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A Review on Different Types of Mobile Phone Batteries

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ABSTRACT: The use of mobile phone has been increased in last few years which also increased the expectation of the user. Mobile phones are used in almost everywhere for various purpose which have increased the dependency of human beings on it. Batteries are the most essential part of any mobile phone and continuous improvement in it is a major research area for Scientists and Engineers. As the use of mobile phones is increasing various new features are also adding up in the system which somewhere limits the battery backup. In this paper, we are doing a review on different types of batteries which includes their performance along with advantages and disadvantages.

KEY WORDS: Battery, Lithium ion and polymer, Nickel-Metal Hydride, Nickel Cadmium

I. INTRODUCTION

Mobile phones have become a basic need of human being because of its various features like instant call making facility, personal safety, general conveyance and so on which all makes life easier. Mobile phone is like a watch, it has calculator, organizer, notepad mp3 etc. It also helps to connect to the world through internet connection. So, it requires a long-life battery. If a mobile phone has some fault due to charging of a battery then it is difficult to utilize all the features of cellular phones. To improve the battery life of cellular mobile phones, a review on various batteries can help anyone to improve its performance.

II. BATTERIES AND ITS TYPES

A battery is a storage of electrical energy and this energy can be used or dissipate by some electro-chemical reactions [1]. It contains electrolyte solution with metal electrode which result it as a current container. A battery can act as an energy source only when it obtains stable voltage, stable power supply and a constant current for a period of time [2]. The major features of batteries are that, it has simple construction or structure, it is easily portable, it has simple charging and discharging operation and external change (like change in weather or temperature) do not affect it [3]. There are basically two categories of batteries:

1. Primary Battery – They can be used only once and after the use it is discarded.
2. Secondary Battery – They are rechargeable.

So, we use secondary battery as an energy source or power source for cell phones. There are mainly five types of secondary batteries:

(i) Lead-Acid Battery: The lead-acid is the oldest type, low cost rechargeable batteries which are used in heavy-duty applications. These batteries are usually very large and because of their weight, they're always used in non-portable applications such as solar-panel, backup power, and in power generation/distribution. These batteries are not used in cell phones [3].

(ii) Lithium (Li-poly) Polymer Battery: This battery is light weighted and it is very strong and resistant. It uses polymer electrolyte which is highly conductive semisolid (gel) instead of liquid electrolyte. It provides higher power and it can be made to any shape or size. It has no memory defects so it can be recharge to the full regardless the charge left in it. It can maintain its performance even in low temperature and it can retain the charge when not in use for a long period of time [4]. With all these advantages it has some limitations that is it can catch fire when overcharged or overheated. If this battery gets misshaped, it will never hold charge and cannot be used again [5].

(iii) Lithium-Ion (Li-ion) Battery: It is a rechargeable battery having high energy density and low self-discharge feature. Less maintenance is required as it does not have any water level needed which have to be monitored. It has long lifespan. It is of 3.7V usually while the other batteries are of 1.2V and that means that the battery is best suitable for the latest models. It uses fast charging system.

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(iv) Nickel-Metal Hydride (Ni-MH) Battery: It is a type of rechargeable battery with great speed. It can maintain its performance in both high and low temperature. It is recyclable. It has very high self-discharge ratio and high energy density [5].

(v) Nickel Cadmium (Ni-Cd) Battery: It was the original battery which was in used in past but in today's time, it is highly outdated because it can be very hazardous due to a toxic chemical present in it called cadmium. It can harm the environment, so its use has been reduced to about null [5].

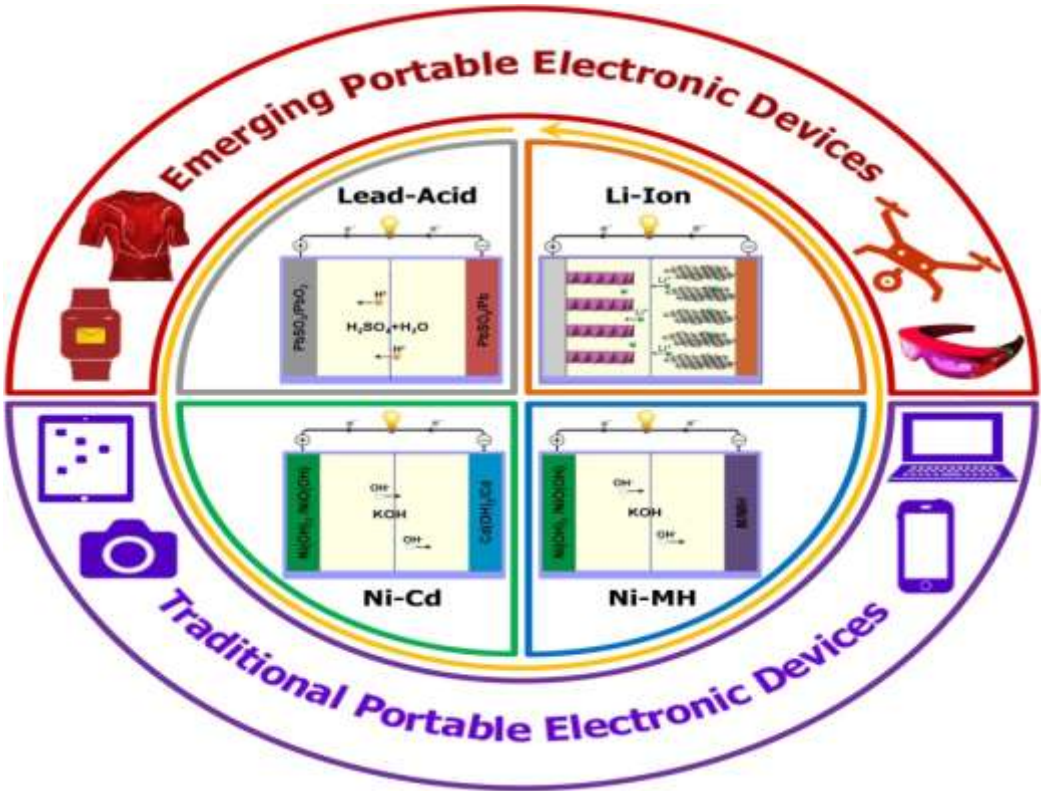

Figure 1: Rechargeable batteries and their applications in traditional and emerging portable electronic devices

III. PERFORMANCE COMPARISON IN BATTERIES

Before comparing batteries, the first question arises what is the best battery used among all, there are some factors from which we can decide the best among all. The main factors are as follows;

- Very high-power densities.
- Charge/Discharge lifecycle
- Size density

While one battery type may be designed for small size and long runtime. Another battery may be built for long life, but the size is big and bulky. A third battery may provide all the desirable entities for a battery, but the price would be too high for commercial use [7].

Mobile phone industries have been cleverly adapted that batteries should have small size, high energy density and low price. The various applications, shapes and performance comparison of batteries are shown in figure 1, 2 and Table 1.

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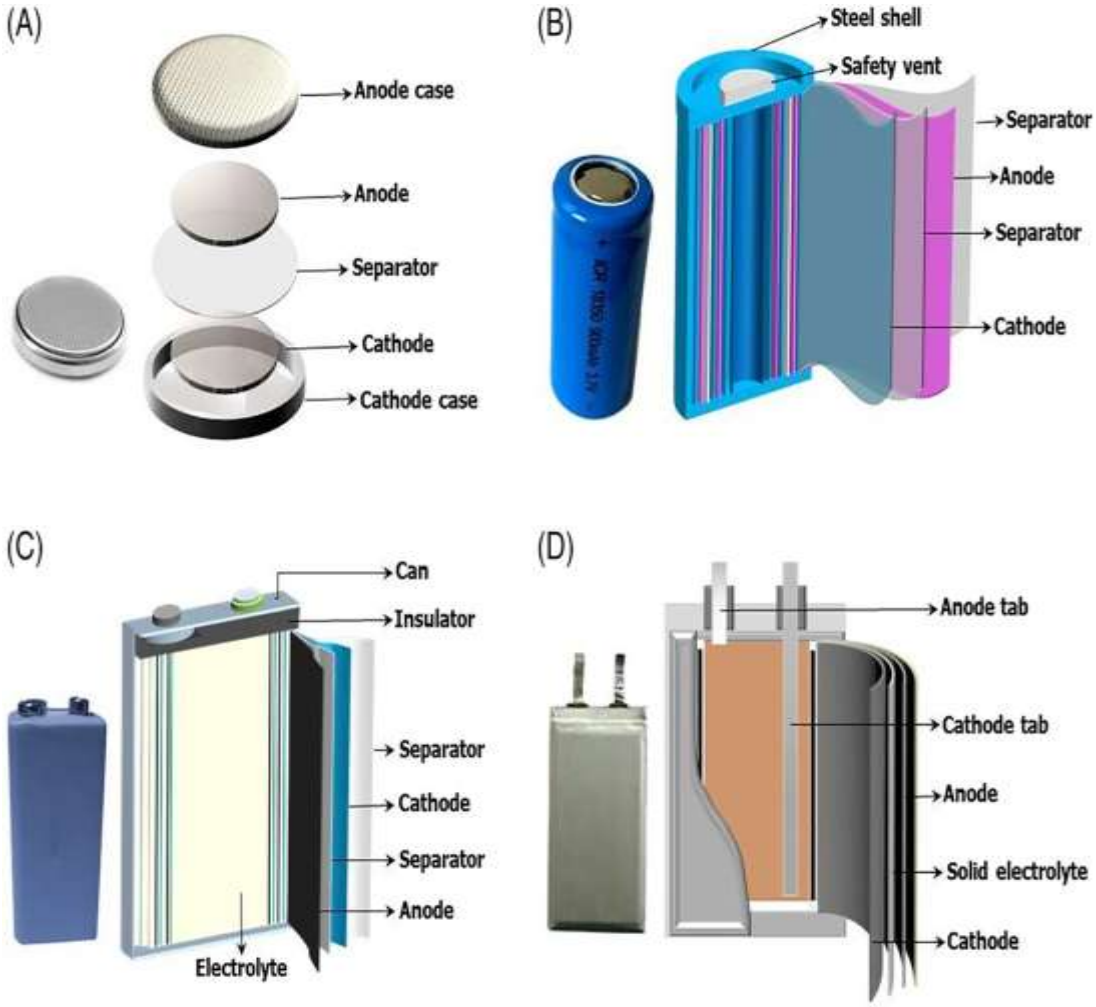

Figure 2: Typical rechargeable battery configurations: A-Coin, B-Cylindrical, C-Prismatic, and D-Pouch shapes

Table 1: Characteristics of different batteries [7]

Types ⇨ **Properties** ⇩	**Lithium Polymer**	**Lithium Ion**	**Nickel Metal Hydride**	**Nickel Cadmium**
Internal Resistance (in mΩ)	**200 – 300 (7.2V pack)**	**150 – 250 (7.2V pack)**	**200 – 300 (6V pack)**	**100 – 200 (6V pack)**
Cycle Life (to 80% of initial capacity)	**300 - 500**	**500 - 1000**	**300 – 500**	**1500**
Fast Charge Time	**2 to 4 hours**	**2 to 4 hours**	**2 to 4 hours**	**1 hour**

Self-discharge/Month	**~10%**	**10%**	**30%**	**20%**
Overcharge Tolerance	**Low**	**Very low**	**Low**	**Moderate**
Cell Voltage	**3.6V**	**3.6V**	**1.25V**	**1.25V**
Load Current -Peak -Best result	**>2C 1C or lower**	**>2C 1C or lower**	**5C 0.5C or lower**	**20C 1C**
Maintenance Requirement	**Not required**	**Not required**	**60 to 90 days**	**30 to 60 days**
Commercial use since	**1999**	**1991**	**1990**	**1950**

IV. CONCLUSIONS

In today's time, our whole life is revolving around mobile phones which cannot operate without a battery. So, long battery life is the necessity of time. Battery life is the time to which a device can function or run without being recharged. So, it is very important to know about battery life as well as various battery types which can be used by smartphones. In this context our review provides a better insight about smartphone batteries and their performances.

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