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A Review on Lead Acid Battery

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ABSTRACT

There are many various battery chemistries that can be employed, and employing batteries for energy storage is one of the most crucial and effective ways to stabilise power networks. Although lead batteries have been successfully employed for utility energy storage and are typically used in automotive and industrial applications, there are a number of rival technologies, such as flow batteries, sodium-sulfur batteries, and Lion batteries. The lead battery technology and how it might be improved for energy storage applications are described. In recent years, lead batteries have been improved to have substantially longer cycle lifetimes compared to 20 years ago in situations where the battery is not regularly returned to a completely charged condition. Lead batteries are capable of having extended cycle and calendar lives. For static installations, lion batteries' benefits in terms of energy density and specific energy are less significant. Regarding lead batteries, several technical aspects of Li-ion and other battery types are covered. Lessons learnt from a number of larger lead battery energy storage projects are analysed. Lead is the commodity metal that can be recycled the most effectively, and lead batteries are the only type of battery energy storage that can be recycled almost entirely.

KEYWORDS: A review of lead acid Batteries, construction, and working of batteries,and factor affecting battery life and application.

Introduction

Lead acid batteries are the most common large-capacity rechargeable batteries. They are very popular because they are dependable and inexpensive on a cost-per-watt base. Few other batteries deliver bulk power as cheaply as lead acid, and this makes the battery cost-effective for automobiles, electrical vehicles, forklifts, and marine and uninterruptible power supplies (UPS).

Lead acid batteries are built with several individual cells containing layers of lead alloy plates immersed in an electrolyte solution, typically made of 35% sulphuric acid (H_2SO_4) and 65% water (Figure 1). Pure lead (Pb) is too soft and would not support itself, so small quantities of other metals are added to get the mechanical strength and improve electrical properties. The most common additives are antimony (Sb), calcium (Ca), tin (Sn), and selenium (Se). When the sulphuric acid comes into contact with the lead plate, a chemical reaction is occurring, and energy is produced.

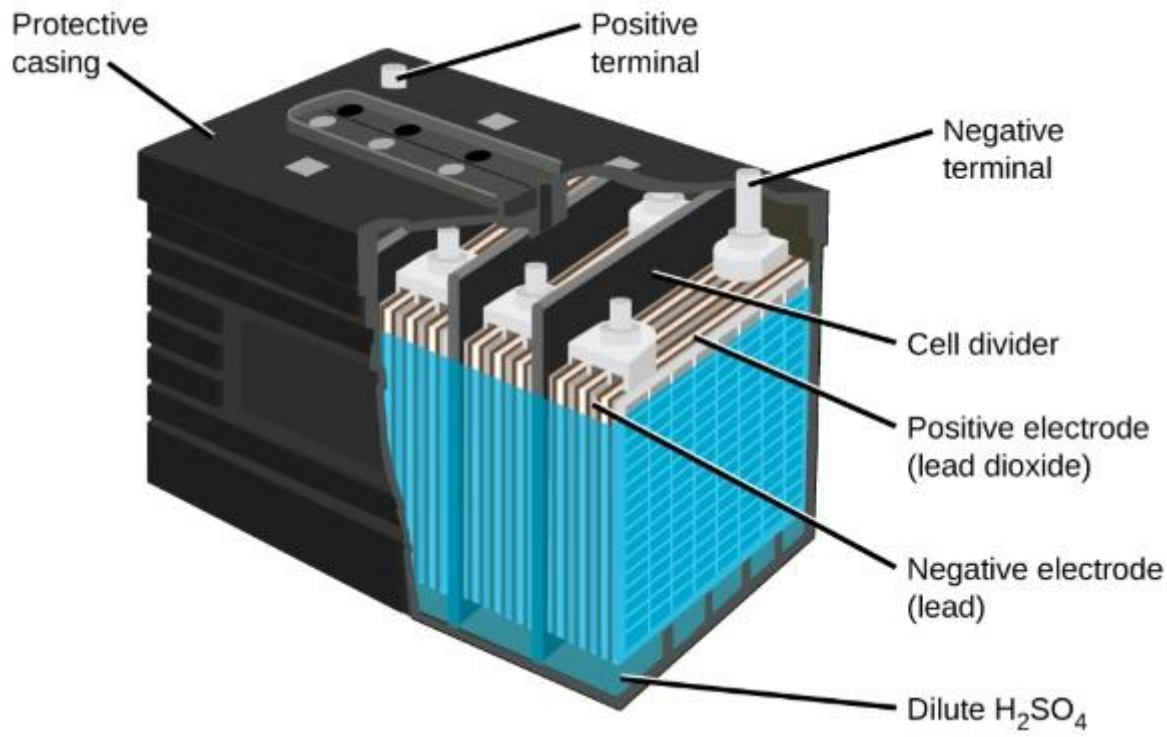
Lead acid batteries are heavy and less durable than nickel (Ni) and lithium (Li) based systems when deep cycled or discharged (using most of their capacity). Lead acid batteries have a moderate life span and charge retention is best among rechargeable batteries. The lead acid battery works well at cold temperatures and is superior to lithium-ion when operating in sub-zero conditions. Lead acid batteries can be divided into two main classes: vented lead acid batteries (spillable) and valve-regulated lead acid (VRLA) batteries (sealed or non-spillable)

HISTORY

Lead acid is the oldest rechargeable battery in existence. invented by the French physician Gaston Plante in 1859lead acid was the first rechargeable battery for commercial use, we still have no cost-effective alternatives for cars, wheelchairs, scooters, golf carts, and UPS systems. It was the first battery that could be recharged by passing a reverse current through it.

Planet's first model consisted of two lead sheets separated by rubber strips and rolled into a spiral. In 1881, Camille Alphonse Faure invented an improved version that consisted of a grid lattice, into which a lead oxide paste waspressed, forminga plate. It is design was easy to mass produce. The manufacturer (1886) of lead acid batteries was Henri Tudor.

CONSTRUCTION



Components of a lead acid battery:

Positive plate: -

- PbO_2 (lead peroxide), deposited on a grid frame of antimony lead alloy (when the battery is fully charged, the positive plate is dark brown in colour)

Negative plate: -

- Pb (porous spongy lead), deposited on a grid frame. When the battery is in charged condition, the negative plate is grey in colour.

Container: -

- it is constructed in a single piece and made of acid-resistant hard rubber orbituminous composition. Now a day polypropylene is used, which is strong translucent, and light in weight.

-it is divided by partition into compartments for an individual cell.

- Ribs are there at the bottom of each compartment. The battery plates rest on these ribs.

- The space between the ribs is provided to collect sediments. This minimizes the danger of short circuits due to sediment.

Separators: -

Separators are placed between the negative and positive plates. This prevents the positive and negative plates from direct contact with each other, resulting internal short circuit.

-Also, they may be porous to permit electrolytes to circulate between the plates.

-The separator is made of wood, spun glass, porous rubber sheet, glass fibber, or resin-impregnatedfibber.

-some batteries have separators made of polyvinyl chloride or polyethylene-saturated cellulose.

Cell cover: -

- Each cell is sealed by a cover of hard rubber through which the positive and negative terminals are projected.
- Adjacent negative and positive terminals are connected by cell connector straps.
- Its cover has an opening for filling the electrolyte and a filler cap is provided on this opening with an air vent to escape the gases.
- The edge of the cell cover is sealed with an asphaltic sealing compound.

Electrolyte: -

- The sponge lead and lead peroxide fill the respective plate.
- Electrolyte is a chemically pure sulphuric acid diluted with distilled water.
- The level of electrolyte must be 10 to 15 mm above the top of the plate.
- When the electrolyte has been added and the battery is given an initial charge then it is ready for operation.

Taper terminal: -

- Battery terminals are of a special design made tapered to a specific dimension. So that all positive and negative cable clamps will be it.
- The positive terminals are slightly larger in diameter at the top than the negative terminal.

Cell connectors: -

- Connector straps connect the negative and positive terminal post of the adjacent cell just above the cell cover.
- Each cell of a lead acid battery produces 2 volts.
- Connectors must be heavy enough to carry the high current required for starting without overheating.

WORKING OF BATTERY

The working of the battery can be understood by knowing the changes taking place during the charging or discharging of the battery.

Chemical reaction during charging and discharging

- A fully charged lead acid battery consists of lead peroxide (Pb02) as the positive plates, spongy lead (Pb) as the negative plates, and diluted sulphuric acid (H2SO4) and (H20). The dilution of the electrolyte at a relative density of the lead is known as the active material.
- The splitting of the electrolyte into these parts is the reason that a charging or discharging current can flow through the liquid.
- The chemical reaction takes place between the three chemicals in the battery. In presence of H2SO4, the electrons from one group of plates collect on the other group of plates.
- The voltage of a cell is created due to the ions (charged particles) being forced into the solution from the electrodes by the solution pressure. The lead will give up two positively charged atoms, which have given up two electrons, into the liquid.
- This flow of electrons is continuing until it is an insufficient balance of electrons to create a 2 volts pressure between two groups of the plates.
- This results in a pressure of 2 volts between the terminals of the battery cell. If two terminals are connected by a circuit the electron will flow.
- After a certain amount of current has been withdrawn, the battery is discharged or dead.
- When it is discharged, it is not capable of delivering any additional current. It is then charged.
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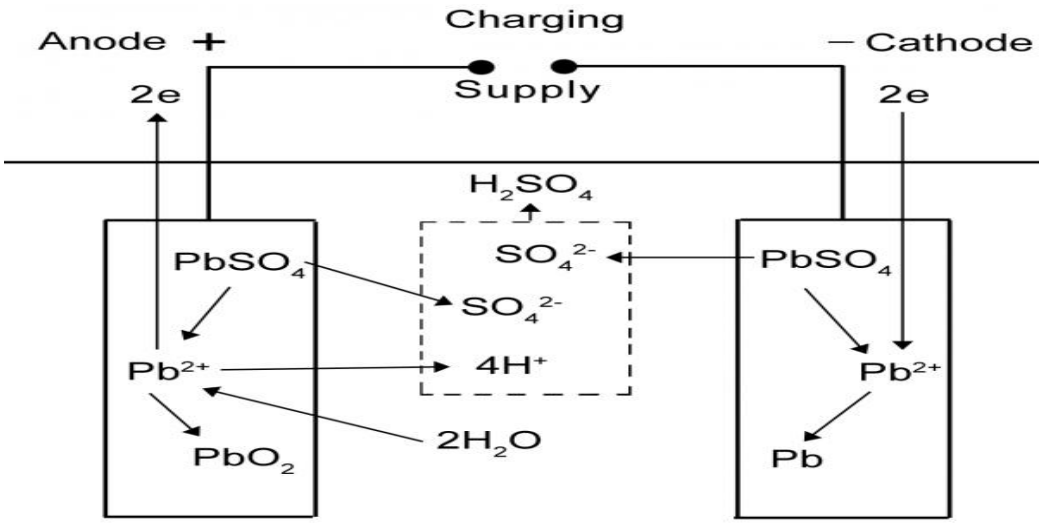

lead acid battery types

1) Flooded Type – The conventional engine ignition type has a traction kind of battery. The electrolyte has self-ruling movement in the lamina section. People who are using this type can have serviceability for each lamina and they can add water to the cells when the shower gets zestless up.

2) Sealed Type – lead-acid battery is just a minor change to the flooded type of battery. Even though people hold no access to each cell in the battery, the internal design is almost like that flooded type one. The main variation in this type is that there exists enough amount of acid which withstands the happening of smooth flow of chemical reactions throughout the battery life.

3) VRLA Type – These are called valve-regulated lead acid batteries which are also termed as a sealed type of battery. The value-controlling procedure permits the safe evolution of O_2 and H_2 gases at the time of charging.

4) AGM Type – This is the Absorbed Glass Matte type of battery that permits the electrolyte to get stopped near the plate's material. This kind of battery augments the performance of the discharge and charging processes. These are especially utilized in power sports and engine initiation applications.

5) Gel Type – This is the wet kind of lead-acid battery where the electrolyte in this cell is silica-related which makes stiffening of the material. The recharge voltage values of the cell ate minimal when compared with other types and it has more sensitivity too.

Advantages of lead-acid batteries

- Low-cost and simple manufacture Low cost per watt-hour
- High specific power, capable of high discharge currents good performance at low and high temperatures
- No block-wise or cell-wise BMS is required

A disadvantage of lead-acid batteries

- Low specific energy; poor weight-to-energy ratio
- Slow charging: Fully saturated charge takes 14–16 hours Need for storage in charged condition to prevent sulfation Limited cycle life; repeated deep-cycling reduces battery life Watering requirement for flooded type
- Transportation restrictions for the flooded type
- Adverse environmental impact

Application: -

- These are employed in emergency lighting to provide power for sump pumps.
- Used in electric motors
- Submarines
- Nuclear submarines

FACTORS AFFECTING BATTERY LIFE

1) Improper electrolyte level
2) Corrosion of terminals and conductors
3) Overcharging
4) Undercharge/sulphation
5) Poor mounting
6) Cycling

Conclusion:

Lead-acid showers as the modern industrial production and life, a modern battleground necessary for replacement energy, its status, and performance management directly stupefy the efficiency of industrial production, the trend of the battlefield, this paper summarizes the use on the outside of shower management system of shower parameters testing method and the characteristics of variegated types of the lead-acid shower managementsystem.

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