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IEEE Guide for the Characterization and Evaluation of Sodium-Beta Batteries in Stationary Applications

IEEE Power and Energy Society

Sponsored by the
Stationary Battery Committee

IEEE
3 Park Avenue
New York, NY 10016-5997
USA

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IEEE Guide for the Characterization and Evaluation of Sodium-Beta Batteries in Stationary Applications

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of the
IEEE Power and Energy Society

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Abstract: This document provides guidance for evaluation of the characteristics and performance of Sodium-Beta batteries by a potential user for stationary applications. Information regarding technology description, safety, aging and failure modes, evaluation techniques, and regulatory issues is included in this guide. This document is to be used in conjunction with IEEE Std 1679™, IEEE Recommended Practice for the Characterization and Evaluation of Emerging Energy Storage Technologies in Stationary Applications. Sodium-Beta batteries include those secondary (rechargeable) electro-chemistries with sodium as the active species exchanged between the electrodes during charging and discharging, and operating above the melting point of sodium. These batteries use a solid β″-alumina electrolyte, typically written as β″-alumina. Examples of secondary Sodium-Beta batteries are sodium-metal chloride and sodium-sulfur batteries.

Keywords: battery, β″-alumina ceramic, energy storage, high-temperature battery, IEEE 1679.2™, molten salt, secondary, sodium-beta, sodium-metal halide, sodium-nickel chloride, sodium-sulfur, standby service, stationary application

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3 Park Avenue, New York, NY 10016-5997, USA

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Micheal Carmel
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Shuzhen Xu

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Daniel Barsell
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Introduction

This introduction is not part of IEEE Std 1679.2-2018, IEEE Guide for the Characterization and Evaluation of Sodium-Beta Batteries in Stationary Applications.

Sodium-Beta batteries have seen a tremendous growth in interest and application, in particular where battery size and weight and operation in wide ambient temperature ranges are of paramount interest. The use of these batteries are now being evaluated and used in stationary applications. Because of the differences between Sodium-Beta batteries and conventional industrial batteries, such as lead-acid and nickel-cadmium, there is a need for objective information and suitable evaluation techniques. This document provides a technology description, information on aging and failure modes, a discussion on safety issues, evaluation techniques and regulatory issues for the major types of Sodium-Beta batteries for use in stationary applications.

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IEEE Guide for the Characterization and Evaluation of Sodium-Beta Batteries in Stationary Applications

1. Overview

1.1 Scope

This document provides guidance for an objective evaluation of Sodium-Beta energy storage technology by a potential user for any stationary application. This document is to be used in conjunction with IEEE Std 1679™ IEEE Recommended Practice for the Characterization and Evaluation of Emerging Energy Storage Technologies in Secondary Applications.[1]

For the purposes of this document, Sodium-Beta batteries include those secondary (rechargeable) electrochemistries with sodium as the active species exchanged between the electrodes during charging and discharging, and operating above the melting point of sodium. These batteries use a solid β″-alumina electrolyte, typically written as β″-alumina. Examples of secondary Sodium-Beta batteries are sodium-metal chloride and sodium-sulfur batteries. Non-rechargeable batteries are beyond the scope of this document.

The outline of IEEE Std 1679 is followed in this document, with tutorial information specific to Sodium-Beta batteries provided as appropriate. Examples of tutorial information include technology descriptions, operating parameters, failure modes, safety information, battery architecture, and qualification and application considerations.

This document does not cover sizing, installation, or routine maintenance and testing requirements, except insofar as they may influence the evaluation of a Sodium-Beta battery for its intended application.

1.2 Purpose

Sodium-Beta batteries have been used in various stationary and non-stationary applications for many years. With the growing availability of Sodium-Beta batteries, there is a need to provide appropriate information on safety and operating conditions related to these applications. End-users would benefit from having a guide to assist in evaluation of this technology for stationary applications.

Used with IEEE Std 1679-2010, this guide describes a format for the characterization of Sodium-Beta battery technologies in terms of performance, service life, and safety attributes. This format will provide a framework for developers and manufacturers to describe their products. The resulting information will assist

[1]Information on references can be found in Clause 2.