Recent publications

1 M. Klein, H. Vaidyanathan and A. Charkey, Ni–Zn electric vehicle battery, *The Electrochemical Society, Fall Meeting 1978, Pittsburgh, PA, Extended Abstract No. 86.*
2 M. Klein, A. Charkey, H. Vaidyanathan and S. Viswanathan, Performance characteristics of Ni–Zn electric vehicle battery, *Proc. 14th Intersoc. Energy Conversion Engineering Conf., Boston, August, 1979.*

RESEARCH, DEVELOPMENT AND DEMONSTRATION OF A NICKEL–ZINC BATTERY FOR ELECTRIC VEHICLE PROPULSION

ESB Technology Company, 19 W. College Avenue, Yardley, PA 19067 (U.S.A.)

The contract covers research and development that will result in the delivery and testing of nickel/zinc electric vehicle batteries having improved performance, life, and cost. The contract includes the design, engineering, and delivery of demonstration modules and the optional procurement of small numbers (up to 15) of full-sized batteries (20 - 30 kW h range) in order to demonstrate the technology; participation with ANL in the establishment of test standards and post-test examination procedures; establishment of maintenance procedures; provision of safety and environmental impact data; a materials availability study; and the design and specification of auxiliary components important to the operation of batteries. The contract is subject to go/no-go decisions during its period of performance. Key technical goals include a specific energy of 70 W h/kg at a 3-hour discharge rate, a specific peak power of 125 W/kg or greater, a life of 400 cycles at 80% depth of discharge, and a volume production price of less than $75/kW h.

Design studies have started to optimize design for best trade-off of energy density, specific volume, specific power and cost. An experiment to evaluate the effect of electrode spacing on performance has started. Available commercial type nickel cathodes have been procured and are being characterized under nickel–zinc VIBROCEL™ conditions. These include both sintered and pocket types. Non-standard, high energy, potentially low cost nickel cathodes are also being obtained for study. These include the INCO CMG type, the DAUG "nickel wool" type and the ESB plastic bonded nickel cathodes. Basic studies on zinc corrosion and deposition have started. Evaluation of different substrates and platings to minimize zinc corrosion is in process. Preliminary work has started on varying conditions of zinc electrodeposition to obtain dense zinc deposit during charging.

Work will continue in all areas stated to maximize energy density, specific volume, specific power and minimize cost. One State-of-the-Art 4-cell module will be submitted for test to NBTL followed by 2 modules (baseline) in early 1980. Final geometry for a full size 20 - 30 kW h EV

battery will be determined, and an order placed for an injection mold for a 4 cell monoblock. A preliminary and updated cost analysis will be prepared based on the results obtained. A go, no-go decision whether to proceed to Phase II is scheduled for July 1980.

Major technical problems remain, energy density, specific volume, and charged stand capability. Of these probably the most difficult is specific volume, since the design concept of the VIBROCEL involves a discrete spacing between battery plates. Energy density should approach goals by lightweight design features, and the use of high energy nickel cathodes. Charged stand performance has already shown improvement by a proper selection of negative substrate materials and platings.

RESEARCH, DEVELOPMENT AND DEMONSTRATION OF A NICKEL–ZINC BATTERY FOR ELECTRIC VEHICLE PROPULSION

Gould, Inc., New Business Division, Rolling Meadows, IL 60008 (U.S.A.)

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Significant progress has been made in the understanding of separator failure mechanisms, and a generic category of materials (ELECTROPOROUS™ separators) is in the development stage. Shape change in the zinc electrode, which has been a significant contributor to capacity loss, has been reduced significantly through the use of electrode and electrolyte additives. The more elusive problems of zinc densification and passivation are now being investigated in depth. Extensive testing of cells, modules, and batteries is done in a minicomputer-based testing facility. Application testing is carried out on dynamometers to characterize and simulate actual missions. A development pilot plant, which utilizes scaled-up processes, is essentially fully operational. It supplies all components/cells/batteries for all project testing activities. Progress in the area of thermal management has been