

LEAD INDUSTRIES ASSOCIATION

430 LEXINGTON AVENUE

NEW YORK 17, N. Y.

Security Information

Restricted

Not for Publication

June 2, 1953

SUBJECT: SEVENTH ANNUAL BATTERY
RESEARCH AND DEVELOPMENT CONFERENCE

To Members of the Lead Industries Association:

The Power Sources Branch of the Signal Corps Engineering Laboratories at Fort Monmouth, New Jersey, annually sponsors a Battery Research and Development Conference to acquaint the battery industry with the progress of Signal Corps Battery Research and Development programs and to encourage cooperative interchange of information on batteries with the aim of producing a more rapid advancement of knowledge in the battery art. The Conference this year included papers on nuclear batteries and solid ion conductor batteries, the zinc-silver peroxide battery, high rate and secondary batteries including the following systems: manganese dioxide, lead-acid, thermal cells and nickel-cadmium. A special symposium was also devoted to dry cell batteries.

The Association, as it has in the past, was invited to send a delegate to this Conference which was held on May 13 and 14, 1953, at Asbury Park, New Jersey. Reports on those papers of specific interest to the lead industry are attached. Other papers with the following titles were also presented and detailed abstracts of any of them are available from the Association upon request.

"Investigations on Aluminum Cell Systems" - Alfred B. Garrett, Ohio State University

"Batteries with Improved Storageability" - Olin Industries, Inc.

"Dry Cell Capacity Predictor" - Grenville B. Ellis, Power Sources Branch

"Nuclear Batteries" - Alexander Thomas, Tracerlab, Inc.

"Solid Ion Conductor Batteries" - W. Van der Grinten, General Electric Company

"Separators" - Paul F. Bruins, Polytechnic Institute of Brooklyn

"Cell Design" - J. S. Bone, Eagle-Picher Company

"Radioactive Tracer Studies" - John A. DeRosa, Patterson, Hoos & Company



- 2 -

"Theoretical Considerations" - John B. Conn, Merck & Co., Inc.
"Manganese Dioxide Systems" - Olin Industries, Inc.
"Thermal Cells" - Harry A. Durney, Jr., Catalyst Research Corporation
"Vibrators and Dynamometers for 'B' Supplies" - Joseph A. Mas, Vibration Research Laboratories, Inc.
"The Magnesium Dry Cell" - Roy C. Kirk, The Dow Chemical Company
"The Magnesium Dry Cell" - John Revendon, Power Sources Branch
"Miniature Low Drain, Long Life Dry Cell" - Olin Industries, Inc.
"Separators for Dry Cells" - Roland Chireau, Polytechnic Institute of Brooklyn
"Manganese Dioxide" - Edward W. Samaden, Tennessee Corporation
"Specification Testing of Manganese Dioxide" - William F. Nye, Chemical Physics Branch
"Carbon Black" - A. V. Peppard, Godfrey L. Cabot, Inc.

We have been requested to caution you that this report is security information and is restricted. It contains information affecting the national defense of the United States within the meaning of the espionage laws and the transmission or the revelation of its contents in any manner to unauthorized persons is prohibited by law.

Very truly yours,

Robert L. Ziegler
Secretary

SEVENTH ANNUAL BATTERY RESEARCH
AND DEVELOPMENT CONFERENCE
MAY 13-14, 1953

SECURITY INFORMATION
RESTRICTED

Nuclear Batteries
By
John H. Coleman
Radiation Research Corporation

Purpose:

To investigate the Utilization of radioactive energy as a direct source of electrical energy for use as a portable battery having at least a 15-year operating life and an operating temperature of 160°F to -65°F.

History:

It was found that good insulators under continuous beta radiation first decrease in resistance, reach a minimum, and then increase in value. A battery was constructed and demonstrated after a satisfactory accelerated life test on one insulator.

Experimental Work:

The induced resistance effect was studied in various insulators as a function of time, temperature, and beta current density for application in a battery to supply 50 micromicroamps at several thousand volts. The use of hydrogen 3 as a beta source was investigated for use in a battery to supply 1000 micromicroamps with no detectable external radiation. Transformation means were studied to supply higher currents at lower voltages.

Future Studies:

To complete insulation studies and fabrication of tritium batteries. To investigate more efficient beta sources, voltage transformers, and voltage regulators.

NOTES: Nuclear Batteries

Others are investigating using gamma radiation as power source. In all cases, shielding will be required and will most likely be lead. The average size of the battery described is 1 cubic inch comprising a steel cup 1 inch in diameter and 1 inch high with an aluminum electrode, polystyrene insulator, and beta source situated centrally. The space between is filled with lead probably about 5 ounces for a 1 cubic inch cell.

SEVENTH ANNUAL BATTERY RESEARCH
AND DEVELOPMENT CONFERENCE
MAY 13-14, 1963

SECURITY INFORMATION
RESTRICTED

Lead-Acid System

By

H. E. Zahn
Gould-National Batteries, Inc.

One-hundred high rate primary batteries of the lead-acid system have been built and the performance of sample cells measured. These cells were designed for best performance at the ten minute rate using present commercial manufacturing methods carried to the limit of practicality in the direction of using thin plates, thin separators, high acid gravity, minimum grid weight, and low density pastes.

The performance of these sample cells has been compared with that of automobile batteries, and has been found to be best at high discharge rates. At a ten minute rate a power output has been obtained which is about three times that of an automobile battery (per pound of battery).

A considerable saving in weight may be possible by using aluminum grids and solving the problems of lead plating and paste volume.

A considerable improvement in average voltage might be made by using still thinner plates and lead plated aluminum grids. This would be particularly important for discharges in the neighborhood of the one minute rate.

NOTES: Lead Acid System

This report concludes Signal Corps contracts on the investigation of high rate lead-acid systems. Regarding the use of lead plated aluminum grids, the author pointed out that while this offers a definite means of improving performance, many problems still exist in the mechanics of preparing successful grids made stamped sheet aluminum electroplated with pure lead.

SEVENTH ANNUAL BATTERY RESEARCH
AND DEVELOPMENT CONFERENCE
N.Y. 12-14, 1953

SECURITY INFORMATION
RESTRICTED

Nickel-Cadmium System

By

H. W. Koren
Sonotone Corporation

Purpose:

The purpose of this contract is to develop and design a readily activated reserve battery, capable of dry charged storage for extended periods of time based on the secondary sintered plate nickel-cadmium alkaline electrochemical system, and the improvement of high rate discharge characteristics so that the capacity at the one minute rate approaches as closely as possible the capacity after the one hour rate.

Experimental Work:

This is a continuation of work reported a year ago.

Dry Charging

Methods of charging, washing and drying cells which were used for evaluation of dry charging are described.

Cells prepared by these techniques show activated capacities up to 65% of normal capacity when used as a secondary cell. Permanent loss of capacity after dry charging activation and recycling amounts to 3% and 10%.

Cells vacuum dried with electrolyte and activated with water showed lower voltage levels but not permanent loss of capacity on recycling. However, loss of available voltage occurs on storage even though the charge retention to low end voltage is nearly 100%. Experiments were performed on the electrochemical forming plates, assembling them into cells and activating with KOH solution. Loss in capacity much higher than when cells as a whole are dry charged. As a result of this work, the oxidized form of the negative active material is found to be CdO , $2H_2O$.

Measurements of the resistance of various separators examined for suitability for nickel-cadmium cells are reported.

Work on Improving High Rate Performance of Nickel-Cadmium System.

1. Work on sintering thin plaques.
2. Work on loading other thin plaques.
3. Work on high rate discharge for thin plate cells.

Future storage tests indicate the loss of negative capacity. Whether this is due to the system or is due to external leaks of air into the dry cells will have to be determined. Thinner plaques in process will yield still better utilization at the one minute rate.

SEVENTH ANNUAL BATTERY RESEARCH
AND DEVELOPMENT CONFERENCE
MAY 13-14, 1953

SECURITY INFORMATION
RESTRICTED

Nickel-Cadmium System
By
Arthur Fluischer
Nickel Cadmium Battery Corporation

Purposes:

The purpose of the research investigation is to determine the behavior of the negative plate of the sintered-plate nickel-cadmium alkaline storage battery on cycling and to devise methods for improving the performance of the negative plates.

Experimental Work:

Cycling tests on test cells assembled with an element of one negative plate and a positive group of two plates of the size and thickness supplied in the BB-221/U replacement battery have been continued at discharge rates of 10 and 37.5 amperes. The latter rate, corresponding to the current density on discharge at the cranking rate of 300 amperes for the BB-221/U battery, has been adopted for screening tests because it allows a maximum schedule without automatic cycling equipment.

The program has included the testing of plates prepared with a variation in conditions of impregnation and the testing of cells with a variation in assembly components and electrolyte composition. The effect of iron has been studied in plates prepared by sintering mixtures of iron oxide and carbonyl nickel powder.

A saving in preparative time has been shown to be feasible in that plates impregnated in only one cycle of treatment show the characteristic behavior of cycling. Using such plates, it has been shown that Hibitine reagent increases the coefficient of utilization of the negative active material without influencing appreciably the cycling characteristics.

An improvement in the cycling characteristics has been achieved in cells assembled with felted cellulose (Cebiril) separators.

Various observations on the behavior of the test cells during cycling, the effect of electrolyte change, and analyses of the plates after cycling will be cited as factors to be considered in the development of a working hypothesis on the cycling characteristics of the sintered negative plate.

Future:

Cycling studies will be continued with emphasis on the evaluation of addition agents consisting of organic compounds that affect the cycling characteristics of the negative plate.