11 R. V. Homsy, The 1000-cm aluminum–air power cell, *UCRL-86971*, Lawrence Livermore National Laboratory, November 1981.
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16 S. P. Perone, N. Kirkman-Bey and J. F. Cooper, Parametric study of an alkaline–electrolyte, aluminum–air flow cell, Fall Meeting of the Electrochemical Society, Denver, CO, October 1981, *LLNL Preprint*, *UCRL-85935*, June 1981.
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ALUMINUM/AIR BATTERY DEVELOPMENT

Lockheed Palo Alto Research Laboratory, Palo Alto, CA 94304 (U.S.A.)

The objectives of this contract are to develop, test, and demonstrate hardware components for the aluminum/air battery. The principal task is to design, construct, and test a six-cell subscale (200 cm^2), rapidly refuelable aluminum/air battery. In addition, parametric cell tests using subscale cells will be conducted along with tests of components and systems studies.

Current collection techniques have been studied and improvements integrated into hardware to be used for six-cell testing. Modification of the test stand is currently in progress and will include provisions for remote sensing and control by computer-actuated interfacing.

Previous studies were made of two subscale and one full-size rapidly refuelable battery designs involving a moving cathode (Mark 1-2) and a moving anode (Mark 1-1 and Mark 1-3). The moving anode design was selected for further study because of simpler mechanical design and equivalent electrochemical performance. This design is being used to construct a six-cell subscale module to conduct parametric testing including mass and thermal balances. In addition, current collection techniques will be optimized, and rapid refuelability and complete anode utilizations will be demonstrated.

Technical objectives for 1983 are to design and fabricate a full-size wedge battery and evaluate performance in comparison with the moving anode design.

Recent publications

1 E. L. Littauer, R. P. Hollandsworth and D. J. Levy, Rapidly-refuelable aluminum–air battery, *Proc. Second International Workshop on Reactive Metal–Air Batteries* (Belgrade Meeting), September 2 - 4, 1982, to be published.

AIR ELECTRODE R & D FOR ALUMINUM/AIR BATTERIES

ELTECH Systems Corporation, (formerly Electrolytic Systems Division, Diamond Shamrock Corporation), P.O. Box 348, Painesville, OH 44077 (U.S.A.)

The purpose of this contract is to identify the life-limiting parameters associated with air-depolarized cathodes when used in drive cycles compatible with those anticipated for an electric vehicle. Once these limitations are identified, improved cathodes designed to meet the stringent life-performance-cost criteria demanded by the vehicular use will be fabricated and tested. Optimized electrodes are supplied to the battery development groups.

Conductive wetproof layers made from a blend of carbon and polytetrafluoroethylene (PTFE) were unable to prevent electrolyte from weeping through to the air side. Replacement of this conductive wetproof layer by a pure PTFE wetproof layer increased the lifetime of a cathode made with 10 percent Pt on RB carbon from 100 cycles to nearly 500 cycles. An improved conductive wetproof layer has also been developed that matches the performance of the pure PTFE layer, but preserves the option of electrolyte- or air-side current collection on the cathode.

To determine whether pore blockage by precipitated alumina was a reason for cathode failure, a series of life tests was conducted in which cathodes and operating conditions were identical except for the presence of stannate and aluminate in the electrolyte. The presence of 1 M $NaAl(OH)_3$ and 0.06 M $NaSn(OH)_3$ in the electrolyte resulted in an average lifetime of 488 cycles, compared to a lifetime of 280 cycles in 4 M NaOH without stannate or aluminate. The cathodes used in these tests were made with 10 percent Pt on RB carbon and pure PTFE wetproof layers. It was further demonstrated that the rate constant for peroxide decomposition is an order of magnitude greater in the electrolyte with aluminate and stannate than in caustic alone. Because carbon corrosion is believed to be a possible cause for cathode failure, the depressed peroxide concentration in the presence of aluminate and stannate may explain the improved lifetimes.

Cathodes were examined by source-excited fluorescence analysis to determine the rate of platinum loss from electrodes made with 10 percent Pt on RB carbon. A plot of the amount of platinum remaining in the cathodes as a function of time exhibits a logarithmic decay to a nonzero value. Based on these results, it is believed that the gradual decline in cathode performance is due to the loss of the catalyst.