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LEAD INDUSTRIES ASSOCIATION

420 LEXINGTON AVENUE

NEW YORK 17, N. Y.

CONFIDENTIAL

NOT FOR PUBLICATION

June 11, 1951

SUBJECT: REPORT OF FIFTH ANNUAL BATTERY RESEARCH AND DEVELOPMENT CONFERENCE

To Members of the Lead Industries Association:

The Fifth Annual Battery Research and Development Conference under the auspices of the Power Sources Branch of the Signal Corps Engineering Laboratories, Fort Monmouth was held on May 16 and 17, 1951 at the Berkeley-Carteret Hotel, Asbury Park, New Jersey. These Conferences are held annually to acquaint the battery industry with the progress of Signal Corps battery research and development programs and to encourage cooperative interchange of information on the art of battery manufacture.

The following are abstracts of technical reports on storage batteries that may be of specific interest to members of the Lead Industries Association.

Very truly yours,

Secretary.

LOW TEMPERATURE CHARGING OF LEAD-ACID BATTERIES

By
Eugene Willihnganz
Gould-National Batteries, Inc.

Purpose:

The purpose of the investigation is to develop a practical means of charging lead-acid storage batteries at sub-zero temperatures and at a reasonable rate.

Experimental Work:

Previous work on this contract has shown that the failure to accept a charge is primarily a failure of lead sulphate to dissolve in the negative plate at a reasonable rate and that this slow solution rate of lead sulphate is due to the expander used to give good capacity at low temperatures. It was found that one expander was commercially available which could give a much better charge rate than the material customarily used, but would sacrifice some low temperature capacity. Additional experimental work has now been carried out to show that the poor charge rate of the usual commercial expander is due to impurities in the expander and is not due to the ingredient which gives the high capacity. If the expander is omitted from the battery entirely, the charge of the battery is still very slow due to troubles occurring in the positive plate and most of the work during the past year has been devoted to exploring the chemistry of the positive plate.

When the negative plate is first put on charge, it accepts current at a high rate to produce what appears to be a layer of oxygen on the surface of the lead peroxide. This is a rapid reaction, but once this oxygen layer is established, further charge can occur only at the rate at which this oxygen layer reacts with the dissolved lead sulphate. This reaction is slow and may be limited either by the rate at which lead sulphate dissolves or the inherent reaction rate between the oxygen and dissolved lead sulphate at the surface of the lead peroxide. As nearly as we can tell, this reaction will not accept more than one ampere under most favorable conditions at -40°F. If the charge is continued for more than one ampere hour, a barrier is set up in the positive plate which limits the charge current to an extremely low value.

Future Work:

The nature of this barrier mentioned above has not been established, and further experimental work will be directed towards establishing the nature of this barrier and possible means of removing it.

SPECIAL PURPOSE BATTERIES

By
Harold E. Zahn
Gould-National Batteries, Inc.

Purpose:

The purpose of this investigation is the development of basic design data for high rate discharge "one-shot" batteries, of light weight, using the lead-acid system, for operation over the -65°F to +160°F temperature range.

Experimental Work:

The general plan of problem attack is to determine optimum conditions for obtaining maximum efficiency from each of the several battery components.

Factors thus far found to effect capacity as measured in terms of ampere-hours obtained per pound of active material were as follows:

1. Positive and negative active material efficiency at high discharge rates increases as grid thickness decreases over the .060 to .020 inch range.

2. Positive and negative active material efficiency at high discharge rates increases as pellet size decreases.

3. The effect of separators upon high discharge rate capacity may be analyzed on basis of acid availability immediately adjacent to the positive plate. Negative plate capacity is little effected by separator geometry or material.

Future:

Experiments in progress on acid volume and gravity effects will continue.

New experimental cast grids of design indicated by pellet studies will be used to check original work.

Multi-plate cells will be constructed incorporating all advantageous features found to determine efficiencies of larger plate groupings.

CHEMICAL ANALYTICAL METHODS FOR BATTERY MATERIALS

By
Howard Knapp
Power Sources Branch

Purpose:

The purpose of this investigation is the development of rapid and accurate methods for the chemical analysis of battery component materials, keeping the sample size necessary for these determinations at a minimum.

Experimental Work:

The experimental work has included analysis of Manganese Dioxide for the following constituents:

1. Available Oxygen
   a. Ferrous Ammonium Sulfate Method
   b. Oxalate Method
   c. Iodide Method
   d. Arsenious Oxide Method
2. Total Manganese
   a. Volhard Method
   b. Bismuthate Method
   c. Persulfate Method
3. Moisture Determination
   a. Variation in time
   b. Variation in temperature
4. pH Determination
   a. Variation in digestion time
   b. Variation in digestion temperature
   c. Cooling procedure
5. Iron
   a. Volumetric
   b. Colorimetric
   c. Polarographic
6. Lead
   a. Gravimetric
   b. Colorimetric
   c. Polarographic

Future:

It is planned to extend this investigation to include:

1. Trace impurities in Manganese Dioxide
2. Analysis of other battery materials such as Carbon Blacks, Silver, Lead, Nickel, Zinc, Magnesium, their components and alloys.
3. Battery electrolytes such as Sulfuric Acid, Sodium Hydroxide, Potassium Hydroxide and others.

Other papers presented at the Conference were as follows:

SCEL MnO_2 Program	Mr. Charles H. Clark, Power Sources Branch
Electrolytic Manganese Dioxide	Mr. Ernest A. Winter Tennessee Corporation
Manganese Dioxide	Mr. Lloyd Berg Montana State College
Manganese Dioxide	Mr. Joseph C. Schumacher Western Electrochemical Company
The Magnesium Dry Cell	Mr. Arthur F. Daniel Power Sources Branch
The Magnesium Dry Cell	Mr. Roy C. Kirk Dow Chemical Company
Battery Separator Materials	Mr. John J. Murphy Power Sources Branch
Low Temperature Batteries	Mr. Alfred B. Garrett Ohio State University
Low Temperature Batteries	Mr. Millard F. Gill Olin Industries, Inc.
Low Temperature Batteries	Mr. Albert F. Vinal Union Carbide and Carbon Corp.
Low Temperature Batteries	Mr. Thomas C. O'Nan P. R. Mallory & Co., Inc.
Miniature Dry Cells	Mr. Paul Marsal Union Carbide and Carbon Corp.
Miniature Dry Cells	Mr. R. E. Ralston P. R. Mallory & Co., Inc.
Alkaline Dry Cell Batteries	Mr. William Sharr Power Sources Branch
Special Purpose Batteries	Mr. Nicholas T. Wilburn Power Sources Branch
Special Purpose Batteries	Mr. Johan Bjorksten Bjorksten Research Laboratories