Battery talk
BATTERY INFO | UPDATES | NEWS
ISSUE 01 2010

What are Silver/Calcium Batteries?

The terms Silver Calcium, Hybrid or Antimonial batteries are referring to the combination of materials that are added to lead during the battery manufacturing process. Battery grids are produced using 99% lead plus the addition of alloying metals which are blended to provide added strength and performance benefits.

A number of different lead alloys can be used in the manufacturing process:-

Low Antimony Alloy	=	1.75% antimony + tin & arsenic
Calcium Alloy	=	0.1% calcium + tin & aluminium
Silver Alloy	=	0.06% Silver with calcium + tin & aluminium

In this Issue

Antimony Batteries.

Antimonial alloys have been used in battery plate manufacture for the last 100 years and involves Antimony being added to both the negative and positive grids. Antimony improves the production and shaping (castability) of battery grids and provides the mechanical strength required for the grids to be pasted with lead oxide material. It also delivers improved charge acceptance, greater recovery from inadvertent deep discharges and provides good corrosion resistance properties.

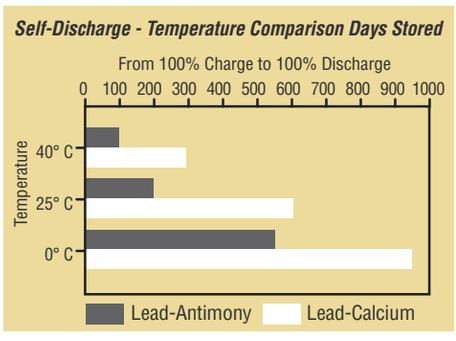
The use of Antimony will increase gassing and water loss rates and thus a small decrease in storage life. In hotter climates this is accelerated as water within the acid is broken down as a result of the antimony in the positive plates dissolving and migrating onto the negative plate and producing hydrogen. Manufacturers have also found that the use of Antimonial alloys in continuous plate making systems cannot be used.

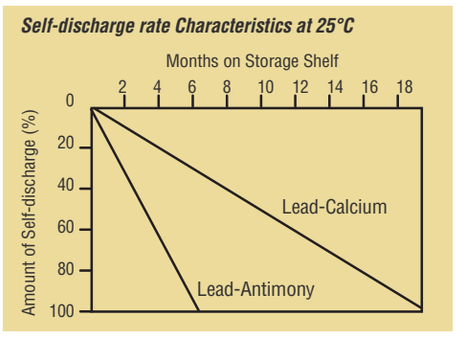
	Benefits	Drawbacks
Antimonial	Very strong plates	Higher water loss & maintenance
	Good cycling (discharge when motor vehicle is idle/recharge when moving)	Battery goes flat quicker if not used. (1-2 months)
	Easier to recharge if battery is drained. (E.g. 1 day)	Lower performance in sub-zero climates
	Performs well in hot environment (climate and under bonnet)	

Calcium/Calcium Batteries.

As demand for lead acid batteries increased, manufacturers investigated more efficient production methods and ways to satisfy the growing demand for batteries that required minimal on-going maintenance.

Calcium alloy technology was developed in the USA and enabled continuous plate making to be a viable process. It involves the addition of small amounts (0.04%-0.11%) of calcium alloys to lead during grid manufacture to provide the necessary strength required in the continuous plate making process. The added benefits of using calcium is that it is less prone to water loss, gassing rates and storage life problems associated with the use of Antimonial alloys.





Small amounts of other elements such as copper, aluminium and Arsenic are added to act as grain refiners. This reduces the size of the lead grain within the battery plates helping to reduce corrosion, provide additional plate strength and prevent fabrication defects and plate brittleness. The addition of tin to the positive plate provides increased conductivity, additional strength and reduces corrosion rates. Batteries manufactured with calcium alloys have lower electrical resistance which results in higher CCA, a particular benefit in colder temperatures where higher CCA's are required to start vehicles.

Despite these benefits the use of lead calcium alloys and the addition of tin does have some problems. Lead calcium batteries fail more rapidly than Antimonial lead alloy batteries due to rapid corrosion of the positive plate in hotter under bonnet temperatures. Lead calcium batteries are also prone to grid growth and cracking which in turn leads to premature battery failure. Here the structure and shape of the positive battery plate changes causing cracking and the shedding of active material, again this is accelerated in higher operating temperatures.

An added complication with calcium batteries is "barrier layer sulphation". When left in a discharged state for extended periods the plate alloy attracts a layer of sulphate which forms an insulator between the plate conductor and the plate material making it difficult to recover a calcium battery when hardened sulphation has set in. In this situation vehicle charging systems and constant voltage chargers will have no effect in recharging the battery to full charge.

	Benefits	Drawbacks
Calcium/ Calcium	Lower battery water loss.	Very difficult to re-charge battery if drained of power (E.g. 3 days with a special charger).
	Battery lasts longest when not in use (7-8 months).	Cycling not as good as Antimonial.
	Highest power output as this is needed for its target market of sub-zero temperatures (North America & Europe).	Not suited to high under bonnet climate environments.
		Some batteries are sealed – cannot add water.

Silver Calcium Batteries.

To address the issues of grid growth, shedding and the increased corrosion rates experienced in higher operating temperatures, manufacturers add silver to the lead-calcium-tin alloys used when producing positive battery plates. This reduces the size of the lead grain within the lead plates providing increased strength, reduced plate growth and helps combat plate corrosion.

However the use of silver in calcium alloys does have some drawbacks. In particular, silver attracts high self discharge and water loss rates, up to 5% more than pure calcium/calcium batteries, which in turn can lead to early battery failure.

Hybrid Batteries.

The Hybrid battery (Century Ultra Hi Performance) combines the benefits of Antimonial positive plates with the advantages of using calcium negative plates. Antimonial positive plates provide superior recovery from deep discharge, superior cycle life, lower states of charge and better resistance to grid growth in higher temperatures.
The use of a calcium negative plate ensures reduced water loss, longer storage life and higher resistance to over charging.

It is important to note however that these performance benefits are influenced by the purity of metals, quality of plate separators and the batteries operating temperature.

	Benefits	Drawbacks
Hybrid	Low water loss (better than some Ca/Ca)	Some low maintenance is needed
	Takes battery longer to go flat if not used (4-5 months)	Performs less well in sub-zero climates (better than antimonial)
	Good cycling (discharge when motor vehicle is idle/recharge when moving)	
	Easy to recharge if battery is drained of power. (E.g. 1 day)	
	Performs best in hot environments (climate and under bonnet)	

Century Hi Performance Batteries.

Century Hi Performance batteries are a calcium/calcium design where both the negative and positive plates incorporate lead calcium alloys. To avoid the addition of silver and the drawbacks this brings, Century Hi Performance and Ultra Hi Performance batteries feature an expanded battery plate design. Expanded plates incorporate a very fine lead grain which delivers superior plate strength and eliminates the need to adds silver. Tin is added to reduce corrosion, and the problem of grid growth is avoided through the use of the expanded plate design.

Conclusion.

Each battery type has some advantages and drawbacks and it is important to consider which type is most suited for a particular market. What is suitable for colder European and North American markets may not necessarily be the best solution for the unique challenges which Australia presents.

The addition of silver into lead calcium batteries helps combat the problem of grid growth and plate corrosion however does not necessarily lead to increased CCA or RC performance specifications. Some OE manufacturers prefer these batteries because they have a longer shelf life due to low self discharge rates. This provides car exporters with an increased chance of having the batteries retain sufficient charge to start the vehicle by the time they reach their export markets.

Leading car manufacturers such as Toyota, Holden and Hyundai have all confirmed that there is no special requirement in new vehicles for silver calcium technology and that other battery types can be used as suitable replacements.

Australia's climate and harsh conditions present unique challenges and therefore a battery which has been designed and built especially to meet these challenges is a more appropriate choice than a battery which has been designed for colder climates.

For more information contact your CenturyYuasa representative.
www.centurybatteries.com.au

CY103-960