

Performance and Life Testing of 12 Ah Saft America HP-12(2001 Generation) Lithium Ion Cells
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The Partnership for a New Generation of Vehicles (PNGV) was a cooperative research and development program between the Federal Government and USCAR, whose members were DaimlerChrysler, General Motors, and Ford Motor Company (1). A major goal of the program was to develop technologies for a new generation of hybrid electric vehicles with fuel economies up to three times (80 miles per gallon) the average 1994 family sedan. The investigation of energy storage devices has focused in recent years on high-power lithium ion batteries, which are being tested at the Idaho National Engineering and Environmental Laboratory.

The Idaho National Engineering and Environmental Laboratory tested six Saft America HP-12, 12 A-h (2001 Generation) lithium ion cells to evaluate cycle life performance of a full-size lithium ion cell for use in a Power Assist hybrid electric vehicle battery. The cells were also tested to investigate the effects of temperature on power fade while cycling. All cells were cycled at a target at 75% state of charge (SOC). Two cells were tested at each of the three temperatures, 30°C, 40°C, 50°C. Test results show that all but one of the full-size cells had sufficient power capability to meet the PNGV simultaneous goals of power/energy at the beginning of life and after 300,000 cycles using a battery size factor (BSF) of 48 cells (2). Saft America supplied the BSF.

The characterization tests show that the initial average capacity of the cells was 16.4 A-h but decreased with time and inversely with temperature over the course of 300,000 cycles, see Figure 1. However, capacity fade shows an inverse dependence on temperature. Both power and capacity were diminished during the low-temperature thermal performance test and increased during the high-temperature test. Results from these hybrid pulse power characterization tests are given in Figure 2. After scaling the results by the BSF, Figure 3 indicates that all but one cell can meet the PNGV power and energy goals at the beginning of life and after 300,000 cycles. Figure 3 also shows that there is no increase in power fade with respect to cycling temperature. Consequently, temperature does not affect the power fade rate of the Saft America (2001 generation) cells during life-cycle testing.

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- for a New Generation of Vehicles, 7th Report, National Academy of Sciences, 2001
2. PNGV Battery Test Manual, Revision 3, DOE/ID-10597, February 2001

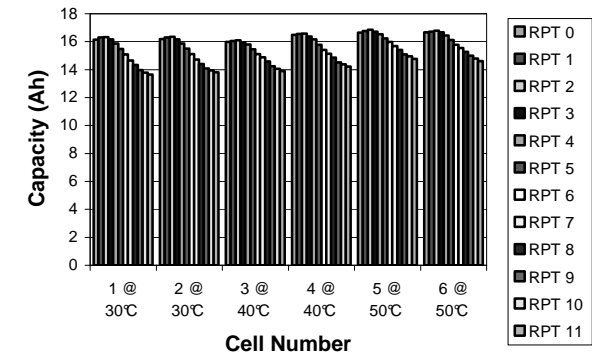


Fig. 1: Capacity Summary for Saft HP-12 Cells, P68.

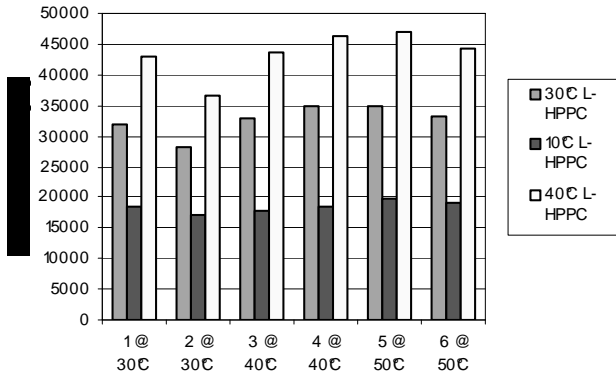


Fig. 2: Low, Medium and Thermal Hybrid Pulse Power Characterization Summary

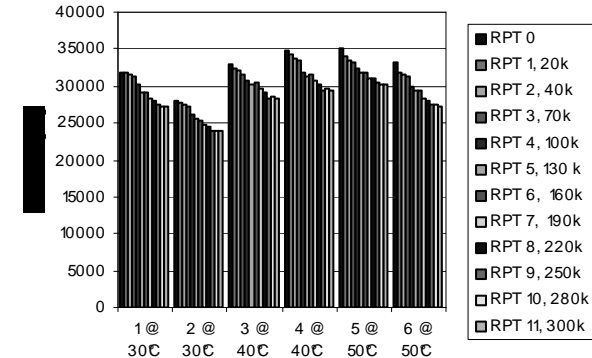


Fig 3: PNGV Power Summary

References

1. Review of the Research Program of the Partnership