

Advanced battery performance for OEMs and consumers

As energy demands increase, from high-drain bursts to extended runtime, traditional battery technologies are feeling the strain. By Joe Carcone

Batteries usually receive very little attention—they are often the least sexy element of any new technology and the last thing consumers think about until they're low or out of power. And, as counterintuitive as it sounds, one of PowerGenix's goals with the introduction of new Nickel-Zinc batteries has been to keep it that way, developing rechargeable batteries that people don't need to think about.

As the popularity and sophistication of portable electronics continues to accelerate and energy demands increase, from high-drain bursts to extended runtime, traditional battery technologies are feeling the strain. Restricted by the confines of the periodic table, the battery industry has historically displayed only modest performance gains—5 to 6% annually—while the energy demands of more highly integrated electronic functions have followed the unbounded growth described by Moore's Law.

The first profoundly new commercial battery technology in more than two decades, PowerGenix's rechargeable Nickel-Zinc (NiZn) shifts the engineering curve for rechargeable battery performance. With higher cell voltage than both Nickel-Cadmium (NiCd) and Nickel Metal-Hydride (NiMH)—1.6 volts compared with 1.2 volts—NiZn batteries deliver one-third greater energy and power than these historically dominant players in AA and AAA rechargeable batteries.

The higher cell voltage afforded by this new chemistry is at the root of NiZn's performance advantages

and explains how NiZn enables electronics to perform better, and keeps batteries out of sight and out of mind longer.

A longtime user of replaceable battery systems, I'll use the cordless telephone industry as an example to explore the advantages of NiZn battery technology—though the traits carry across applications.

A typical battery pack used in a cordless telephone handset consists of three AAA cells with a voltage of 3.6 V and a capacity of 700 mAh. Because NiZn presents a higher cell voltage than NiMH (1.6 V vs. 1.2 V) it offers electronic designers an opportunity to vastly increase battery pack power, and even accomplish handset designs using only two AAA cells. This would result in smaller, lighter cordless handsets and reduce costs using one-third fewer cells.

NiZn's increased voltage also introduces a new level freedom for designers, delivering battery performance better able to meet minimum voltage requirements for electronic devices—the minimum power required before a unit ceases to operate. Most importantly, NiZn voltage during discharge (typically 1.75 to 1.2 V) is usually entirely within the operating voltage range of devices, resulting in better overall performance of the device throughout the battery's entire discharge cycle.

But, power isn't the only place NiZn shines. The chemistry also improves cell capacity, offering a 33% improvement in volumetric capacity compared to NiMH systems. Together with a higher battery pack

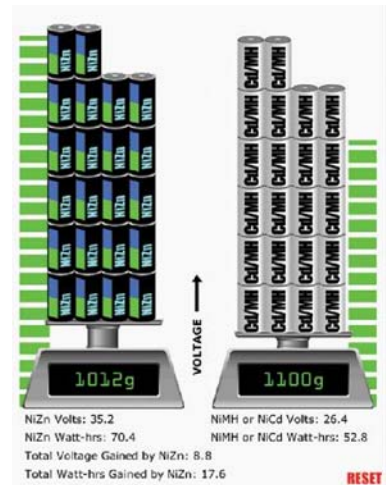
voltage and improvements in battery pack energy capacity, cordless phones users will enjoy significantly longer operating time. And, with improved self-discharge characteristics, NiZn technology extends handsets battery lifetime between visits to the charging station. It also helps alleviate OEM concerns with shipping duration and storage at temperature, assuring battery packs do not arrive at the end user fully discharged.

The Environmental Choice

Nickel-Zinc's core chemistry is non-toxic and manufactured from abundant and highly recyclable nickel and zinc. And, unlike NiMH and NiCd, it contains no rare earth elements (REEs), making NiZn the most recyclable rechargeable battery on the market. Earlier this year PowerGenix's NiZn batteries became only the fifth chemistry approved for collection by the Rechargeable Battery Recycling Corporation (RBRC) in North America and the first in eight years.

Nickel-Zinc batteries from PowerGenix have also been certified to be compliant under Europe's Reduction of Hazardous Substances (RoHS) directive, the most stringent standard for toxic and heavy metal reduction in electronics.

As portable power needs have matured, battery choices have become as specialized as their technology counterparts. Will you require lon-



PowerGenix's website has an interactive "battery graph" that demonstrates the benefits of its NiZn technology versus NiMH or NiCd chemistries.

ger runtime or intense power bursts? Will the batteries be subject to deep discharge or require pack management? Are you confined by size and weight restrictions; what about cost? To be sure, no single battery technology is the best choice for every application.

However, we believe Nickel-Zinc technology has the ability to replace existing Nickel-Cadmium and Nickel Metal-Hydride chemistries in the market. Along with superior environmental and safety credentials, NiZn's 1.6 V capacity makes it the first rechargeable battery able to provide power equivalent to primary, single-use, batteries—giving it the ability to not only obsolete competing rechargeable technologies, but also directly compete for the first time with primary batteries.

Joe Carcone is Vice President, Business Development at PowerGenix.

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Battery Chemistry	Package	Mass (g)	Volume (cm ³)	Nominal Voltage	Capacity (mAh)	Energy (mWh)
NiZn	AAA	11.5	3.8533	1.6	850	1402.5
NiZn*	AA	25	8.3391	1.6	1500	2475
NiCd	AAA	11	3.8533	1.2	250	300
NiCd	AA	24	8.3391	1.2	700	840
NiMH	AAA	12	3.8533	1.2	700	840
NiMH	AA	27	8.3391	1.2	1200	1440

- NiZn: Higher nominal voltage compared to NiCd and NiMH
- NiZn: Higher capacity compared to NiCd and NiMH
- NiZn: Higher energy compared to NiCd and NiMH
- NiZn*: First generation specification capacity 2008.