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RESEARCH, DEVELOPMENT, AND DEMONSTRATION OF A NICKEL/IRON BATTERY FOR ELECTRIC VEHICLE PROPULSION

Westinghouse Advanced Energy Systems Division, P.O. Box 10864, Pittsburgh, PA 15236 (U.S.A.)

The objective of this contract is to develop an advanced nickel/iron battery capable of meeting the near-term battery performance and projected cost goals for electric vehicle propulsion. The goals for 1982 were an energy density of 54 W h/kg, a peak power density of 104 W/kg, and a cycle life of 800 cycles.

The 1982 program continued to involve the fabrication and evaluation of full-sized prototype cells, modules, and batteries. It will be aimed at advancing the technical capabilities of the nickel/iron battery while reducing its potential cost in materials and process areas. Improved full-sized pasted nickel electrodes (25-A h capacity, 2.4-mm thick) have shown stable capacity over 700 cycles at the C/3 rate. Composite iron electrodes (1.0 mm) have exhibited a stable capacity exceeding 24 A h in over 1000 cycles in three plate cells. Complete cells on test at Westinghouse have demonstrated a specific energy of 57 to 63 W h/kg at the C/3 rate and cyclic stability over 1200 cycles at 80 percent depth of discharge (DOD). Two five-cell modules (220 A h) at the National Battery Test Laboratory have demonstrated a specific energy of 43 W h/kg, a peak sustained 30-s power of 90 W/kg, and a cycle life of over 900 cycles at 80 percent DOD at the C/3 rate to failure (capacity reduction to 75 percent of rated). A weight penalty of 0.26 kg/cell was included to allow for the weight of the electrolyte management system. Temperature tests have been performed on a six-cell module and have shown a decrease in capacity at 0 °C of only 25 percent in ampere hours and 29 percent in watt hours as compared to performance at 25 °C.

In 1983 reduction in nickel electrode swelling (and concurrent stack starvation) to improve cycling will continue to be an area of major effort to reach the final battery cycle life objectives. Pasted nickel electrodes with modified active material composition continue to show promise for meeting the life objective while providing a low manufacturing cost. Other efforts are

aimed at improving the electrolyte and gas management system to increase reliability and safety.

Recent publications

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RESEARCH, DEVELOPMENT, AND DEMONSTRATION OF A NICKEL/IRON BATTERY FOR ELECTRIC VEHICLE PROPULSION

Eagle–Picher Industries Inc., C and Porter Streets, P.O. Box 47, Joplin, MO 64801 (U.S.A.)

The purpose of this contract is to design, develop, and demonstrate full-sized (25- to 30-kW h), nickel/iron batteries suitable for use in electric vehicle propulsion, while meeting performance goals of specific energy of 54 W h/kg, peak specific power of 104 W/kg, and a cycle life of 800 cycles for 1982.

The Eagle–Picher Industries (EPI) program has concentrated on the characterization, fabrication, and testing of the required electrodes, cells, and 6-V, 270-A h modules. Electrodes of the final configuration have now exceeded 2000 cycles in tests at EPI and have shown very little capacity decline. Full-scale cells and modules at EPI have completed over 800 cycles