BATTERY TESTING AND EVALUATION (NATIONAL BATTERY TEST LABORATORY)

Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439 (U.S.A.)

The objectives of the program are to (1) provide a facility for testing cells and batteries at various stages of development in accordance with contractural requirements with DOE battery developers; (2) provide a centralized and independent facility for characterizing, quantifying, and comparing the performance of various types of batteries under uniform operating conditions; (3) verify performance of batteries under simulated operating conditions prior to application demonstrations; and (4) provide data for battery analysis and modeling.

The National Battery Test Laboratory (NBTL) became operational in June 1978 to accommodate the testing program in support of the DOE electric vehicle battery development program. In August 1979, the laboratory was officially dedicated. Presently, the testing capability of the laboratory is 50 independently operated test stations, 45 for cells and modules (0 to 4 kW h) and 5 for full-sized electric vehicle batteries (40 kW h). A cell/module test station can test batteries from 0 to 12 V at currents from 0 to ±500 A. A battery test station can test batteries from 12 to 200 V at charge currents to 350 A and discharge currents to 500 A. Both the cell/module cyclers and the battery cyclers are completely programmable and use no electromechanical reversing relays. As a result, currents can be quickly and reliably switched from large negative to large positive values as necessary to simulate regenerative braking during driving profile tests or to simulate sudden load reversals during other tests.

The laboratory also has facilities for testing batteries at elevated and at reduced temperatures and under controlled humidity conditions. Three walk-in chambers, each large enough to handle two electric vehicle batteries, provide controlled temperatures from greater than 50 °C to −30 °C and controlled relative humidity from 5 percent to 95 percent. An instrument and a methodology were developed and implemented to measure battery peak-power for a sustained duration at various depths of discharge. Standard test procedures presently in use for characterization and for life-cycle testing were formulated with the aid of the Standards and Specifications subcommittee of the National Battery Advisory Committee (ad hoc). These standard tests consist of the following elements: (1) standard capacity, (2) self-discharge, (3) hysteresis to partial depths of discharge, (4) specific energy as a function of specific power, (5) range on simulated driving profiles, (6) peak power, and (7) life cycle.

As of June 1982, 138 cells (comprising 70 electric vehicle modules and 1 electric vehicle battery) were under test, and testing had been completed on 494 cells.

Performance and life verification testing of modules and batteries under uniform test conditions with standard and special test procedures will be continued during 1983. Modules and/or batteries to be tested include improved lead–acid, nickel/iron, and nickel/zinc electric vehicle batteries; lead–acid hybrid vehicle batteries; and (if far enough advanced) zinc/chloride, zinc/bromine, or sodium/sulfur technologies.

Facility maintenance and improvement will be provided to accommodate the needs of the testing program. The number of test stations that can provide simulated driving profiles and other types of programmable loads will be expanded from 6 to 10 to meet the needs of the program. An additional 100-kW test station will be installed to accommodate advanced batteries such as Zn/Br, Zn/Cl, or Na/S.

Recent publications

1 D. Corp, E. Berrill, D. Fredrickson *et al.*, Peak-power characteristics of improved electric-vehicle batteries, *1982 SAE Congress, Detroit, MI, February 22 - 26, 1982.*
2 W. H. DeLuca, R. L. Biwer and N. P. Yao, Effects of constant-current/constant-voltage charge parameters on lead–acid traction cell performance, *Proc. 16th Intsoc. Energy Conversion and Eng. Conf.*, Am. Soc. Mech. Eng., 1981.
3 F. Hornstra, E. Berrill, P. Cannon *et al.*, Battery testing results at the National Battery Test Laboratory, *4th DOE Battery and Electrochemical Contractors' Conf., Washington, DC, June 2 - 4, 1981.*
4 F. Hornstra, C. Christianson, P. Cannon *et al.*, The impact of regenerative braking on battery performance and energy cost in electric vehicles in urban driving patterns, *EVC Symposium VI (EV EXPO 81) sponsored by the Electric Vehicle Council, Baltimore, MD, October 21 - 23, 1981.*
5 F. Hornstra and N. P. Yao, Standard test procedures for electric-vehicle batteries at the National Battery Test Laboratory, *1982 SAE Congress, Detroit, MI, February 22 - 26, 1982.*
6 C. A. Swoboda, P. H. Cannon, F. Hornstra *et al.*, Solid state high common-mode battery cell voltage scanner, Argonne National Laboratory, *Report ANL/OEPM-81-7*, November 1981.

BATTERY ENERGY STORAGE TEST (BEST) FACILITY

Public Service Electric and Gas Company, 80 Park Plaza, Newark, NJ 07101 (U.S.A.)

The objective of work under the Tripartite Contract between the Department of Energy (DOE), the Electric Power Research Institute (EPRI), and Public Service Electric and Gas Company (PSE & G) is the design (Phase I), construction (Phase II), acceptance testing (Phase III), and operating (Phase IV) of a national test facility to evaluate and assess advanced load-