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Nickel-zinc batteries could help power the start-stop revolution

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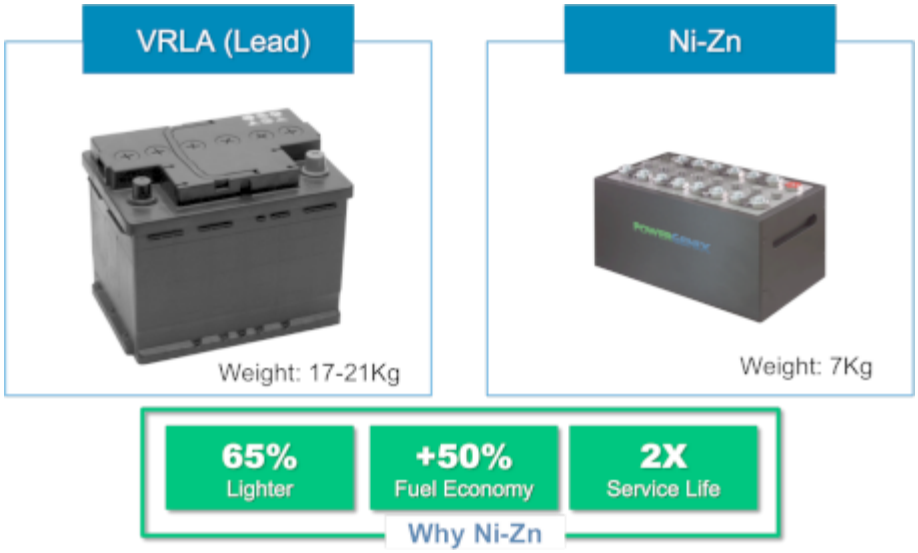

Nickel-zinc battery technology offers several advantages over lead-acid for start-stop applications, according to PowerGenix.

In response to high oil prices and increasingly strict limits on carbon emissions, governments worldwide continue to tighten fuel-efficiency standards. These regulatory changes have opened the door to a wide spectrum of alternative vehicle technologies.

While electric and hybrid-electric vehicles (EVs and HEVs) will play significant roles in this emerging mix, start-stop hybrids (also known as micro-hybrids) are projected to claim over 40% of the market in the next five years. In a start-stop hybrid, energy from the battery is not used to propel the vehicle. Instead, the start-stop technology saves energy by shutting off the engine while the vehicle is at rest, automatically restarting it when the driver steps on the gas pedal.

Start-stop is the simplest kind of hybrid technology and is expected to become the most common because it is the lowest-cost hybrid alternative. At a cost as low as $300 per system, it is one of the most cost-effective means of improving efficiency for vehicles using in internal-combustion engine. Current micro-hybrid technology can improve fuel economy by 5-10%, and future systems may achieve savings as great as 15%. If widely adopted, it could substantially reduce fuel consumption and air pollution from idling vehicles.

Many automakers are enthusiastically pursuing the technology, which is fast becoming standard on new European vehicles. **Lux Research**projects that start-stop technology will be included in 34 million vehicles per year by mid-decade, capturing 37% of the global new vehicle market. The U.S. **EPA** and the U.S. National Highway Traffic Safety Administration (**NHTSA**) in a report predict that micro-hybrids will account for 42% of global sales of new passenger vehicles by 2016.

To date, the main barrier to the widespread adoption of micro-hybrids is the limited suitability of current battery technologies.

Lead-acid batteries are currently the most common choice for micro-hybrids because of their low cost, but they have critical performance limitations. Studies have shown that even the most advanced lead-acid batteries may take up to 10 min to recover from a single start-stop event, meaning that the battery's ability to recharge after a stop declines rapidly from first use. With such a handicap, the battery is unable to support the next stop event, resulting in a corresponding decrease in fuel economy.

In addition, micro-hybrids typically use oversized starter motors to accomplish quicker engine crank-ups, creating electrical loads that lead-acid batteries are unable to support. The batteries begin to deteriorate within weeks, rendering them unable to support minimum system voltage during engine start. To compensate, automakers have been forced to develop workarounds that further diminish the cost and fuel-economy advantages that lead-acid batteries might offer. In some modifications, the start-stop function can be momentarily disengaged, although that decreases fuel economy. In others, supplementary systems are added to compensate for voltage depression, increasing system cost and complexity.

Lithium-ion (Li-ion), another alternative vehicle battery technology, also has limitations. Although Li-ion batteries offer high performance, they are also costly due to complex manufacturing processes. Li-ion batteries also suffer from safety problems: thermal issues have on occasion caused them to combust spontaneously.

The nickel-zinc (NiZn) battery is well suited to meet both the technical and cost challenges of micro-hybrids, according to **PowerGenix**. It says NiZn batteries provide sustained, high charge acceptance over a much longer life span. And unlike lead-acid batteries, they can handle the heavy stop-and-go duty cycle while maintaining system voltage, thus eliminating the need for reductions in start-stop operations or costly supplementary systems. They are half the weight and size of lead-acid batteries and thus offer a vehicle weight advantage as well.

The company claims that NiZn is the only advanced battery technology able to meet the tight cost requirements of start-stop systems. Also, unlike Li-ion batteries, NiZn batteries are completely safe: the aqueous electrolyte solution is not subject to thermal issues and contains no toxic heavy metals. NiZn is also the most recyclable advanced battery technology, with over 90% of the constituent materials recoverable.

Dan Squiller, CEO of PowerGenix, wrote this article for AEI.