ARE LITHIUM BATTERIES ONLY FOR MOBILE PHONES & EVS?

There is a perception that lithium battery technology is reserved only for mobile phones and Electric Vehicles (EVs), given the general perception of this energy storage device. We all know that you should not fly with lithium power banks because some earlier versions suffer from thermal incidents, and we have all seen images of popular electric cars suffering the same fate.

*So why are manufacturers persisting with this type of battery? Well, the first reason is a little thing called "**energy density**" – or how much electricity can be discharged from a battery, given its physical properties.*

If we compare a 120 Ah (Amp hour) lithium battery to a 120 Ah Calcium Flooded (Ca) battery, both may have identical case dimensions - except the Calcium (Ca) could weigh up to twice as much. The maximum recommended discharge limit of the lithium battery sits at about 80% or roughly 96 Ah, with the calcium-flooded batteries recommended discharge limit at 50% or 60 Ah.

*The lighter battery can be discharged at a greater capacity, therefore it has a more significant **energy density**. Let's put that result in the "pro" column.*

***Battery cycles** are another attribute manufacturers look for when selecting the energy storage device for their vehicles.*

A cycle is when the battery starts at 100% capacity, is discharged to its lowest recommended limit, and then recharges back to 100%.

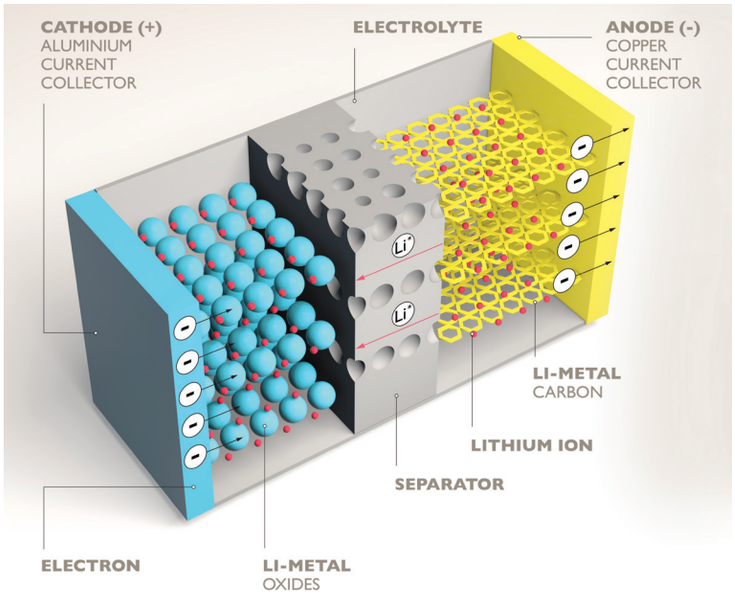
Used in the above manner, the lithium battery has a life of about 4000 cycles, while the calcium flooded can only maintain 800 discharge cycles. If we look at these figures as battery replacement intervals, the lithium battery may last up to 5 years, with the (Ca) battery needing replacement after only 2.

The construction of a flooded SLA (Start, Lighting, Accessory) and lithium battery is very similar, with the Calcium Flooded battery having six series connected cells, each equalling between 2.1 and 2.2 volts when fully charged, or a total of This 12.6 to 13.2 open circuit volts.

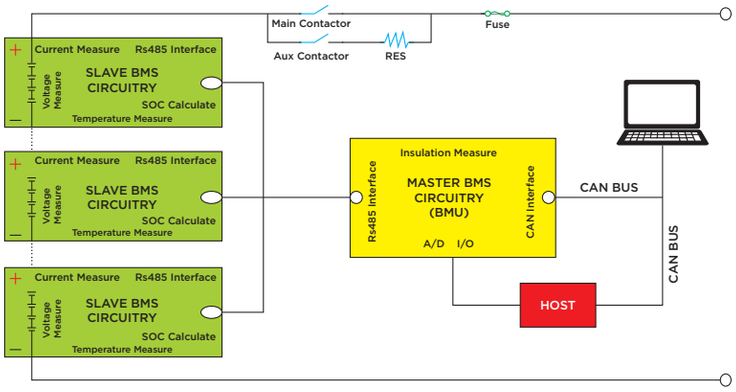
The most common lithium battery used in modern vehicles is the lithium-ion phosphate (LiFePO4), which is rated at 12 volts nominal but could, in fact, be somewhere in the range of 10 to 14.6 volts because there are only four series-connected cells rated from 2.5 and 3.65 volts each.

These cells are comprised of plate groups, using either cobalt, manganese, nickel or other rare earth metals as the cathode and anode. The quantity or concentration of each metal within the plates (composition) is the determining factor between a lightweight, high-energy battery that you should never take on an aeroplane to a slightly heavier but safer energy storage system that resists thermal incidents.

No matter which design is chosen, lithium is used as the electrolyte in each cell. Again, slight variations in electrolyte composition will change the battery's charge and discharge behaviour, environmental suitability, and energy density.



Lithium-ion cell



Battery Management System (BMS)

The other main difference between flooded SLA and lithium batteries is using a battery management system (BMS) that manages the needs of individual cells by protecting them from operating outside safe operating limits.

Each microcontroller is responsible for current flow to and from the cell, thermal management, and balancing.

Advances in high-capacity lithium battery technology have seen the need to develop on and off-vehicle charging systems suited to their needs.

Lithium batteries require a constant current and voltage charge algorithm - unlike those used in conventional charging systems.

Yes, the initial purchase price is more than a standard flooded battery, but overall, the benefits of using lithium batteries outweigh this cost.

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