

Integrating advanced, lithium-based batteries into vehicles



O A A T A C C O M P L I S H M E N T S

High-Power Energy Storage and Advanced Batteries

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Challenge

Advanced lithium-based batteries offer higher power and energy and potential for long life and low costs. Successfully integrating these batteries into hybrid and electric vehicles is critical to transforming prototypes into production vehicles. The batteries – developed by the U.S. Department of Energy (DOE) and the United States Advanced Battery Consortium – have been integrated into a number of hybrid and electric vehicles.



The AVESTOR lithium metal polymer battery integrated into a Ford Think City electric vehicle.

Technology Description

The successful integration of batteries in vehicles is indicative of several important achievements by any battery technology. First, the battery can consistently meet minimum performance standards. If the battery cannot deliver sufficient energy and power, then the vehicle will not perform well in acceleration or range tests. Second, the basic cell technology can be reliably produced in high volume. Modern vehicle batteries can have up to several hundred cells that must work together consistently. Finally, the prototype battery must have a reasonable life. If the battery does not have reasonable life, early failures at the cell or module level will quickly disable the vehicle.

In preparing for vehicle integration, prototype batteries are first tested vigorously at the cell, module, and battery pack level in laboratory environments. These tests establish that performance and life goals are being reasonably met. Additional abuse tolerance tests will establish that the battery is reasonably safe to utilize in the vehicle, and will not pose a hazard to the operating personnel. Only when these criteria are met can battery-vehicle integration proceed.

Accomplishments

DOE and the United States Advanced Battery Consortium sponsored the development of two lithium-based battery systems that are being developed for both hybrid and electric vehicles. The first is a lithium ion battery being developed by SAFT in United States and France. The second is a lithium metal polymer battery being developed by AVESTOR (a subsidiary of Hydro-Quebec) in Montreal, Canada. Both technologies can be either a high-power battery for hybrid vehicles or a high-energy battery for electric vehicles. Over the past year, the following vehicle integrations were performed with these battery technologies:

- SAFT High Power Lithium-Ion Battery: DaimlerChrysler ESX3 Hybrid Vehicle Concept Vehicle under the Partnership for a New Generation of Vehicles (PNGV),
- SAFT High Energy Lithium-Ion Battery: Ford e-KA and Peugeot 106 Electric Vehicles,

- AVESTOR High Power Lithium Metal Polymer Battery: General Motors Precept Hybrid Concept Vehicle under PNGV and Honda Insight Hybrid Vehicle,

- AVESTOR High Energy Lithium Metal Polymer Battery: Ford Th!nk City Electric Vehicle.

These efforts were also complemented by significant lithium battery-vehicle integration efforts by Nissan in Japan. Nissan integrated advanced lithium ion batteries from Shin-Kobe into their Tino hybrid vehicle and their Altra and Hypermini electric vehicles. Nissan has taken their battery-vehicle integration efforts to the demonstration level, with approximately 100 vehicles operating on lithium ion batteries. Lithium ion batteries for hybrid and electric vehicles are also being offered by Japan Storage Battery.

Benefits

Successfully integrating a large number of advanced lithium-based battery technologies into hybrid and electric vehicles helps raise the competitive pressure to bring vehicles offering these technologies to market. Higher fuel costs have emphasized the need for improved fuel economy. Recent reaffirmation of the zero emission vehicle requirements by California and the Northeast states emphasizes the need for hybrid and electric vehicles in the near term. These demonstrations of the ability of the lithium-based battery technology to meet the requirements for advanced vehicles move this technology closer to market commercialization.

Partner in Success

- United States Advanced Battery Consortium (for battery development)

