

IMPORTANCE OF LITHIUM SILICON BATTERY (LI-ION)

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ABSTRACT: -

Lithium silicon battery is a type of Li-ion battery commonly we used graphite as an anode but here we used silicon on the place of graphite as an anode. Comparison of other batteries like Li-Po batteries which mean lithium polymer battery that are more effective, more prevalent and more energy density. In today's advanced world Li-ion battery is essential for supplying power for a long cycle of time. Li-ion batteries are used in EV, DRONES, ENERGY STORAGE SYSTEMS and many ELECTRONICS Devices. We used Li-ion batteries in any places like hot & cold temperature, different environments or even in SPACE. The market of Li-Si batteries has hiked every day. There are some companies that manufacture rapidly LI-ion batteries SONY, XNRGI, GLOBAL GRAPHENE GROUP and many mores. In the past Li-ion batteries were only used for small devices such as mobile, small toys and small electronics devices. There are six types of Li-ion batteries, but most commonly used battery is LCO (lithium cobalt oxide).

KEYWORD: - Lithium, Silicon, Battery, Electronics, Graphite, Anode, Polymer, Companies and LCO.

I. INTRODUCTION: -

Li-ion batteries are invented in 1985 through AKIRA YOSHINO. He got a noble prize in chemistry and IEEE medal for ENVIRONMENT and SAFETY TECHNOLOGIES. Firstly Li-ion battery was used by SONY Corporation in 1991. 18650 batteries were manufactured for small electronics devices. Li-Si batteries were invented in the 1960's by HERBERT and ULAM. They patented as a primary battery. Li-Si battery is an alloy and mixture of Lithium, Cobalt, Manganese, Nickel and Silicon. We use Silicon as an anode at the place of Graphite. Graphite is heavier than silicon and the charge density of Graphite is very low as compared to Silicon. Graphite has 372 mAh/g and Silicon has 4200 mAh/g charge density but it's a theoretical gravimetric capacity. Silicon has 10 times higher energy capacity than Graphite. Li-Si batteries charge faster than the Li-ion batteries. Li-ion batteries have a separate temperature for charging that is (5-45) degree Celsius. Silicon is also abundant, cheap, environmental friendly element and easily found as compared to Graphite. The ability to hold more than 50% extra charge than previous Graphite anode batteries. It gives us emergency back-up power in case of power fluctuation and also gives a good charging performance at cooler temperature. As compared to Li-ion batteries Li-Si batteries work 4 times more efficient.

II. PREVIOUS RESEARCHES: -

Silicon is the most promising material in Li-ion battery due to high energy density, fast charging, more efficient and low cost. But in Li-ion battery Si anode can lead maximum volume expansion nearly 10 to 20 cycles, which can cause material crumbling and swelling, thus affect the battery life cycle and Si become a poor conductor of electricity AND that expansion are called as a ANISOTROPIC STRESS. IN simple "LITHIATION OF SILICON" called as an An-isotropic expansion that's the major disadvantage of Si element.

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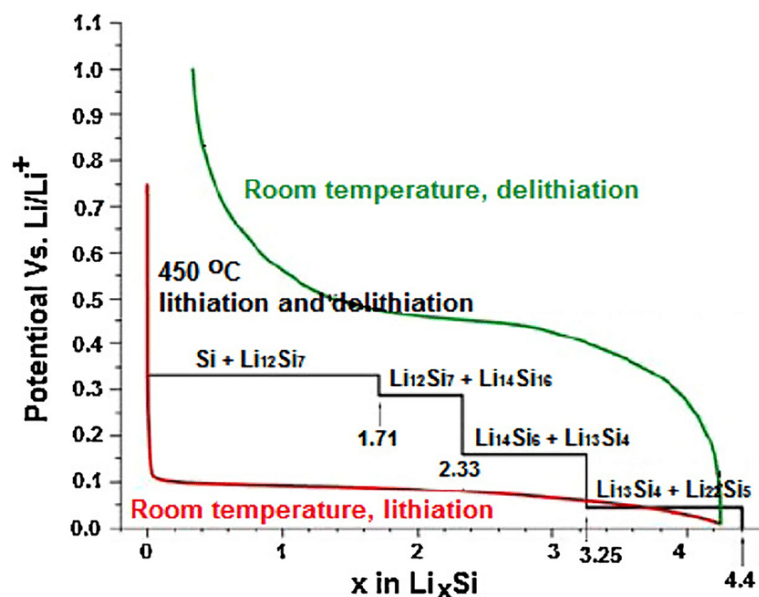


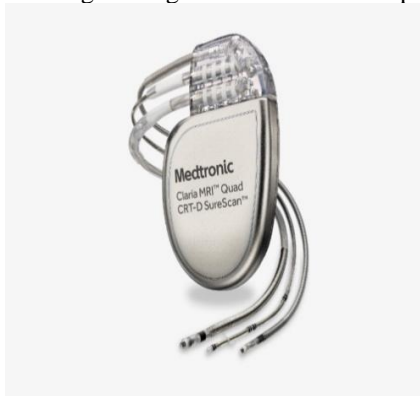
Figure 1. LITHIATION OF Li-Si

USES OF Li-Si BATTERY:

As we know Li-Si batteries are predominant battery type that is used in PORTABLE CONSUMER ELECTRONICS AND ELECTRIC VEHICLES. The most commonly used Li-ion batteries are LCO (Lithium Cobalt Oxide) that are mostly used in Laptops, Smart phones, Toys, etc. It also seen significantly uses for grid-scale energy storage and also a Military scale and Aerospace Applications. In Military Scale it is used to make ELECTRIC VEHICLES which is easy to lift in any situations and lighter, it has no fuel problem and low maintenance charge. In medical sectors it is very useful in a device called PACEMAKER. In Pacemakers Li-ion batteries are very common they provide a long life cycle, low drain current, high energy density and desirable voltage. The life span of Pacemaker has 7 to 8 years and weight about 25 to 30 grams. Like as many emergency devises that we are used as Digital camera, Power banks, Personal Digital Assistants, Watches, UPS(uninterrupted power supply), Solar energy storage, Surveillance Alarm System and many more.

III.FUTURE SCOPE:-

Rapidly increasing of Li-ion batteries have emerged as most important energy supply object in normal operation for portable devices such as Mobile Phone, Laptops, Cameras, etc. The market of these batteries has hiked rapidly in 2009 and the estimated of Li-Si in global market has 10 million USD in present and it grows 247 million in future 2030. Due to rapidly increasing demand of EV (electric vehicles) it has been triggered because of the very high energy density, stability and low maintenance cost. Li-Si batteries rapidly replacing the lead-acid and nickel-metal hydride (NIMH) batteries. The future of Li-Si batteries in Military grade systems, advance weapons like LAH Helicopters, HAL Drones and Light weight vehicles. It is rapidly used in medical field of making pacemakers as a cardiac health device.



CONCLUSION:-

Li-Si batteries has potential to sustainable future by providing low maintenance cost, high energy density and nature friendly energy storage solution. The advancement of Li-Si technology have closer to this goal as a researcher has developed many techniques to improved their stability as a anode and try to de-stress the Litigation process of Silicon crystal. If we find the solution to how to stop the expansion of Silicon the we get a solution we get a very low cost, efficient, stable and high energy density element for the Future green renewable technology.

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