Report on LiPo

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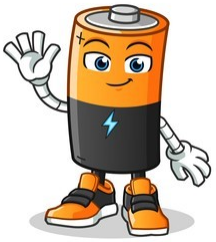

1 Introduction

A **Lithium Polymer** battery abbreviated as **LiPo** is a rechargeable battery of lithium ion. Unlike other batteries which use liquid electrolyte, it uses high conductivity semisolid polymers as electrolyte. These batteries provide high specific energy i.e energy per unit mass. These batteries find use in mobile devices, radio controlled aircraft etc

2 Design

Lithium polymer cell is one member of the family of lithium cells which along with LiPo has lithium ion and lithium metal cells. The key difference between LiPo and the rest is the electrolyte used. LiPo cell has solid polymers such as PEO(poly ethylene oxide), PAN(poly acrylonitrile), PMMA(poly methylmethacrylate), PVdF(poly vinylidene fluoride) whereas lithium ion lithium metal cells use lithium salt such as $LiAlF_6$ in organic solvents.

3 Parameters

LiPo batteries are characterized by some parameters as listed below

- **Cell count:**

  This represents the number of cells in a battery and also indicates the voltage across the ends of the battery.

  2S means two cells in series → Terminal voltage is $2 \times 3.7 = 7.4V$

  2P means two cells in parallel → Terminal voltage is $3.7V$

- **Capacity:**

  Capacity is a measure of how much power can a battery hold. This is usually measured in units of milliamp hours(mAh). 5000mAh lipo batteries are widely used in automobiles.

- **C rating:**

  C rating represents how fast a battery can be discharged safely and without causing any harm to the battery. The product of C rating with capacity gives the maximum amp draw of the battery within safety limits

  $$\text{C rating} \times \text{Capacity} = \text{Max amp draw}$$

  There are two types of C ratings

  a. Continuous C rating: This is the C rating when an automobile is moving at a constant speed.

  b. Burst C rating: This is the C rating when an automobile is accelerating.

  As we would expect Burst C rating of a battery is always higher than Continuous C rating.

- **Internal Resistance:**

  This is a measure of difficulty a battery has in delivering power. The internal resistance increases upon using due to the build up of Li_2O. This is usually measured in units

of milliohm($m\Omega$). Due to this property of battery there will be a certain voltage drop inside the battery which is given by

$$\text{Voltage drop} \;=\; \text{Internal Resistance} \;\times\; \text{Current drawn by load}$$

4 How LiPo is different from other batteries

- LiPo batteries are much lighter compared to other batteries like NiMH(Niclkel Metal Hydride), NiCd(Nickel Cadmium). This is reason why LiPo is preferred over these in Flying machines like drones.
- LiPo batteries can be manufactured in almost any shape we want.
- LiPo batteries have much higher specific energy rating which is another reason as to why theses are preferred for flying EVs.
- LiPo batteries have higher discharge rates compared to others.

5 Safety Measures

- LiPo batteries must always be kept in a fireproof container. Batteries should not be exposed to sunlight or heat as this may result in battery catching fire.
- While charging or discharging current and voltage must be in the range rated by the manufacturer.
- Since individual cells can get different voltages after repeated charging and discharging, a battery charger with balancer should be used to equalizes the voltages of the cells.
- It is advised to keep LiPo batteries in storage mode (around 3.8 V per cell) and in a cool environment when they are not used for longer periods This prolongs the life of the battery.
- When disposing LiPo battery, they should be to discharged completely until there is no charge left (0 volt). So that they won't burst into flames when punctured. Then it should be handed over for recycling.

6 Recycling

With the ever increasing demand for EVs, recycling of lithium and other vital elements from disposed batteries is the need of the hour. Martin Eberhard, co founder of EV company Tesla has a new battery recycling startup - Redwood Materials. According to him around 95% of the materials in a battery can be recycled for further usage. He believes that effective recycling of batteries will be the game changer and would boom the EV production in coming days.