

Base station lead-acid battery decay over several years



Overview

In ideal conditions, a lead acid battery can have a lifetime between 3 to 20 years, which may dramatically decrease due to: 1) extreme temperatures, 2) cycle service, 3) overcharging, 4) undercharging, and 5) manufacturing variability in a power bank. What are the major aging processes in lead-acid batteries?

The major aging processes in lead-acid batteries are: Anodic corrosion (of grids, plate-lugs, straps, posts). Positive active mass degradation (shedding, sludging) and loss of adherence to the grid. Irreversible formation of lead sulfate in the active mass (crystallization, sulfation). Short-circuits. Loss of water.

Do lead-acid batteries affect the environment?

E-mail: friedrich.jasper@kit.edu Received 3rd March 2025 , Accepted 15th May 2025 Although lead-acid batteries (LABs) often act as a reference system to environmentally assess existing and emerging storage technologies, no study on the environmental impact of LABs based on primary data from Europe or North America since 2010 could be found.

What is a physics-based battery degradation model?

This article presents ab initio physics-based, universally consistent battery degradation model that instantaneously characterizes the lead-acid battery response using voltage, current and temperature. Capacity (in Coulombs or Ampere-hours) is the useful charge a battery can hold. Charging and discharging involve electroic reactions.

What causes lead-acid battery failure?

Nevertheless, positive grid corrosion is probably still the most frequent, general cause of lead-acid battery failure, especially in prominent applications, such as for instance in automotive (SLI) batteries and in stand-by batteries. Pictures, as shown in Fig. 1 taken during post-mortem inspection, are familiar to every battery technician.

Why are lead-acid batteries used as secondary sources of energy?

Lead-acid batteries have been widely used as secondary sources of energy for many years. Their extensive usage is due to several characteristics such as high specific energy, high-rate discharge capability, low cost manufacturing and recycling as well as high energy density.

What happens when a battery ages?

In lead-acid batteries, major aging processes, leading to gradual loss of performance, and eventually to the end of service life, are: Anodic corrosion (of grids, plate-lugs, straps or posts). Positive active mass degradation and loss of adherence to the grid (shedding, sludging).

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