UDC 612.311.61

LI-ION AND LI-POL BATTERY

Orehov I.A., Pikuza E.V.

Belarusian State University of Informatics and Radioelectronics, Minsk, Republic of Belarus

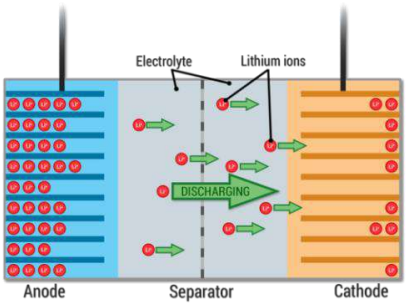
Sokolova M.A. – lecturer of the department of foreign languages

Annotation. Engineering thought is constantly developing: it is stimulated by constantly emerging problems that require the development of new technologies for their solution. At one time, nickel-cadmium (NiCd) batteries were replaced by nickel-metal hydride (NiMH), and now lithium-polymer (Li-pol) are trying to take the place of lithium-ion (Li-ion) batteries. NiMH batteries to some extent pushed NiCd. But what is the situation with lithium batteries? What are their features and how do Li-pol batteries differ from Li-ion? Let's try to understand this issue.

Keywords: Li-ion battery, Li-Pol battery, application of Li-ion and Li-Pol batteries, characteristics of Li-ion and Li-Pol batteries.

The first experiments on the creation of lithium batteries began in 1912, but only six decades later, in the early 70s, they were first introduced into household devices. And, I emphasize, it was the batteries. Subsequent attempts to develop lithium batteries (rechargeable batteries) proved unsuccessful due to problems related to ensuring the safety of their operation. Lithium, the lightest of all metals, has the greatest electrochemical potential and provides the greatest energy density. Batteries using lithium metal electrodes are characterized by both high voltage and excellent capacity. But as a result of numerous studies in the 80s, it was found out that the cyclic operation (charge — discharge) of lithium batteries leads to changes on the lithium electrode, as a result of which thermal stability decreases and there is a threat of the thermal state getting out of control. When this happens, the temperature of the element quickly approaches the melting point of lithium — and a violent reaction begins with the ignition of the gases released.

The most obvious design difference between real lithium-ion and lithium-polymer batteries lies precisely in the type of electrolyte that is placed between positively and negatively charged electrodes. In the first case, a liquid substance is used, in the second - a porous chemical or gel-like material. The latter is now increasingly used in modern laptops and some electric vehicles. Nevertheless, due to the high cost, its distribution, despite some obvious advantages, is still quite limited. Lithium polymer batteries have a principle of operation similar to lithium-ion cells, that is, they work on the reversibility of a chemical reaction. Here, the anode is a material made of carbon, where lithium ions are introduced. Vanadium, manganese or cobalt oxides are used in the cathode. The operation of such a battery is based on the ability of polymers to transition to a semiconductor state due to the inclusion of electrolytic ions in them. Lithium salts are still used here as the chemical basis of the electrolyte. However, they are located in the corresponding polymer gasket, which is located between the cathode and the anode. Due to this, lithium polymer batteries can be made in any arbitrary shape.



Picture 1 – Battery working principle.

To find out, taking into account individual priorities, which is better, Li-polymer or lithium-ion battery, you need to compare their characteristics. This is easy to do with the help of a comparison table:

Table 1 – Technical characteristics of li-ion and li-pol batteries.

Technical specifications	**Li-ion battery**	**Li-Pol battery**
Energy intensity	high	low, the number of charge and discharge cycles is less
Standard size	small selection	high choice, independent of the standard cell format
Weight	slightly heavier	light
Capacity	less	Almost twice as high at the same size
Battery life	approximately the same	
Risk of explosion and fire	higher	built-in protection against electrolyte leakage and overcharges
Charging time	longer	shorter
Wear and tear	up to 0.1% monthly	less active
Price	cheaper	more expensive

In general, lithium-polymer batteries are gradually replacing lithium-ion batteries in the smartphone industry due to their safety, universal form factor and low weight - this applies to devices of the upper and middle line. Although more affordable phones will probably use lithium-ion battery technology for some time yet.

Lithium-ion current sources are widely used in various fields. They are used to equip digital electronics, personal electric vehicles, robots, battery tools, wheelchairs and many other devices. They have standardized standard sizes, are easily matched to the necessary parameters and are well known to consumers. Powerful batteries are successfully used for devices requiring high short-term current consumption.

Lithium-polymer energy storage devices allow you to get the right capacity with a smaller size and weight of the current source, therefore they are in demand in portable devices, quadrocopters, toys, airsoft guns. The main differences between Li-polymer batteries are a higher price, a large variability of shapes and a smaller number of internal loads.

In practice, both types of batteries have similar characteristics, so the choice preferences depend mainly on the scope of use. In addition to the type of battery and the cathode substance, the characteristics of the current source are affected by the quality of the raw materials used and the production technology.

References:

1. *Lithium-ion and lithium-polymer batteries [Electronic resource]. – Mode of access: https://www.ixbt.com/mobile/review/lipol.shtml. – Date of access: 20.03.2022.*

2. *Lithium-ion and lithium-polymer batteries: what is the difference? [Electronic resource]. – Mode of access: https://zen.yandex.ru/media/apptime/litiiionnye-i-litiipolimernye-akkumuliatory-v-chem-raznica-5f50a9a22506f211d16d6779. – Date of access: 20.03.2022.*

3. *Lithium-ion vs. lithium-polymer: what is the difference between batteries in modern smartphones [Electronic resource]. – Mode of access: https://trashbox.ru/link/li-ion-and-li-pol-batteries#chapter-3. – Date of access: 20.03.2022.*

4. *What is the difference between Li-ion and Li-Pol battery? Which option is better to choose? [Electronic resource]. – Mode of access: https://virtustec.ru/news/chto-vybrat-litij-ionnyj-ili-litij-polimernyj-akkumulyator.html#subtitle4. – Date of access: 20.03.2022.*

5. *What is the difference between Li-ion and Li-Pol? Application and cost [Electronic resource]. – Mode of access: https://electric-wheels.ru/batterie/chem-otlichaetsya-li-ion-akkumulyator-ot-li-pol#1. – Date of access: 20.03.2022.*

6. *Lithium-ion and lithium-polymer batteries [Electronic resource]. – Mode of access: https://electrosam.ru/glavnaja/jelektrooborudovanie/jelektropitanie/litii-polimernye-akkumuliatory/. – Date of access: 20.03.2022.*