early 1979, a Laser Raman Spectroscopic technique for the *in situ* examination of the positive electrode of the lead–acid cell was developed. This technique was used to confirm the formation of a thin layer of α-PbO_2 interposed between the $PbSO_4$ and the β-PbO_2 layers in the electrode. This effort will continue in 1980 and new projects will be undertaken in response to needs identified by battery developers.

The planned effort for 1979/80 consists of technical monitoring and evaluation of the contractors research and development effort, coordinating the setting of performance specifications, and testing procedures for advanced batteries in conjunction with the subcontractors, NBTL, and the BEST Facility Group. It is anticipated that a first cost and preliminary design study of the advanced lead–acid battery will be carried out in this period. The ANL support research is anticipated to continue using the new *in situ* analytical technique to elucidate the failure mode mechanism of the lead–acid cell positive electrode, thus providing information to improve active material utilization and battery cycle life.

Recent publications

1 K. W. Choi and N. P. Yao, Thermal analysis of lead–acid cells for load-leveling applications, *J. Electrochem. Soc.*, *125* (1978) 101.

ADVANCED LEAD–ACID BATTERIES FOR ELECTRIC UTILITY LOAD-LEVELING APPLICATION

C&D Batteries/ELTRA Corporation, 3043 Walton Road, Plymouth Meeting, PA 19462 (U.S.A.)

This project has just begun, and it encompasses the research and development and demonstration of advanced lead–acid battery technology with major goals of increasing the cycle life of the utility sized, stationary lead–acid battery from the state-of-the-art of 1800 cycles to >3000 cycles at a reduced cost per cycle of ~0.5 c/kW h $cycle^{-1}$ and operating and maintenance costs of <0.5 mil/kW h. These goals are to be accomplished in three phases. The first phase (3 years) will emphasize the research and development of a low-maintenance cell capable of long-lived cycle application. The reduction of cost, and increased cycle life will be achieved primarily by R&D of improved active material, using additives in the paste and/or electrolyte, using low corrosion expanded metal alloy, electrolyte circulation, separator retainer improvement and the development of a subsystem for further reduction in battery maintenance. Phases II and III will emphasize the engineering development and demonstration of pilot-line production of the advanced

battery leading to the manufacture and testing of a 5 MW h BEST battery. In addition to the specified RD&D, information will be provided on the potential recyclability, the environmental impact, and the safety factors of lead–acid batteries. The annual cost and design study of a lead–acid load leveling battery system based on the developed advanced concepts will be carried out to identify areas of improvement for further development effort.

The program management and quality assurance plans for this effort are being prepared for ANL approval.

ADVANCED LEAD–ACID BATTERIES FOR ELECTRIC UTILITY LOAD-LEVELING APPLICATION

ESB, Inc., 19 West College Ave., P.O. Box 336, Yardley, PA 19067 (U.S.A.)

This project has just begun and it encompasses the research and development and demonstration of advanced lead–acid battery technology with major goals of increased cycle life of utility sized, stationary lead–acid batteries from the state-of-the-art of 2000 cycles to >3000 cycles at the reduced cost per cycle of ~1.5 ¢/kW h cycle^{-1} and a reduced operating and maintenance cost of <0.5 mil/kW h.

These goals are to be accomplished in three phases. The first phase (3 years) will emphasize cell design optimization accomplished through the evaluation of critical variables affecting battery energy output, energy efficiency and cycle life. Tests will be conducted using full size cells. Phases II and III (3 years) will emphasize the engineering development of advanced lead–acid battery design, the manufacture and testing of a 5 MW h BEST battery incorporating cost reduction and improved life design. In addition to the specified RD&D, information will be provided on the potential recyclability, the environmental impact, and the safety factors of lead–acid batteries. An annual cost and design study of the lead–acid load leveling system using the results of advanced concepts developed will also be provided. During this period, the program management and quality assurance plans for this effort were completed.

BATTERY ENERGY STORAGE TEST (BEST) FACILITY

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

The objective of this work is the design (Phase I), construction (Phase II), and acceptance testing (Phase III) of a national test facility to evaluate