

Alternatives to Lead-Acid Starter Batteries

Lead-free battery systems are already on the market in high-voltage electric and hybrid-electric vehicles, and are expected to grow significantly over the next decade. These alternatives offer several performance advantages over conventional lead-acid batteries. With additional development to achieve mass production volumes, these alternative batteries could also compete with emerging 42-volt (higher voltage battery systems to satisfy increased electrical demand) and the standard 12-volt systems.

Nickel Metal Hydride

Nickel metal hydride (NiMH) batteries are currently used in high-voltage electric and hybrid electric vehicles (e.g., Toyota Prius), as well as other products like portable electronics. NiMH has several advantages to conventional lead-acid battery systems, including more than twice the energy density, and three times the life expectancy.

Manufacturers:	Texaco Ovonic ; Panasonic EV ; Sanyo ; SAFT ; GP Batteries .
Performance Advantages:	Higher power density, reduced weight and volume, increased battery life.
Environmental Benefits:	Less material use, improved fuel economy due to lighter weight and energy storage capacity; potentially recyclable without need for additional smelting.
Recyclability:	Recycling of NiMH batteries is technically possible but the infrastructure is currently immature. Manufacturers of vehicles containing these batteries have indicated that they will assist the development of the recycling infrastructure. NiMH batteries may be recycled using wet-chemical or electrochemical technologies, thus avoiding the potential air emissions associated with smelting, which is the process used for lead-acid battery recycling.

Lithium-Ion

Lithium-ion (Li-Ion) batteries, common in computer and electronic equipment, are now emerging in automotive applications. Li-Ion systems offer higher power density than both lead-acid and NiMH batteries, providing enhanced performance, although currently at a higher cost. Federal Express, a U.S.-based package delivery company, has recently selected Li-Ion as the battery system for a new fleet of diesel-electric hybrid delivery vehicles supplied by the Eaton Corporation, and other manufacturers are also considering Li-Ion for hybrid-electric applications (e.g., Nissan).

Manufacturers:	Hitachi/Shin-Kobe ; SAFT ; Telcordia .
Performance Advantages:	Higher power density, reduced weight and volume, improved longevity, reduced heat generation.
Environmental Benefits:	Low-toxicity materials, improved fuel economy due to lighter weight and energy storage capacity.
Recyclability:	According to Shin-Kobe, copper and steel are currently recovered. Research is being conducted on methods to recover lithium, but recyclability may not be as critical given the low toxicity of the materials and reduced environmental impacts from production.