

Flight Feathers

The official publication of OneWingLowSquadron.org

MEETINGS

FIRST
SATURDAY OF
THE MONTH
AT 11AM

NO MEETINGS
JULY/AUGUST

NEXT MEETING:
May 4th

EMERGENCY
CALLS FROM
OUR FIELD

352-485-5111

2024

WISE OWLS

RON SANDERS
PRESIDENT
& TREASURER

RICHARD GIBSON
VICE PRESIDENT

GILBERT PRIEUS
SECRETARY

ART SCHEURER
SAFETY COORDINATOR
& FIELD MARSHALL

BRET MARTIN
FERNANDO MESA
AMA INTRO PILOT
INSTRUCTORS

No pictures this month so I'm posting an "infotainment" article on Lipo battery puffing.

Why does my Lipo puff? (and what to do about it)

There are three causes of Lithium Polymer battery (Lipo) puffing/swelling. The first two are manufacturing defects. The only thing we can do about those is avoid buying badly manufactured batteries. If you only wish to know what you can do about avoiding puffing your alleged good batteries, skip ahead to cause #3.

Cause #1 Contamination during manufacturing

The most common is water contamination. Chinese Lipo manufacturing is located on the coast where humidity is higher. Humidity control is tricky. Air that's too dry creates possibility of spark in a volatile chemical environment, too wet and water contamination occurs.

A water contaminated battery passes electricity through water (electrolysis) that separates the water into free roaming hydrogen and oxygen (what could possibly go wrong!). Two things typically happen. The hydrogen can become bound to the anode or cathode. Under conditions of overcharge or over discharge (read **HEAT**), oxygen and hydrogen can combine with Lithium to create lithium hydroxide (LiOH). That leaves a spare free roaming oxygen molecule. With conditions of electricity and **HEAT**, the molecules will combine into O2, oxygen gas, or O3, ozone gas. Gas expands and voila -- a puffed battery.

Cause #2 Poor Separator Formula.

A battery consists of an anode, a cathode, and a separator. Nano-tech, and Graphene Lipos are simply improvements on the battery anode to make it tolerate physical expansion and contraction from **HEAT** better and maintain low resistance longer (read avoid creating **HEAT**).

The separator material electrically separates the anode and cathode but allows the transfer of ions from cathode to anode when charging and from anode to cathode when discharging. A separator with insufficient electrolyte or containing contaminants or defects has more resistance. The battery cannot maintain its C rating, resistance increases, and that creates -- guess what -- **HEAT**.

Lithium Polymer batteries contain -- drum roll -- lithium. Given the high charge/discharge rates we use, Free oxygen molecules O₂, are sometimes released at the cathode or anode. Lithium combines with this free oxygen (only in the presence of **HEAT**) to create a kind of lithium rust on the anode or cathode called lithium oxide. In the process an atom of oxygen is released. This atom combines with others to make O₂ gas molecules. The lithium oxide increases anode resistance (reduces conductivity) and that creates -- oh no, not again! -- **HEAT**. That creates more lithium oxide that makes more O₂ gas and more resistance that creates more .. well, you get the picture -- a battery puffing and circling the performance drain hole.

Cause# 3 Over charging and over discharging

Or in other words -- **HEAT** -- caused by the passing of a large electric current through a resistance, A.K.A.-- your battery. When charged or discharged too quickly, lithium oxide forms at BOTH the anode AND (to a lesser extent) the cathode. Even with a good separator (see cause #2) this accelerates the process described in cause #2 and "puff goes the battery". FINALLY something we can do about puffing. If you read causes cause #1 and cause #2 you can probably guess that leaving your Lipos baking in the sun or in a hot car is not going to be helpful! Actually, that's one of the worse things you can do.

Avoid over charging at high currents(Amps). Your batteries should NEVER get even slightly warm when charging. Batteries with higher C ratings (less resistance) will tolerate slightly higher charge current rates but every bit of **HEAT** hurts.

Now for voltage over charging. A lithium battery's maximum voltage is 4.20V AT ROOM TEMPERATURE. Below 50 deg. F a Lithium battery's max voltage is 4.0V. So be careful when charging in cold weather to avoid over voltage charging. A lot of chargers don't take battery temperature into account when stopping the charge.

The discharge cycles we typically employ on Lipo batteries are far beyond what any of them are designed to tolerate. It's a wonder we get the life out of them that we do. So, our NORMAL use of Lipos is *technically* considered over discharging. But there's over discharging and there's abuse.

Ok, what is abuse? It's OK for a battery to be warm after an aggressive flight. 140 deg. F is a Lipo's happy zone where it is most efficient. But around 150 deg. F bad things start to happen with Lithium degeneration. So monitor your battery's temperature after every flight. A bit warm to the touch is OK -- maybe even optimal. Too hot to hold more than 1-2 seconds is asking for trouble in the form of thermal run-away. You need a higher capacity battery or one with a higher C rating.

Puffed Battery Remedies

And now mateys, let's all sing it out,

"what do we do wi' a puffed up bat-tree... ear-lye in the mor-nin".

Well the answer is -- not much. Poking a hole to let the gas out will (if you're REAL LUCKY and don't have to call the fire dept) only let air and humidity in and make things worse (see cause #1).. Freezing or cooling only contracts the gas until it warms back up. I tried that. Bottom line, once it's puffed, there's no going back that I'm aware of.

You need to decide if you want to continue to use a puffed battery or discard it. There are several opinions on whether continuing to use it is safe or not. I don't have a dog in that fight so I won't recommend one or the other.

If you do after all decide to use it, you can, IF IT WAS A WELL-MANUFACTURED BATTERY TO BEGIN WITH, simply take it out of your Hotliner and put it in your Old Timer. Reducing the discharge load will often stop the puffing from getting worse and result in a usable battery for less demanding applications.

O yeah, and keep it away from...

HEAT