Using Lithium Phosphate Chemistry Batteries: A Beginner's Perspective

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In my life time battery technology has changed dramatically. When I studied for my licence (in the early 1970's) there were just two types: alkaline dry cells (1.5 volts), also packaged into batteries of various voltages, and lead acid batteries (approximately two volts per cell). Then came Nicads and what a huge step forward they were! Good quality ones could be re-charged many times, e.g. 300/400, but I did better than that. But they were heavy, gave 1.2 volts per cell and developed a memory, resulting eventually in a lower than useful life and charge, if they were not fully discharged before re-charging.

Lead Acid batteries. These are commonly used by amateurs as portable power sources and as home station supplies. Our house is powered by a solar system: we are not connected to the grid. For portable use I commonly use a 12 volt, 7.2 amp hour battery (specifically a SLAB). It is great, but it weighs 2.65 Kilos. If you are operating a few hundred metres at the most from your car they are fine. If you are hiking they give you a pain in the back! Carrying two is worse, but if you are activating a summit you don't want to get to the top and find your one battery is dead. A 12 volt, 4.3 amp-hour battery weighs 1.75 kilos. SLABS are relatively safe, we are familiar with the technology and they are reliable. To get some perspective on hiking and portable amateur radio have a look at some of the blogs: eg VK5PAS and VK5BJE to name just two. I took two SLABS with me on a recent trip to Maria Island in Tasmania and I suffered for two days as a result.

Lithium Ion batteries

You probably already have a lithium battery in your collection. Lithium ion batteries are commonly made for hand-held radios. They can be recharged at any time during a discharge cycle, they are small and have pretty good capacity. My ICOM hand held radios use these. The new Lithium Polymer batteries are developed from Lithium Ion batteries. I am not going to say too much about the theory: you can read that. There is plenty of information on the web.

Lithium Polymer

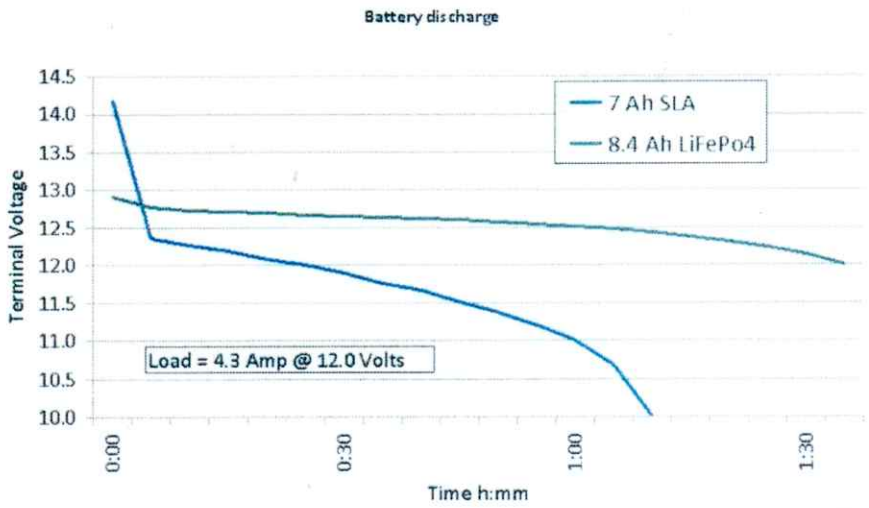
Today I will provide an introduction to two types of Lithium batteries developed for the Radio Control market. These batteries are built into pouches not metal cylinders. So there is a weight saving up front. And there is no lead (Pb, atomic number 82) and this is very important in reducing weight. Here is a LiPO battery rated at 4.8 amp hours (4800 milliamp hours). It weighs 650 grams. Here is a lithium Iron (LiFePo4) battery rated at 8400 milliamp hours and it weighs 1.090 Kilos. LiPo cell voltage is 2.7 v discharged and 4.23 fully charged and Lipoly cells have to be protected during the charging process by limiting the voltage to 4.235 volts per cell. A good charger will take care of this. I will say more about charging later. LiPo or LiPoly batteries need care. They should only by charged while you are present on concrete or other non-combustible material and should be charged with a balanced charger. Demonstrate.

When you decide to use LiPo batteries you will need to do some other calculations and adjustments because there batteries are not designed for 13.8 volt radios. LiPo batteries come in a variety of voltages: it all depends on hour many cells are put

together to make the battery. Amateurs typically use either three or four cell batteries. If you use an FT817nd you may choose to use a three cell LiPo battery. An FT817 can operate on just over ten volts. A three cell Lipo produces 11.1 volts and a 2200 milliamp hour battery can be purchased for about $10 US. I choose to use four cell batteries because I have two QRP radios and the second will not operate below about 11.5 volts. A four cell LiPo produces produces 14.8 volts, in my opinion too high for an amateur radio. Yeasu rate their radios at 13.8 + or – 15% (14.8 volts falls within the safe range, but an FT817nd will just produce heat with the higher battery voltage). I use diodes to reduce the voltage. I have two variations here to show you. I also have a DC to DC converter I will build into a metal box to ensure no hash.

The second Lithium variation I use is the Lithium Iron phosphate battery (LiFePO4). My large battery is a four cell configuration and discharges to 13.2 volts, is rated at 13.2 volts and is slightly higher in voltage when charged. These batteries are reputed to have a longer life than their cousins, LiPo chemistry.

Both these batteries have another advantage over lead acid batteries. Here is a chart produced by Peter Fraser, VK3ZPF that shows the discharge curve for a 7.2 amp hour lead acid battery and a Lithium Iron Phosphate battery (8.4 amp hour).



Peter used a 50 watts quartz halogen globe, the temperature was 15 degrees C, each battery was sampled every five minutes for a voltage reading and each battery was full charged before the experiment. You can read more about Peter's work on http://vk3zpf.com/ The almost constant discharge voltage from the Lithium Iron batteries is great for amateurs. I have LiPo batteries and they are great, but they are more difficult to use and you need to take great care in charging them and using them. Both of these forms of Lithium batteries will be destroyed if you try and draw too much from them. I use an alarm on both batteries to remind me of the critical point and then switch batteries.

When buying these batteries you will need to buy a charger. There are chargers and chargers on the market, or good and not so good. Buy a quality charger capable of charging Lithium batteries up to six cells configuration and which produce a **balanced** charge. This is critical. Each cell will be balanced and be equal to its neighbours in the battery. I recommend a 240 volt charger. Mine also charges from 12 volts. Please contact me if you need help.