.

Fuel Cells

Fuel cell technology is considered a niche or a special need type of market. Similar to any new technology, the end-result products take time to truly penetrate the market. For mass-market commercialization to occur, a product must typically start small, be adopted by a small percentage and then blossom into full growth. Fuel cells are expected to follow this time line curve closely.

Fuel cells offer a wide range of benefits. A single fuel cell can produce water, electricity or heat and it is inherently clean, efficient and safe. Furthermore, these cells possess the unique ability to address environmental degradation and energy security challenges.

Fuel cell development began more than 25 years ago as a result of the need to find a reliable, lightweight power source for sophisticated military and space applications. Fuelled by pure hydrogen, these cells produce zero emissions of carbon dioxide, oxides of nitrogen, or any other pollutant. Fuel cells used in applications ranging from backup equipment to portable electronic devices all maintain a similar goal, to extend runtimes.

Conclusion

Extending battery runtime is a key industry focus at this time. A high level of R&D and technology advancement is focused on this trend and several areas have witnessed a positive improvement. This is expected to be an ongoing trend in the energy industry as applications continue to evolve and demand increased power and capabilities. Time will tell if this insatiable desire for extended battery runtimes will ever truly be fulfilled.

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Reprinted from the March/April 2008 issue of Battery Power Products & Technology magazine. © 2008 Webcom Communications Corp.
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