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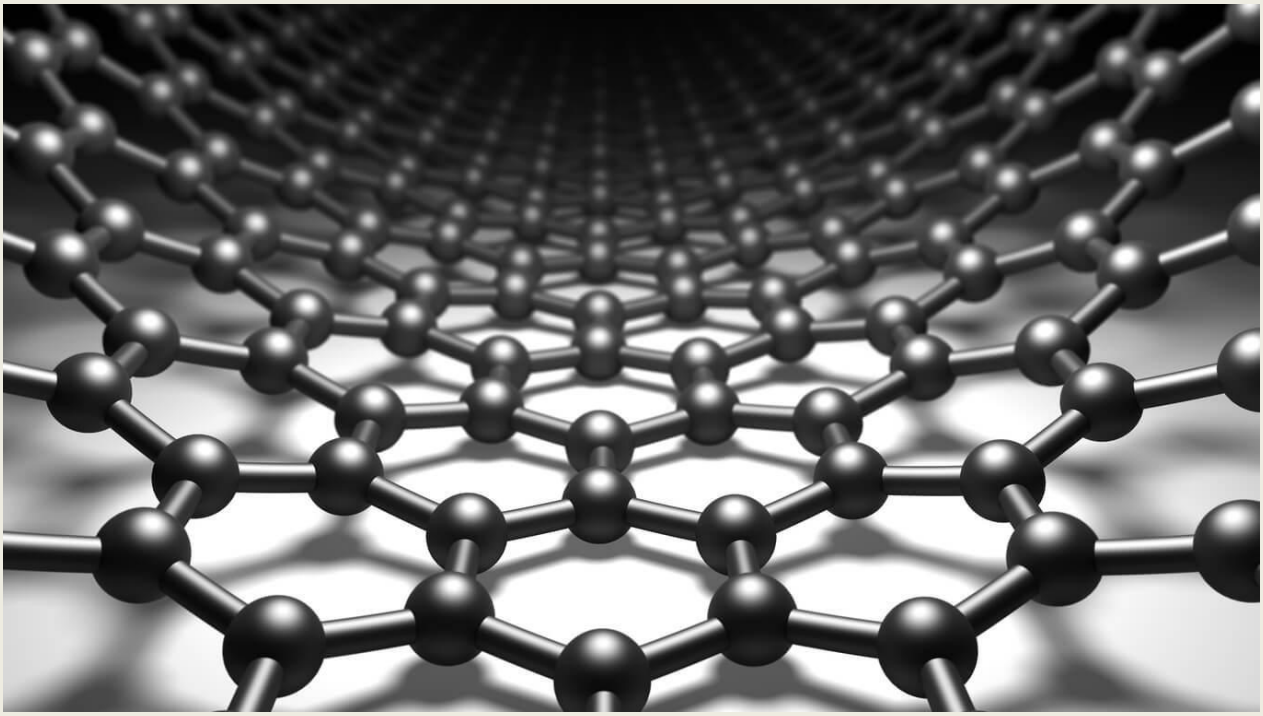
Lead Carbon Ultra Battery



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Lead Carbon Ultra Batteries

Introduction

Growing demand for batteries on a global scale

Due to the rapid development of the industry, the application of batteries in transportation, communication, power, military, aviation, marine, commercial facilities as well as in the daily needs of users has become more extensive.

The performance of conventional lead based batteries is not optimal

Because of its inherent structural characteristics, traditional lead-acid batteries suffer from plate sulphation, active material loss, high water loss rate, serious acid pollution, poor low temperature performance, short life cycle, poor transport safety and other flaws. In order to overcome the structural weaknesses in lead-acid batteries, gel electrolyte has been used as replacement in gel batteries. Although it reduces acid mist, reduces water loss rate and self-discharge rate, and improves the discharge performance, it raises new problems such as poor penetration of the gel material, weak compatibility with the AGM separator and a slow reaction to the electrodes.

By its unique technology Lead Carbon batteries have a high performance

To overcome the fundamental flaws of the lead-acid, AGM and gel batteries, we instead recommend the newer and superior Lead Carbon Batteries, which are ideal products to replace lead acid, AGM and gel batteries.

In line with the industrial development trend of the 21st century, Lead Carbon batteries pioneered the new concept of environmentally friendlier Nano-Carbon / Activated Carbon (Graphene) negative plate design, and marked the iconic innovation of battery technology. The excellent properties of Lead Carbon batteries are well received in many provinces and cities in. This new type of environmentally friendly product is rapidly blending into the consumer lifestyles of many industries and is widely accepted by institutions and individuals.

The patented technology found in lead carbon batteries uses a special advanced technology negative carbon plate formula, developed to completely replace traditional regular Sulphuric lead acid batteries. This in turn improves the product's application and safety performance. The electrical properties of the battery are consistent and achieve high reliable performance + longer life. It effectively overcomes the disadvantages of plate Sulphation, active material loss and water loss rate, has good low temperature product life.

Lead carbon batteries have longer a longer cycle-life. If you take the battery's 'end of life' to be the point at which it can only be charged/discharged to 80% of its original capacity, a lead carbon battery will last for 7000 cycles at 30% DoD daily – compared to 2000 – 5500 cycles at 30% DoD for VRLA-types and 800 cycles at 30% DoD for flooded batteries.

Lead carbon batteries are better at sitting at partial states of charge (PSOC). Ordinary lead type batteries work best and last longer if they follow a strict 'full charge'-'full discharge'-full charge' regime; they do not respond well to being charged at any state in between full and empty. Lead carbon batteries are happier to function in the more

Lead Carbon batteries use super capacitor negative electrodes. Carbon batteries use a standard lead type battery positive electrode and a super capacitor negative electrode. This supercapacitor electrode is the key to the longevity of the carbon batteries. A standard lead-type electrode undergoes a chemical reaction over time from charging and discharging. The super capacitor negative electrode reduces corrosion on the positive electrode and also helps to inhibit Sulphation for the negative electrode, which in turn leads to longer life of the electrodes itself which then leads to longer lasting batteries (up to a 20 year max design life, or around 10 years daily real world life for most typically average NZ solar clients).

Lead carbon batteries have faster charge/discharge rates. Standard lead-type batteries have between maximum 5-20% of their rated capacity charge/discharge rates meaning you can charge or discharge the batteries between 5 – 20 hours without causing any long term damage to the units. Lead Carbon have a theoretical unlimited discharge rate and a fast charge rate also.

Ultra High Charge vs Discharge Efficiency Level. Standard lead-type batteries usually have around a 50% charge vs discharge efficiency, so for every 1000w of solar / generator charge power you put into the battery (per hour) 50% of that is retained and 50% is wasted. Over a day, week and year this equates to ALOT of wasted energy with standard lead acid / agm / gel batteries. In turn a lead carbon battery operates typically between 90-92% charge vs discharge efficiency rating. This means for every 1000w of solar / generator charge power you put into the battery (per hour) then 90% of that is retained and only 10% is wasted. Over a day, week and year this means a HUGE amount of savings, especially if some of your charging power was coming from running a petrol / diesel generator.

Common sizes available are: 12v 40Ah ,12volt,100 AH

Advantages summarized

Compared to mainstream rechargeable industrial batteries like lead acid, lead gel and AGM batteries, Lead Carbon batteries perform as follows:

•Lead Carbon batteries can be charged faster

•Lead Carbon batteries can be discharged deeper (even to 100% DOD!)

•Lead Carbon batteries can be charged below 7 degrees Celsius

•Lead Carbon batteries can be cycled more often (2400 @ 80% DOD)

•Lead Carbon batteries have ultra low gassing (only if over-charged)

•Lead Carbon batteries can be used in a partial state of charge

•Lead Carbon batteries can be stored for 1.5 years without top-up charging

•Lead Carbon batteries require no special ventilation or cooling

•Lead Carbon batteries do NOT have risk of fire or explosion (unlike lithium batteries)

•Lead Carbon batteries do not release any harmful, dangerous or poisonous gasses during normal charging / discharging usage.

• Lead Carbon batteries will not leak any harmful or dangerous acid during normal charging / discharging usage.

• Lead Carbon batteries do not require an active BMS system to protect & balance them (unlike Lithium

Batteries

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- Lead Carbon batteries do NOT suffer from Liquid / GEL drying out inside the battery like normal AGM.

- Lead Carbon batteries are one of the most ABUSE TOLERANT / RESISTANT batteries available today.

- Lead Carbon batteries can easily be retrofitted (retro-fitted) to 95% of applications that use existing lead acid

- Lead Carbon batteries have an operating temperature from +2 to +40 degrees Celsius

Technical specifications

Lead Carbon batteries are a range of new products that were successfully developed based on existing batteries (but aimed to be much better and longer lasting). It has better performance characteristics compared to the conventional batteries and is the result of new technical breakthroughs. The fundamental issues of serious lead acid battery acid pollution, electrode Sulphation, short life cycle, poor low temperature performance and other flaws are resolved, setting a high standard of "efficiency, safety, and long-life".

Structure characteristics

Special Electrolyte Composition

A unique complex technology of Activated Carbon / Nano Carbon /Graphene is used to synergize a much longer life and higher efficiency internal Anode (negative) advanced plate technology, thereby optimizing the reaction between the electrolyte and the active electrode material, effectively preventing Sulphation problems / issues (supporting true PSOC - Partial State of Charge) and extending its service life. The electrolyte within the battery internally re-combines giving no leakage, making the battery safe and reliable. The battery may be installed using in a variety of orientations, making it easy to use. This opens a wide range of installation applications, since the risk of electrolyte leakage is eliminated. This reaction also improves the products safety making it less harmful to installers and users alike.

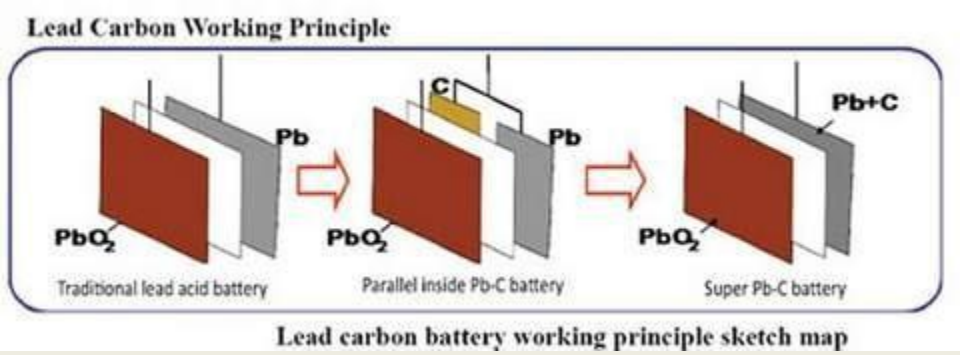
Safety Valve

A safety exhaust valve is used that has high sensitivity, and can open or close according to the internal pressure change of the battery. Safety valves are made of corrosion-resistant, anti-aging special rubber composite, which can retain the air-tightness and liquid-tightness of batteries with long-term use and constant open and close valve pressure. The internal pressure of the batteries is maintained at optimal safety range.

Sealing Performance

Battery compartment and cover are seals made of rubber rings and terminals that are dual-sealed. A sealing material that has small shrinkage is used to ensure that the terminal seals well.

Working principle



Lead carbon battery working principle sketch map

It forms a new active center in negative electrode by adding active Carbon, that can reduce lead deposition over potential, the lead sulfate will be translated into lead more easily. Growing up of lead sulfate can be suppressed efficiently through this technology.

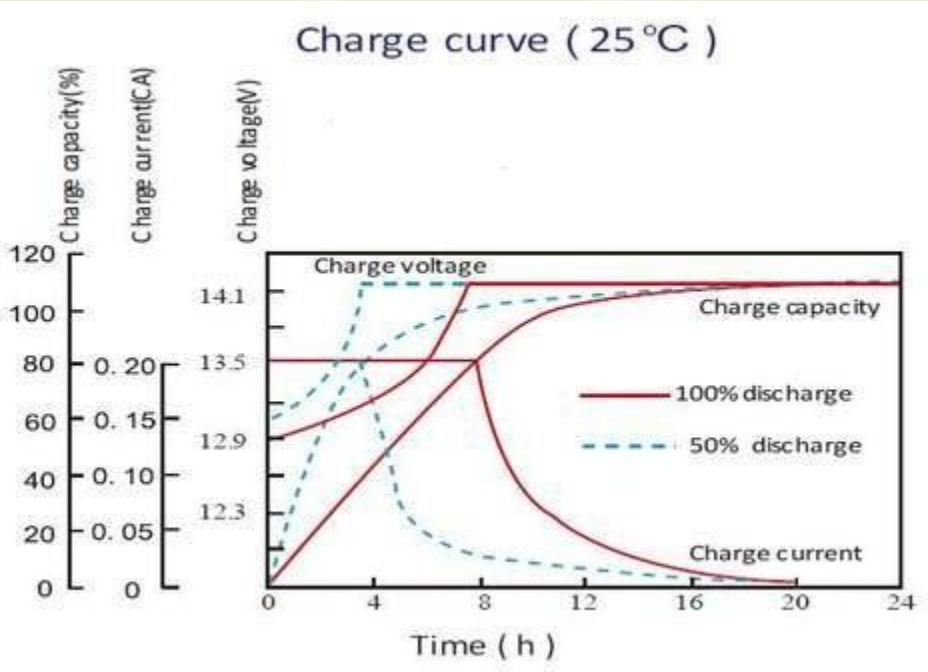
When discharging, the positive and negative active material reacts with the acidic element of the electrolyte and becomes Lead Sulphate and water, causing the acid density to decrease. When charging, the acid that concentrated in the positive discharge material (during discharge cycles) is released back into the electrolyte. At this time the Lead Sulphate in the positive and negative plate transforms in to lead dioxide which causes the acid density in the electrolyte to increase.

With conventional lead based batteries, after charging or prior to charge completion, all the charging current is used for electrolyses of the moisture in the electrolyte. The positive plates release oxygen and the negative plate hydrogen gas. If the gas recombination efficiency of the battery is low, a large percentage of the gas will escape leaving less moisture in the battery after every charge. This action causes the electrolyte content to decrease due to water loss, raising the acidity in the battery and shortening the life of the battery. This is known as late charge fluid loss phenomenon.

With Lead Carbonl batteries, besides the regular chemical reaction, the composite electrolyte has various additives that participate in the electrochemical reaction. This helps to inhabit the oxygen and hydrogen gas during the charging cycle increasing the batteries recombination rate. This in turn reduces the water loss during and after charging. When discharging, the Lead Sulphate can be totally transformed back into active material, prolonging the battery's use life.

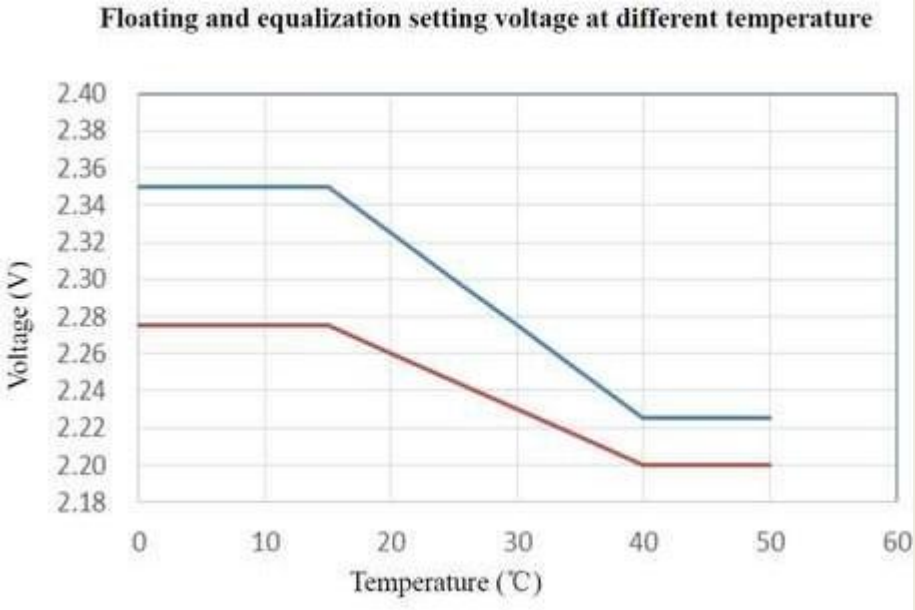
Lead Carbonl batteries have a much higher electrical conductivity, heat resistant and acid resistant abilities than standard AGM on the market thanks to it's Activated Carbon (Super Capacitor) Negative Plates. This advanced Activated Nano-Carbon Plate composition in combination with the AGM Technology can effectively protect the plates and prevent the active material from falling off during use. The electrolyte is completely absorbed and stored in the AGM. Since the AGM is completely saturated with electrolyte no free liquid electrolyte will be present in the battery to spill or fall out during normal operations, therefore the battery can now be used in various directional positions without leaking (eg standing on it's end or side).

Charge characteristics



Lead Carbon Batteries are high-end products that work best with good quality battery chargers that have a compatible charge profile (or ability to adjust custom charge settings). Below settings for automated battery chargers are recommended to fully utilize the benefits of Lead Carbon Batteries.

• Cyclic charging: the battery is frequently charged and discharged like a daily routine. The battery is boosted to a higher voltage (absorb / equalization) phase then automatically followed by the float phase when and if the battery is (close to) full. You don't want to exceed 14.1v for the boost / absorb / equalize charging phase.
• Standby charging: the battery is only discharged once per week (or less).
• Float charging: the battery is in a constant charged state and rarely discharged. The Float Phase will also set in on standby charging when the battery is full (fully automated).



Discharge characteristics

Battery Capacity Batteries under certain discharge conditions will release a certain amount of current. This amount of current released is called the capacity. The symbol used to identify the capacity is "C". The commonly used unit of measure is Amp Hours (Ah).

The battery capacity can be defined in two parts, namely rated capacity and actual capacity under different discharge conditions. The actual capacity of the battery under certain discharge conditions is calculated by the current (A) multiplied by the discharge time (h). The resulting unit is Ah.

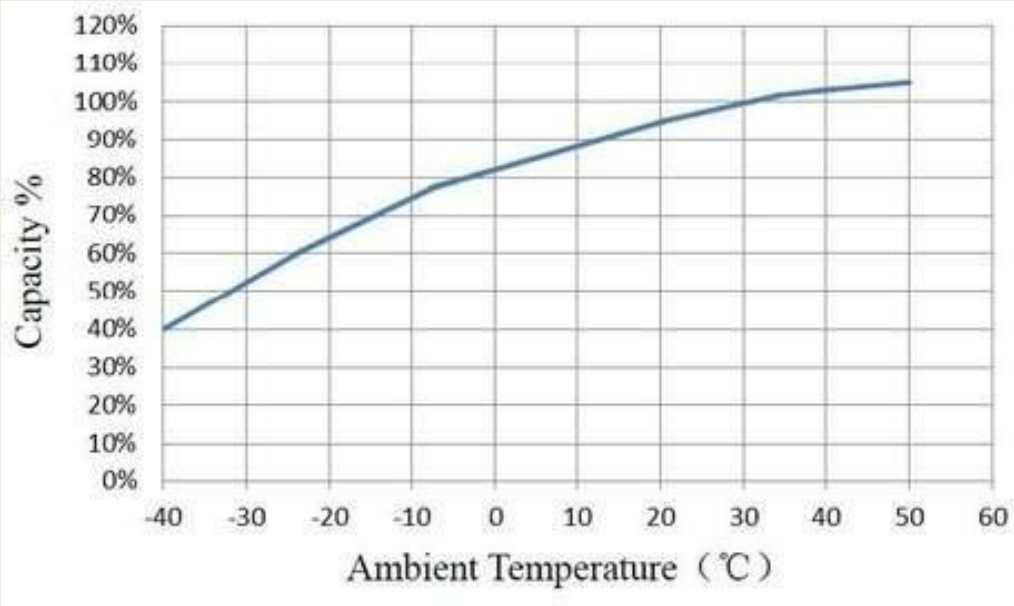
Battery Discharge Rate

The battery discharge rate uses rated hours to determine the discharge time. This time is influenced by the amount of current drawn from the battery. If the discharge current increases, the discharge time will decrease and also affect the rated capacity.

Influence of Temperature on Capacity

The discharge characteristics and temperature of batteries are closely related. When the temperature is low, the discharge capacity of the battery will be reduced. For example, when the temperature is dropped from 25°C to 5°C, the capacity of the battery will drop to about 70% of its rated capacity.

As the ambient temperature rises, the battery capacity will increase within a certain range, for example, the battery capacity will rise to about 105% of the rated capacity when the temperature rises from 25°C to 40°C, however if the temperature continues to rise, the capacity increase will slow down, and ultimately not increase further.



Discharge Voltage

The termination voltage refers to the battery voltage dropping during discharge to the minimum working voltage required for operation. The termination voltage and the discharge current are closely related. Generally during high current discharge the termination voltage of the battery should be set lower.

Over discharging below the termination voltage should be avoided since the over discharging could only gain a small amount of additional capacity, but drastically reduce the battery's service life.

DISCHARGE CURRENT (A)	DISCHARGE VOLTAGE (V/CELL)
0.05C or less than the discharge gap	1.9
0.05C or similar to this value	1.85
0.1C or similar to this value	1.8
0.2C or similar to this value	1.75
0.2C - 0.5C	1.7
0.5C - 1C	1.6
1C - 3C	1.5
3C	1.3

Termination voltage of Lead Carbon batteries when discharged at different current.

Self-Discharge

The self-discharge characteristics of a battery changes with environmental temperatures, the higher the temperature the higher the self-discharge, so the batteries should not be stored in an environment that is subjected to extremely high temperature conditions for long durations of time. Due to the use of our unique lead carbon plate technology, the self-discharge consumption of Lead Carbon Batteries is efficiently reduced. At a constant 25°C environmental temperature Lead Carbon Batteries can be kept on a shelf for up to 1.5 years without constant top up charging. The batteries will maintain over 60% of their rated capacity after 12 months.

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Lead Carbon vs AGM / GEL vs Lithium Comparison

Below is the table showing how lead carbon batteries compare against AGM / GEL and Lithium battery ptions.

		Lead Carbon		AGM / GEL		Lithium
Max / Design Life	✓	20 Years		3-6 Years		6-10 Years
Cycle Life 30% DOD	✓	6000		1300-1400		5000
Cycle Life 50% DOD	✓	3500		600-900		3500
Cycle Life 80% DOD	✓	2400		200-300	✓	2400-3000
Max DOD %	✓	100%		50%		80%
Partial State of Charge	✓	Hardly Affected		Sulphation Issues	✓	Hardly Affected
Dendrite Growth Issues	✓	No	✓	No		Yes
Risk of Fire / Explosion	✓	Low / None		Low / None		High / Yes
Maintanence		Maintanence Free		Maintanence Free		Maintanence Free
Warranty	✓	3 years		1-2 years		Varies
Years in the market		5+	✓	30+		< 4
Current upfront cost price		$$$	✓	$$		$$$$$$
Cost of ownership over 10 yrs		$		$$$		$$$$
Cost per kWh of Usable Storage	✓	$		$$		$$$$$$
Retro-Fit onto existing systems	✓	EASILY		EASILY		DIFFICULT / CAN'T
On-Grid + Off-Grid Application	✓	Yes, easy for both	✓	Yes, easy for both		On-Grid Only mostly
Charge vs Discharge Efficiency %	✓	90-92%		50-55%	✓	90-92%

Reach us:

CharzeMax Global Pvt. Ltd. (A Nordische Company)
Sigma Haven 4th-FR, FL-F4,
1117, Kalikapur, Haltu, Kolkata- 700078,
West Bengal, India

www.charzemaxglobal.com admin@charzemax.com