Shree Sai Research Lab.

Sodium Sulfate LR Grade Anhydrous Tablets

Technical Data Sheet

Sodium Sulfate Lr Grade Tablets (For Electrolyte Additive in Lead Acid Batteries)

Sodium Sulfate Lr Grade Tablets is a battery life saver which prevents battery by early premature failure. It is used in electrolyte of free flooded conventional lead acid & VRLA batteries.

Sodium sulfate acts by the common ion effect to prevent the harmful depletion of lead sulphate ions.
The addition of sodium sulphate provides an 'inventory ' (excess) of sulphate ions that are available for more conductance.

The growth of large crystals, called hard sulfate, occurs by a dissolution precipitation process when the battery is on open circuit. At the low acid concentrations in a discharged battery, the solubility of lead sulfate reduces the number of failures from shorting when the battery is deeply discharged or stored with minimal electrolyte.

Why Sodium Sulfate Lr Grade Tablets :

Sodium Sulfate LR Grade Tablets is needed to prevent mechanism of loss of capacity of battery. It had been studied by analyzing cause of capacity loss in battery by formation of Lead Sulfate layer between the active materials of Plates; it deposits and hardens the battery plates. This process in called sulfation. The rate of formation of Lead Sulfate passivating non conducting layer inhibits the performance of generating eletctric currents in the battery. Such battery reduces accepting charging & discharging process. Sodium Sulfate LR Grade Tablets formula works longer essentially slowly and continuously freeing the battery plates of sulfation.

How a Lead Acid Battery works?

When lead Di-oxide of the positive plate & spongy of negative plates reacts in presence of sulfuric acid, chemical reaction takes place to produce Lead Sulfate & water. Useful energy from the chemical reaction is suitable tapped as an electrical energy.

DISCHARGING ⟷ CHARGING

Reversible Reaction

How Sodium Sulfate Lr Grade Tablets Work In Lead Acid Batteries? (Common Ion Effects)

Sodium sulfate are highly water soluble and they dissociate in water, producing sulfate ions. Concentration of these salts have been kept at such level that conductivity is high and this helps electrical current to pass through it. The addition of sodium sulfate & provides an inventory (excess) of sulfate ion that are available for more conductance.

The growth of larger crystals, called hard sulfate occurs by a dissolution precipitation process when the battery is in a discharged condition.

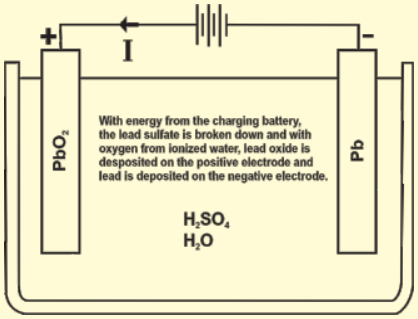
Lead Acid Battery Reaction While Working : The reaction in lead acid battery is reversible as shown bellow:

$$2PbSO_4 + 2H_2O \underset{\text{discharging reaction} \leftarrow}{\overset{\text{Charging reaction} \rightarrow}{\leftrightarrow}} Pb + PbO_2 + 2H_2SO_4$$

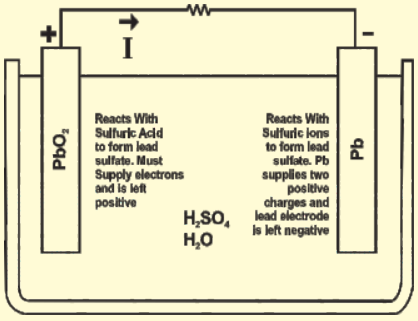
One can observe that sulfate ions are common in both charge and discharge reactions. The reaction is also known as double sulfate theory. During discharge lead sulfate builds up and becomes insulating material, thereby increasing internal resistance of the cell/battery is improved dramatically.

Whenever a solution of an ionic substance comes into contact with another ionic compound with a common ion, the solubility of the ionic substance decreases significantly. In case of Charging

$$2PbSO_4 + 2\,H_2O \rightarrow Pb + PbO_2 + 2H_2SO_4$$



When Na2So4 is added as additive in acid electrolyte, then the concentration of sulfate ion increases, so that the solubility of PbSO4 decrease.



On the other hand in case of discharging:

$Pb + PbO_2 + 2H_2SO_4 \rightarrow 2PbSO_4 + 2H_2O$

When Na2So4 is added as additive to in an electrolyte medium, diluted Sulfuric acid then the concentration of sulfate ion increases, so that the solubility of PbSO4 increase.

Recommendation : By adding common ions (Sulfate Ions) to the acid electrolyte reaction, it will increase the sulfuric acid concentration and hard ions of lead sulfate will soluble so fast, so that the specific gravity increases up to a level in all cells of lead acid batteries.

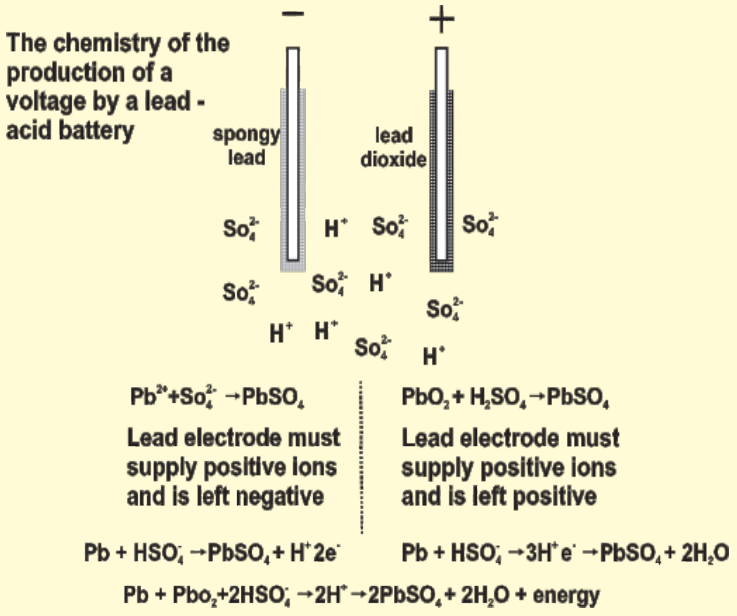
How Sodium sulfate Tablets Work In Lead Acid Batteries? (By Lechatelier Principle)

Lechatelier Principle In Lead Acid Battery Reactions:

According to famous scientist, Lechatelier & his hypothesis that, when a chemical reactants are at equilibrium, the addition of more of one of the ions from another compound will shift the composition to the left, reducing the concentration of other ion and effectively reducing the solubility of the solid to maintain the equilibrium.

The cell reaction in lead battery cell is as shown below:

$$\underset{\leftarrow \text{ discharging reaction}}{2PbSO_4 + 2H_2O \leftrightarrow Pb + PbO_2 + 2H_2SO_4} \rightarrow \text{ Charging reaction}$$



In case of charging

So Equilibrium constant Kc = $[Pb][PbO_2][H_2SO_4]^2 / [PbSO_4]^2[H_2O]^2$

By adding sodium sulfate into lead sulfate, it will increases the concentration of sulfate ions In Lead Sulfate, So that Formation of sulfuric acid will be more faster to attend the equilibrium.

In case of discharging

Equilibrium constant Kd = $[PbSO_4]^2[H_2O]^2 / [Pb][PbO_2][H_2SO_4]^2$

By adding sodium sulfate to sulfuric acid, it will increases the concentration of sulfate ions in acid, So that $PbSO_4$ will be easily formed.

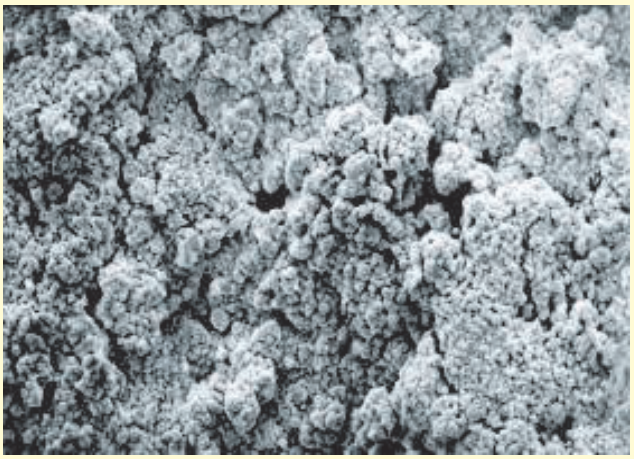
Recommendation:

By adding sodium sulfate ions as electrolyte additive into lead acid batteries, the cell reaction becomes faster for the production of Lead Sulfate in case of discharging and sulfuric acid in case of charging.

According to studies International Battery Council, 60 to 70% batteries are replaced prematurely due to the sulfation that occurs on lead plates. Sulfation is an electrochemical reaction that occurs when a battery is discharged. During normal use or in storage, a battery's sulfuric acid is active between the plates. This reaction creates energy in the form of electric current. It also transforms the acids chemical composition i.e. in contact with the lead plates, forming a solid residue(Lead Sulfate). Finally, the loss of sulfuric acid reduces the electrolyte's sulfuric acid in liquid state becomes solid and the electrolytes specific gravity reading drops. However, after charging the battery, the solid crystal residue will turn into liquid again but doesn't allow the lead sulfate to turn totally into liquid (at 100%). Some residue will remain fixed on the plates or fall down to the bottom of the battery.

Sulfation reduces the electrolyte concentration and, as a consequence the cell voltage is also reduced. As sulfation increases the internal resistance increases & the extra heat generates which produces a mark rise in electrolyte temperature. These higher temperatures then further accelerate the dry out process often culmination in the failure of battery.

This continual sulfate accumulation accelerates the weakening process and finally "Suffocates" the Battery,



Symptoms of Sulfated Batteries

- ☐ A General Lack of Capacity(Deliverable Power)
- ☐ An Increase in Battery temperature while charging & discharging
- ☐ A strong Odour of Hydrogen Gas while charging
- ☐ An excessive use of water
- ☐ A rapid rise in battery voltage while charging
- ☐ A sudden drop of Battery voltage while discharging

Under certain conditions of over discharge, the amount of dissolved lead sulfate may be such that, on recharging, the reduced lead will form metallic bridges between the plates (dendrites).

For Deep Cycle & Automotive Batteries we will know of the problems of dendrite formation between the plates effectively shorting the cell & it will lead to excessive heat or gassing of other cells. The addition of sodium sulfate will reduce this risk.

Sulfation is a Common natural process occurs during discharging. When the battery is deeply discharged or left on open circuit in the discharged condition, abnormal condition will leads into hard sulfation. Because sodium sulfate and zinc sulfate is not isomorphism with lead sulfate and is more soluble. The solubility of lead sulfate in sulfuric acid containing sodium sulfate shows significant effect at different acid concentrations.

Sodium Sulfate increases the solubility of lead Sulfate. While charging lead acid battery at lower acid concentrations due to the common ion effect(Le chatleirs principle).
It inhibits growth of large crystals i.e. called hard Sulfate occurs by a dissolution precipitation process when the battery is on open circuit, at the low acid concentrations in a discharged battery the solubility of lead Sulfate is higher. Most of the reputed companies in India and other countries are using Sodium Sulfate & Zinc Sulfate Tablets as a electrolyte additive since a long in lead acid flooded and VRLA batteries.

1. Sodium Sulfate Lr Grade Tablets decreases sludge formation i.e. falling off or shredding of active materials.
2. Sodium Sulfate Lr Grade Tablets helps to keep plates lesser sulfation and more solubility of lead Sulfate in electrolyte.
3. Sodium Sulfate Lr Grade Tablets increase cold cranking capacity.
4. Sodium Sulfate Lr Grade Tablets prevents early passage of antimony dissolved from the grid reaching to negative plate active material.
5. Sodium Sulfate Lr Grade Tablets keeps positive lead Sulfate dispersed in smaller size particles avoiding hard sulfation.
6. Sodium Sulfate Lr Grade Tablets maintains high ionic conductivity so that charge discharge processes are carried on smoothly and the separator material should not get physically or chemically degraded by lead Sulfate, dilute H2So4, oxygen and hydrogen gases involved during functioning of a battery.
7. Sodium Sulfate Lr Grade Tablets prevents backup downfall in a stationery, Tubular, industrial batteries which have to be fully discharged per cycle.
8. Sodium Sulfate Lr Grade Tablets increase power efficiency consistently
9. Sodium Sulfate Lr Grade Tablets lengthen battery life up to 10 to 25%
10. Sodium Sulfate Lr Grade Tablets reduce levels of hazardous gases and acid spray emissions.
11. Sodium Sulfate Lr Grade Tablets prevents premature capacity loss.

By use of this battery performs consistent cycle life, longer life & high coefficient of utilization.

Material Specification : Sodium Sulfate Lr Grade Anhydrous - Na2SO4

SR.NO.	PARAMETERS	VALUES OBTAINED	UNIT	SPECIFICATIONS
1.	Description	White Colored Tablets	--	White Colored Tablets
2.	Assay Purity of Na_2SO_4	99.990	%	99.0 Min.
3.	Solubility	100% Soluble in water	---	100% Soluble in water
4.	pH of 10% solution	7.10	--	7 to 8
5.	Chloride (Cl)	05	Ppm	10Max
6.	Heavy Metals(Pb)	Nil	Ppm	10 Max
7	Arsenic (As)	Nil	Ppm	10 Max
8.	Iron Content(Fe)	06	Ppm	10 Max
9	Calcium & Magnesium as CaO	01	ppm	10Max
10.	Ignition loss Moisture Content (at105°C)	0.091	%	0.5 Max

Standard Packing : 25 kg. Box packing (Tablets and Powder Form)
Storage : Store in a cool and Dry Place
Dosage : 10 Gm.Per Kg.of Electrolyte Volume.

Sodium Sulfate Lr Grade Tablets Dosage Chart

Instructions : Put Sodium Sulfate Lr Grade Tablets before Heat sealing Top at assembly stage in Battery mfg.

Sr. No.	Model of Battery All Types	Dosage Sodium Sulfate Lr Grade Tablets Per Cell Total In Gms.	No. of Battery Feedings in Nos. Per kg
1.	12V2.5AH	1.0gms x 6 cell = 6gms	166nos.
2.	12V5.0AH	1.50gms x 6 cell = 9gms	111nos.
3.	12V9. 0AH	2.5gms x 6cell = 15gms	66nos.
4.	12V40AH	4.0gms x6cell = 24gms	42nos.
5.	12V50AH	5.0gms x 6 cell = 30gms	33nos.
6.	12V70AH	6.0gms x 6cell = 36gms	28nos.
7	12V88/100AH	8.0gms x 6cell = 48gms	21nos.
8.	12V120AH	10.0gms x 6 cell = 60gms	17nos.
9.	12V150AH	12.0gms x 6cell = 72gms	14nos.
10.	12V180AH	14.0gms x 6cell = 84gms	12nos.
11.	IT BATTERY	16.0gms x 6cell = 96gms	10 nos.
4.0 gm Capsule Shape Tablets also available to put after assembly.			

*** As per manufacturers requirement dosage for other models can also be supplied.**