

The Prospect and Future of Li-ion Battery

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Abstract: In recent years, the rapid growth of portable electronic device market requires higher density characteristics of batteries. The speed at which portability and mobility is advancing hinges much on the battery. What is important is this energy source that engineers design handled devices around the battery, rather than the other way around. Much improvement has been made in reducing the power consumption of portable devices. Currently, the most popular secondary battery is Li-ion battery. Li-ion has won the limelight and become the most prominent battery. This paper reviews the prospect and future of the Li-ion battery.

Keywords: LIB (Li-ion battery), Secondary battery, Li-polymer battery

1. INTRODUCTION

Recently, there has been tremendous growth in the battery industry with the LCD and semiconductor technologies. Because high efficient and portability of the batteries, the energy source, are essential for the future electronic devices such as computer, camcorder and wireless communication. According to the increasing of device simplifications, ultra-slim battery market may be predicted of huge scale developments. Especially, polymer battery with the outstanding safety and slimness will have much potentials.

In this paper, an overview of the common battery and the Li-ion secondary battery are given in Section 2. The market structure is given in Section 3. Finally, the overall conclusions and prospects of the Li-ion battery are summarized.

2. AN OVERVIEW OF THE BATTERY

The battery is an electrical storage device that two electrodes and an electrolyte convert electrochemical energy into electrical energy by the redox (Oxidation-reduction) reactions. An inner structure consists that electrons can flow to the external through conducting wires and this flow make an offer efficient applications and higher capacities to devices as an energy source.

The structure consist of cathode, anode, and electrolyter. Anode is the electrode where oxidation (loss of electrons) takes place. While charging, it becomes the positive electrode and vice versa. Cathode is the electrode where reduction

(gain of electrons) takes place. While charging, it becomes the negative electrode and vice versa. Electrolyte is a medium that provides the ion transport mechanism between the anode and cathode of a cell.

There are many kinds of batteries according to the reversibility of between oxidation and reduction, the form of electrolyte and appearances. The primary and secondary battery divided in the reversibility. In primary battery, energy is exhausted when active materials are consumed-carbon-zinc dry cell, silver oxide battery, alkaline battery, and Li battery. And in secondary battery, active materials are regenerated by charging-nickel cadmium, nickel metal hydride, Li-ion, and Li polymer.

Li secondary battery occurs dendrite effects which has not uniformity in oxidation-reduction. So it brings about difficulties of long service life time and safety. To cover these problems, a series of cell chemistries have been developed using lithium compounds instead of lithium metal. These named Lithium ion batteries (LIB).

LIB produce the same energy as NiMH batteries but weigh approximately 35% less. This is a crucial point in applications such as laptop computers and camcorders where the battery makes a decision of weight in portable devices. In comparison of NiCd and NiMH, LIB has bigger capacities and longer service life time. In addition, the energy density of LIB is typically twice that of the NiCd and LIB is a low maintenance battery. Because the self-discharge is less than half compared to NiCd. the electrical loss quantity is smaller.

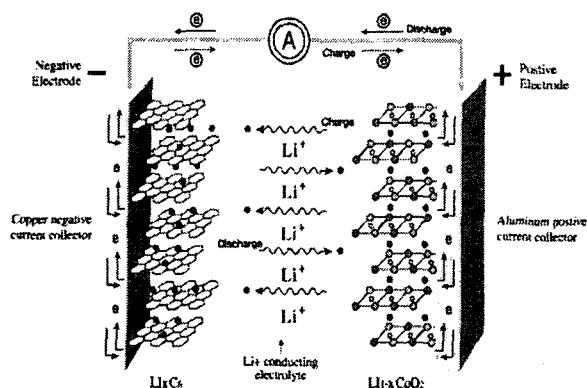


Fig. 1. A schematic of Lithium-ion battery

Despite of these overall advantages, LIB has some drawbacks. While over charging and discharging, there are several dangerous factors. Because the structure of LIB is unstable, it is fragile and so requires a protection circuit to maintain safe operation. The protection circuit limits the peak voltage of each cell. In addition, after monitoring the cell temperature, it prevent temperature extremes.

3. THE SECONDARY BATTERY MARKET

High energy density has been proposed to enhance the operation time because customers need more tiny devices. For this needs, Li-ion secondary battery was commercially developed in 1991. From that time, the secondary batteries have gradually been switching to rechargeable batteries.

In Japan, Korea, and China, the LIB industry is getting improved. They are in the fierce international competition. In Japan, there are the main manufacture company-Sony, Sanyo Electric, Matsushita Electric Industrial, A&T Battery, Japan Storage Battery, TDK. Most Japanese companies make every efforts to reduce the costs and increase manufacture facilities. They are accelerating the extension of installations to consolidate the foundation. Chinese companies are putting spurs to strengthen competitiveness and enlarging the productive capacities. There are too much companies over 100. In Korea, most companies made their position clear to improve from the Li-ion battery to the Li-polymer battery. The main secondary battery demands in domestic is for Li-ion battery in cellular phone. Before 1999, Korea was relied on all imports by Japan. But, the mass manufacture

system can make a localization of products in the long run.

The competition was started between Li-ion battery and Li-polymer battery which are following as the master of the secondary battery industry. Especially, adoptions of Li-polymer battery in PDA are competing outrageously against each other. In Li-ion battery industry, Japanese ones secure the command of the air. On the other hand, Korean, American, and some European ones are doing their best to be commercialized products.

4. CONCLUSIONS AND PROSPECTS

The Li-polymer differentiates itself from conventional battery systems in the type of electrolyte used. The original design uses a dry solid polymer electrolyte. This electrolyte resembles a plastic-like film that does not conduct electricity but allows ions exchange. Most of the commercial Li-polymer batteries used today for mobile phones are a hybrid cells. This battery remains also many problems to solve such as applied voltages and low temperature characteristics.

There are two prospects in mobile phones using the secondary batteries. One is Li-ion battery after down combat, and the other is a method as a single cell using Li-polymer battery.

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