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PURDUE UNIV LAFAYETTE IN DEPT OF CHEMISTRY
COMPUTERIZED PATTERN RECOGNITION APPLIED TO BATTERY TESTING.(U)
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1 Final Report

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ONR Research Project

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COMPUTERIZED PATTERN RECOGNITION
APPLIED TO BATTERY TESTING.

11 December 1980

Task Group No: NR 359-650

15 Contract No: N00014-77-C-7353

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10/ Principal Investigator: Prof. Sam P. Perone
Department of Chemistry
Purdue University
West Lafayette, IN 47907

Funding: April, 1977 - March, 1978, \$45,000
April, 1978 - March, 1980, \$45,000

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Brief Description of Project.

The primary goal of this work has been to develop non-destructive testing methods as a screening procedure for batteries to predict lifetime and identify probably failure mechanisms. A secondary goal has been to develop criteria for predicting imminent failure from battery performance data. We believe that these goals can be met by the application of computerized pattern recognition to the evaluation of measureable features.

In the studies supported by this ONR contract, pattern recognition techniques have been used to analyze data collected previously in established battery testing programs. Because of the ability to evaluate multivariate relationships it was possible to identify previously unobservable multi-dimensional correlations between test data obtained very early in a battery's lifetime and its life expectancy and/or failure mechanism. It was the objective of these initial studies to identify the most meaningful types of measurements for lifetime prediction and to establish the feasibility of lifetime prediction.

The second function to be provided by pattern recognition methods is to evaluate test data generated subsequently by the new short-term screening tests developed. This will involve collaborative efforts with other laboratories to generate such a data base. Probably several iterations in this procedure will be required before an optimum set of short-term measurements is identified. Such studies are prescribed for future work.

Significant Results

In phase one we demonstrated that classification of cells into two arbitrary types---early failure and late failure---can be done with ~100% accuracy on the basis of voltage and/or pressure changes observed during the first charge/discharge cycle. Moreover, we demonstrated that more quantitative lifetime information may be contained in data from the first test cycle. This was shown from cluster

analysis studies, where small clusters of cells with similar relative lifetimes were observed in feature space. The second phase of this project has involved the design and implementation of a battery testing program which will provide the most appropriate type of measurements from initial tests to allow meaningful correlations with lifetime data. These studies will require that large numbers of cells be produced and tested under predefined identical conditions.

Research Assistants Who Have Worked on Project

W. A. Byers and M. Ku (Purdue University)

Publications and Reports

ONR Technical Reports

- (1) W. A. Byers, S. P. Perone, "Computerized Pattern Recognition Applied to Ni-Cd Cell Lifetime Prediction", ONR Technical Report No. 1, NR 359-650, August, 1978.
- (2) W. A. Byers, S. P. Perone, "Guidelines for Development of a Battery Testing Program Suited for Analysis by Pattern Recognition", ONR Technical Report No. 2, NR 359-650, December, 1979.
- (3) W. C. Spindler, S. P. Perone, "Computerized File Search Methods for Examination of Battery Test Data Bases. Identification of Data Sub-sets for Subsequent Statistical and Pattern Recognition Studies", ONR Technical Report No. 3, December, 1979.

Publications

- (1) W. A. Byers, S. P. Perone, "Computerized Pattern Recognition Applied to Ni-Cd Cell Lifetime Prediction", J. Electrochem. Soc., 126, 720 (1979).

Dissertations

None

Awards and Honors

None

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