for the group. Development cells, not yet in production, have demonstrated greater than 95 W h/kg and greater than 100 W/kg. Two 10-cell modules were built and tested. One demonstrated a cycle life of 270 cycles.

DESIGN, DEVELOPMENT, AND FABRICATION OF THE MARK II LITHIUM/IRON SULFIDE ELECTRIC AUTOMOBILE BATTERY

Gould Inc., 40 Gould Center, Rolling Meadows, IL 60008 (U.S.A.)

The objective of this work is the development of an engineering lithium/iron sulfide cell having the following performance and lifetime characteristics at a C/8 charge and C/3 discharge:

- Specific energy — 95 W h/kg,
- Peak specific power — 120 W/kg at 50 percent depth of discharge,
- Cycle life (mean time to failure) — 400 cycles.

The end of life is when the cell capacity decline exceeds 20 percent of the initial stabilized capacity or when the coulombic efficiency drops below 95 percent.

Work has continued during the past year in further developing the powder separator-immobilized electrolyte approach initiated at Gould in 1980. As of June 1982, over 150 (200-A h) powder separator cells have been constructed in a dry room environment. A group of 12 status cells (Group II) tested at ANL has attained a specific energy of approximately 80 W h/kg with a mean time to failure of approximately 300 cycles. The peak specific power of these cells was 74 W/kg at 50 percent depth of discharge.

In subsequent developmental cells that have an improved current collector design and some minor changes in the electrode/separator formulations to the Group II cell, there has been an overall improvement in performance. The specific energy has been increased to approximately 90 W h/kg and the peak power to approximately 130 W/kg at 50 percent depth of discharge without any sacrifice in cycle life; indeed there has been a modest increase with most of these cells failing in the 350- to 400-cycle range.

Assuming that funds are available in 1983, work will continue to improve the performance and cycle life of the powder separator-immobilized electrolyte, iron-monosulfide-type cell. It is anticipated that significant improvements will be accomplished, particularly in peak power, by pursuing a major engineering design program for the electric vehicle cell. The goals for 1983 will be a specific energy of approximately 100 W h/kg and a peak power of approximately 130 W/kg at 80 percent depth of discharge with a mean life of 500 cycles.

Recent publications

1 B. A. Askew and G. Barlow, The development of a secondary lithium–metal sulfide cell for satellite applications, *30th Power Sources Symposium, Atlantic City, NJ, 1982.*

2 G. Barlow, P. V. Dand and B. A. Askew, The development of a low cost lithium–metal sulfide cell, in J. Thompson (ed.), *Power Sources 9*, Academic Press, London and New York, 1983.

3 D. M. Chen, H. F. Gibbard, R. M. Hart and L. D. Hansen, Calorimetric measurements on LiAl/FeS batteries up to 450 C, *36th Calorimetry Conference, Washington, DC, October 7, 1981.*

4 C. C. Chen, T. W. Olszanski and H. F. Gibbard, Thermal behavior of an experimental 2.5-kW h lithium iron sulfide battery, *ECS Fall Meeting, Denver, October 11, 1981, Extended Abstracts, No. 48.*

5 H. F. Gibbard and D. M. Chen, Generation of thermal energy in high-temperature LiAl/FeS cells, *ECS Fall Meeting, Denver, October 11, 1981, Extended Abstracts, No. 49.*

6 H. F. Gibbard, D. M. Chen, C. C. Chen and T. W. Olszanski, Thermal properties of high-temperature LiAl/FeS cells, *Proc. 16th Intsoc. Energy Conversion Eng. Conf., 1* (August 1981) 752 - 756.

7 L. D. Hansen, R. H. Hart, D. M. Chen and H. F. Gibbard, A high-temperature battery calorimeter, *Review of Scientific Instruments, 53* (4) (April 1982) 45 - 48.