

Future of Battery Technology

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Abstract: Modern-day existence is closely dependable on cell battery-powered gadgets affecting day by day elements of our lives, starting from telecommunication gadgets to move motors. there may be an growing call for green and price-powerful batteries. traditional batteries have been riddled with numerous issues and in the age of increasing cognizance approximately global warming and waste accumulation, manufacturing have to be consistent with sustainable improvement standards and strategies. The Nano Diamond Battery (NDB) is a high-energy, diamond-based totally alpha, beta, and neutron voltaic battery which could offer lifelong and green strength for numerous applications and conquer boundaries of current chemical batteries. The strength supply for the NDB is intermediate- and high-stage radio isotopes that are shielded for safety by means of multiple levels of artificial diamond. The power is absorbed in the diamond through a manner known as inelastic scattering, that is used to generate power. The self-charging manner will offer a price for the full lifetime of any tool or machine, with up to 28,000 years of battery existence. for the reason that battery is self-charging and calls for best exposure to herbal air, any extra price can be saved in capacitors, supercapacitors, and secondary cells to increase battery existence for cell phones, aircraft, rockets, electric powered cars, sensors, and other devices and machinery.

Keywords: Battery.

I. INTRODUCTION

Marco Sampaolo. et.al. (2006) The definition of technology as given in Britannica is "Technology, the application of scientific knowledge to the practical aims of human life or, as it is sometimes phrased, to the change and manipulation of the human environment.". From the above definition it is understood that a technology is any device or skill or technique which is used to accomplish a task or a goal. An energy efficient technology is a technology which uses the energy supplied to it such that the energy loss is minimum. Every device or technology has energy loss and wear and tear. So, experts try to develop the existing technology or invent a new technology in such a way that the energy loss caused due to it is minimum and the technology should also be more durable. For instance, the unit of electric energy produced by power station doesn't coordinate with the units dispersed to the consumers. Some of the units are lost in the distribution network. This difference in the produced and dispersed units is known as transmission and circulation loss. This is caused due to the loss of electrical energy in the form of heat due to resistance. One effective method of reducing the energy loss is by replacing the overhead cables by cables being buried underground with the use of cryogenics like Liquid Nitrogen or Liquid Helium to reduce the energy released due to resistance. It is achieved by surrounding the current carrying cables with cryogenic liquids to maintain the cable at very low temperature which in turn reduces the resistance of the current carrying cable. But due to its high production cost, the government is unable to implement this method.

Most of the technologies which are produced now are aimed to be more energy efficient at the same time more productive. So, upgrading to the latest technologies at a regular time period could be one energy efficient method, at least in the case of electrical and electronic devices. But upgrading the technology in a very short interval, for every little development in the technology, where the technology already in use is still good, would result in wastage of resources. In day to day life, electrical energy is constantly used and this can be used efficiently in various ways, such as

1. Not using power.
2. Not using outdated technologies as it might consume more energy.

AHUTI MISHRA (2019), Most of the devices used for domestic purposes are energy efficient. Electronic devices such as refrigerators and air Conditioners usually have a star rating to indicate its energy efficiency. The quantity of stars on the

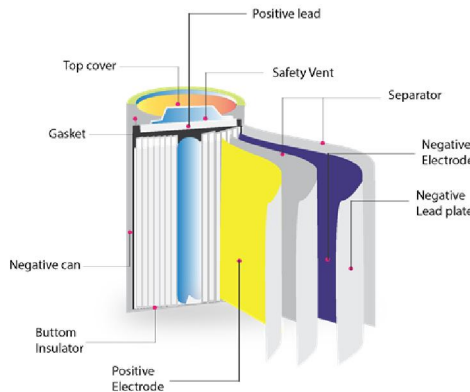
label likewise causes you analyse the productivity of one refrigerator to one more of a similar volume and comparable sort. For instance, a no star Refrigerator consumes 1000 units per year. But a 3-star rating Refrigerator uses only 626 units of electricity consumption per year. Electronic devices like desktops and laptops which are mostly used for work and home are certified as Energy star products by an organization to indicate wastage of energy is minimum. In computers and mobiles, the processors are also being manufactured in such a way that it consumes much lower energy without affecting its performance.

ROBBY BERMAN (2020), Using the available technologies, energy is being used as efficient as possible. But there are losses which cannot be avoided, such as the energy loss caused during the transmission and storage of energy and the loss caused during. So, instead of worrying about the wastage of energy, renewable sources of energy could be adopted than non-renewable sources, by using wind mills, solar panels, etc. This could be an efficient technology as it has no wastage of resources. Companies like Samsung are trying to manufacture Lithium ion batteries with Graphene which can store more energy compared to the regular Lithium ion batteries in a way that it is compatible with devices like mobiles, laptops and gadgets.

Diane McMorris, (2009), Many projects of motor engine that functions using water as fuel are being displayed in many events. But those are usually using electrolysis of water which produces Hydrogen. This Hydrogen is the fuel for the engine to work more effectively. There are various web-based advertising offers of units that will change your vehicle over to "run on water," however this ought to be seen distrustfully. These packs, which join to the motor, use electrolysis to part the water (H₂O) into its component molecules (hydrogen and oxygen) and afterward infuse the subsequent hydrogen into the motor's burning cycle to control the vehicle alongside the fuel. Doing this causes the fuel to consume cleaner and more completely, thus making the engine more efficient.

II. BATTERY TECHNOLOGIES

Yoshino, A. (2012), A battery is a container with one or more cells in it. Each cell produces electrical energy through chemical reactions. A cell contains a positive and a negative terminal. Inside the cell there are positive ions and negative ions and they maintain a potential difference. The positive ions are near the positive terminal and the negative ions are near the negative terminal. The ions are separated by a porous membrane which is semipermeable.



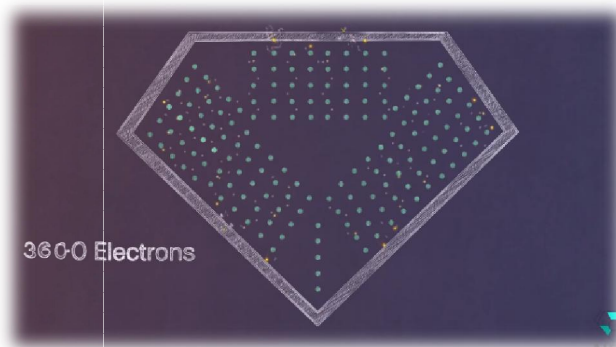
When terminals are connected the electron flows from negative to positive terminal and the current flows in the opposite direction. These chemical reactions yield electrical energy. So, battery is device to store energy. Batteries are divided into two types. They are Primary and Secondary batteries. Primary batteries non rechargeable whereas secondary batteries are rechargeable. Drycells and alkaline batteries are examples of primary batteries. It has wide range of application in our day to day life, such as the AAA batteries and watch cells used for watches. They are disposable and are for single use only. Secondary batteries are rechargeable they also are used in many applications in our day to day life and they are expensive costlier than the rechargeable ones. There are many types of secondary batteries. The one's which are used in the devices like mobile phones and laptops are usually Lithium ion and Lithium polymer batteries. They are also used in gadgets like watches and wireless portable devices. A non-aqueous secondary battery using transition-metal oxides containing lithium ion such as LiCoO₂ as a positive electrode and carbonaceous materials as a negative electrode was invented in 1985. This

is the present-day lithium ion battery. Nowadays most of us own a mobile phone as well as a laptop or a tab. Most of the devices are powered by Lithium-ion batteries. There are several advantages of advantages Lithium ion batteries. It can hold larger amount of energy when compared to other batteries. It has high energy density. It is rechargeable and it has more life cycles than other batteries. The voltage produced by each cell is about 3.6 volts which is higher than other cells. They provide a constant 3.6 volts per cell before falling off as the last charge is used. Rate of self-discharge is much lower than that of other rechargeable cells such as Ni-Cad and NiMH forms. Very little energy is wasted and climatic resistance compared to other rechargeable batteries The Lithium polymer batteries are used in some mobile phones due to its flexibility and ability to be manufactured in many shapes. But its main disadvantage is that it has less charge density than Lithium ion batteries and is costlier. Lithium polymer batteries are nowadays used in flexible devices. The Lithium ion batteries were invented in the year 1985. Since then it has been used in many devices but there is still no new battery technology which is ready to use. There is no replacement for Lithium-ion batteries till now.

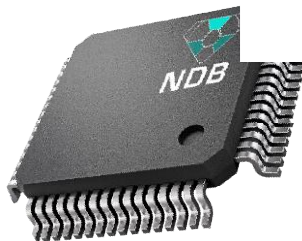
Huilin Pan, et.al. (2016), There are many evolving battery technologies which have a higher possibility of becoming a replacement to Lithium ion batteries. An unexpected chemical conversion reaction in a zinc-manganese oxide battery was found by a research team in Pacific Northwest National Laboratory If the team succeeds in controlling the process, the energy density can be increased in conventional batteries without any increase in its cost. This results in the effective usage of Zinc-Manganese oxide battery in the place of Lithium ion batteries.

Nano-Diamond Batteries:

Loz Blain, (2020), A California based company called NDB (Nano Diamond Battery) has developed a new type of battery technology where they are using radioactive C-14 atoms from nuclear waste materials which are usually buried deep inside the Earth’s crust for safety.



As these batteries are made from nuclear waste materials, there is no wastage of resources. In the Nano Diamond Batteries, each cell consists of Graphite part of nuclear waste material. Graphite is used to absorb radiation in a nuclear reaction. The Graphite is used as a moderator and reflector during nuclear reactions to increase its efficiency. After the nuclear reaction, the Graphite itself becomes radioactive. It is very dangerous and expensive to store or to dispose it. The Graphite contains radioactive C-14 which decomposes to produce Nitrogen, N-14 along with an electron and an anti-neutrino. NDB uses this radioactive Graphite to produce tiny Carbon C-14 diamonds. Each C-14 diamond is coated with regular C-12 diamond to prevent the leakage of radiation.



Each cell consists of one C-14 diamond and a nano-diamond battery requires many such cells stacked up. At first the radioactive C-14 is purified and then it is processed by a technique called chemical vapour deposition which builds the C-14 nano-diamond in the atomic level layer by layer. They also use a method called Metal sputtering. The nano-diamond battery also has a small integrated circuit board and a tiny super capacitor to store and distribute the energy.

BusraBalli et.al., (2019), Sourav Gupta. (2019), The nano diamond battery generates energy due to the decay of radioactive C-14 atoms present in the C-14 diamonds. This C-14 diamond produces average of 3600 electrons as it decomposes. Thus, the C-14 diamond produces electricity. This electrical energy is stored in the super capacitor and is distributed. The super capacitor acts as the storage device and the C-14 diamond is used to generate electricity. The super capacitor has high capacity and high energy density compared to normal capacitors but it has lower voltage limits of 2.5 to 2.7 volts. The supercapacitors are highly efficient compared to normal capacitors. It can last for 10-18 years. It also has a high number of charging cycles ranging from 1 lakh to 1 million times. The half-life of radioactive C-14 is 5730 years and the battery's life span expected to be close to 28000 years. The radioactive C-14 diamond is encased in a layer of C-12 diamond which prevents radiation from reaching out of it. Since diamond is the hardest substance on Earth, there is a lower chance of damage or leakage of radiation and the company has reported that its radiation levels are much lower than the radiation produced by the human body itself. So, it is safe for domestic use. The company says that the battery could be made in any shape or size or in any standard such as the AA, AAA types of batteries. They have said that it could be used to power any appliances or devices. The battery need not be replaced as it has long life.



The example given by the company for the use of its nano-diamond batteries in a small-scale, is to provide energy to devices like mobile phones and laptops, vehicles like cars and trucks, and even to power houses. It can also be used as a power source in pacemakers. The large-scale use is that it could be used to power satellites and other outer space technologies. The company said that the cost of the nano diamond battery would not be too high and will be similar to or sometimes cheaper than the regular Lithium ion battery. This is because radioactive C-14 is a waste material which is usually dumped deep under the soil. The company also gets paid for the safe removal of the radioactive waste material from the power plants. The company has completed a proof of concept and they have said that they are ready to build the prototype. They have also said that their low powered commercial product will reach the market in next two years and the high powered one would reach the market in five years of time. This could be an efficient energy technology of the future which could be used in day to day life. This is also energy efficient technology as the energy wasted during its storage is very less compared to Lithium ion batteries.

III. ADVANTAGES

1. The use of technologies which use water as fuel could decrease the use of petroleum and other depleting fuels. It will also reduce the release of green house gases into the atmosphere.
2. The nano-diamond batteries could be used to power satellites and space stations for many years without changing the batteries.
3. The NDB technology could be used to power many devices in our day-to-day life. It could be used to power devices for a very long time without the necessity of changing it.
4. The nano-diamond batteries are completely biodegradable. So there are no environmental effects caused due the nano diamond batteries.

5. The nano-diamond batteries are extremely strong as they are made up of diamonds. So it cannot be broken easily and are not as dangerous as Lithium-ion batteries which burn in the presence of air.
6. Since the nano-diamond batteries can produce energy for many years, it could be used in pacemakers.
7. The nano-diamond batteries may be even cheaper than Lithium-ion batteries since they are manufactured from nuclear waste. The company gets paid for removing the nuclear waste from the power plants. So the only cost would be manufacturing the nano-diamond batteries from the radioactive grapheme.
8. Nano-diamond batteries could be used to provide electricity even in the most rural areas.
9. The radioactive substances will never get depleted since the half-life of a radioactive C-14 is 5700 years.
10. This technology would further be developed and batteries which are more efficient may be produced

IV. CONCLUSION

These nano diamond batteries could be used in many other ways to power devices. Once the NDB completes its research and development and receives the patent for this product, they could production in large quantities and it would be made available for domestic use.

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