The Advanced Lead-Acid Battery
Technological Breakthrough

100,000 mile test run achieved by The Ultrabattery at Millbrook Proving Ground in England.

Performance exceeds Ni-MH battery used in hybrid electric vehicles.

Surpasses standards set for power-assist HEVs by the United States Department of Energy's FreedomCAR Program.

UltraBattery research has created a **low cost, high power device** that delivers sufficient energy and has a long service-life.

Performance Enhanced through Creativity

Dramatic improvements in the performance of lead-acid batteries have come about not through the use of rare or expensive materials, but through the creative use of the raw materials that lead-acid manufacturers have been using for decades.

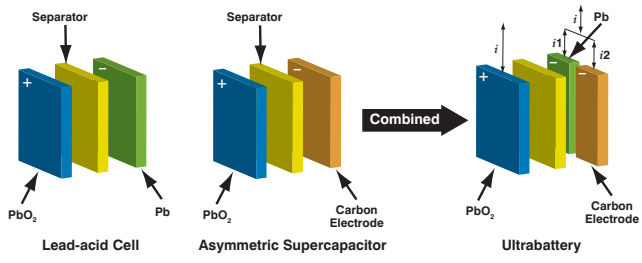
It is the creative use of standard, readily available materials that has enabled engineers to achieve the technological breakthroughs that are making a new generation of affordable, efficient and environmentally-safe lead-acid batteries available for use in hybrid electric vehicles and other energy storage programs.

Quite simply, the addition of certain types of carbon to the traditional lead-acid design has led to the production of the new **'Ultrabattery'** that is breaking performance standards and is positioned to become the low-cost alternative to batteries produced with nickel metal hydride (Ni-MH) or lithium (Li-Ion) technology. In the **'Ultrabattery'** a supercapacitor electrode composed of carbon is combined with the lead-acid battery negative plate in a single cell to better regulate the flow (charge and discharge) of energy, thereby extending the power and life of the battery itself.

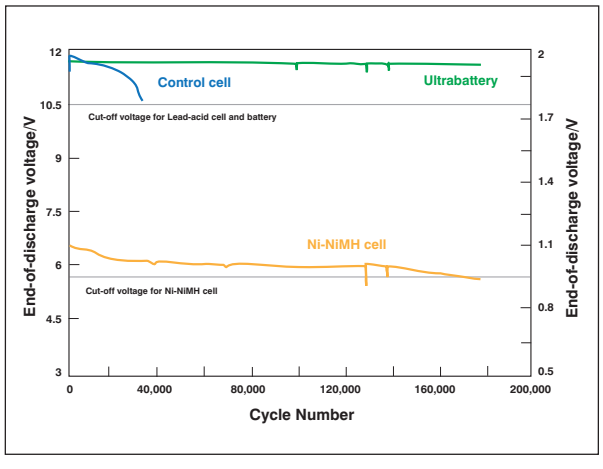
In more conventional designs of lead–acid battery also, the incorporation of the same ingredient, carbon, has sharply reduced the accumulation of lead sulfate deposits that previously inhibited the performance of lead-acid batteries.

Carbon + Supercapacitor = Performance Breakthrough

For years, scientists have known that the accumulation of lead sulfate has prevented lead-acid batteries from achieving a sustained level of operation required for heavy duty performance in hybrid electric vehicles and other energy storage applications.



This problem would occur whenever a lead-acid battery's 'state-of-charge' remained significantly below 100% for a sustained period. Conversely, whenever the battery's state-of-charge would rise much above 70 percent, it could not accept a recharge from either a stop-start braking system or a charge from the engine itself.



Inserting a supercapacitor into the battery acts as a 'buffer' to manage the high-rate charge/discharge process so that the unit can operate within a state-of-charge window below 70 percent successfully.

Deployment of the carbon in a supercapacitor electrode attached to the negative plate has resulted in the creation of the Ultrabattery, produced by the Furukawa Battery Co. of Japan and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) of Australia and tested by the Advanced Lead-Acid Battery Consortium (ALABC) which is headquartered in North Carolina.

The chart to the left shows the performance of three batteries over 200,000 HEV (hybrid electric vehicle) cycles. The first, in blue, is a "control" cell without the supercapacitor or other carbon additions. The second, in green, is the Ultrabattery with the added supercapacitor electrode. The third, in orange, is a standard Ni-MH cell.

ALABC

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