



## Electrical Vehicles – The New Era of Batteries

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### Abstract

Fossil Fuels (Petrol and Diesel) are the limited non renewable source of energy at the earth. Combustion of Fossil Fuels (Petrol and Diesel) is hazardous for nature in the various forms of pollution. Now a day electrochemical cells are used in electrical vehicle as a power source with good efficiency. Electrical vehicles are eco-friendly vehicle. So now a day the era is of Batteries as a power source in electrical vehicle and so on in sustainable development. This paper has provided an overview of uses of Li-ion batteries as a method for power source for electrical vehicles.

**Key Words-** Li<sup>+</sup>-Ion Batteries, electrical vehicle, Fossil Fuel.

### Introduction

Fossil fuels, which include Petrol and Diesel, are the main power sources of energy in vehicles. All these fuels contain—besides the major constituents (carbon, hydrogen, oxygen)—other materials including metal, sulphur and nitrogen compounds. During the combustion process different pollutants like sulphur oxides (SO<sub>2</sub> and SO<sub>3</sub>), nitrogen oxides (NO<sub>x</sub> = NO<sub>2</sub> + NO) and volatile organic compounds are emitted. Gross emission of pollutants is hazardous all over the earth. These pollutants are present in the atmosphere in such conditions that they can affect living beings and environment. Wet and dry deposition of inorganic chemicals as a pollutants leads to acidification of our environment. These phenomena affect the health of the living beings and destroy cultivated fertile soil and forests. Most of the plants, especially coniferous trees are not resistant for such types of chemical oxides pollutants. These hazardous emissions cause stratospheric ozone layer depletion, ground level photochemical ozone formation, toxic or carcinogenic living being

health effects and growth of the global greenhouse effect, accumulation and persistence in the environment.<sup>1</sup>

The world is gradually marching towards a severe energy crisis, what with an ever-increasing demand of fossil fuels energy overstepping its supply. We have known that the energy we use in daily life is limited. Petrol, Diesel and gas have limited availability. Petrol, Diesel and gas have already become too expensive, and with each passing day, they are moving towards being extinct. Prices have been rapidly increasing, due to the increasing demand and the increasing shortage of energy resources.<sup>2</sup>

Electrochemical cells generate an electric current that can be used in batteries or fuel cells to supply electric energy and they can convert chemical reactions to electrical energy. An electrochemical cell made up of 2 metals electrodes, which are linked throughout an electrical conducting solution (an electrolyte) and linked externally with wire to complete the circuit. In such a case, one of the metallic materials (more reactive) begins to solubilise in an electrolyte, whereas the other tends to contain new metal deposited on it. As the metal is dissolved, the more reactive electrons that are used in the metal deposition on the other electrode flow through the external contact (as an electrical current).<sup>3</sup>

Harnessing the potential of renewable energy worldwide is currently being considered to find alternatives for obtaining energy by using technologies that offer maximum power efficiency and minimum pollution. In this context, new energy generation technologies are needed to both generate low pollutants emissions, as well as identifying, planning and implementing the directions for harnessing the potential of renewable energy sources.<sup>4</sup>

Now a day's lithium-ion batteries (Li<sup>+</sup>-ion) are the most common modern battery type as a power sources. In Li-ion batteries, lithium ions shuttle through the electrolyte solution from one electrode to the other. The anode is usually made of carbon-based compounds like graphite. The cathode is usually made of transition metal compounds that contain lithium in their molecular structure. Differences in the battery's cathode, anode, and electrolyte solution give the battery different strengths. Li<sup>+</sup>-ion batteries tend to outperform the other most common battery type such as lead-acid batteries. Li<sup>+</sup>-ion batteries remain the focus of most energy storage research today and are expected to have the broadest range of commercial applications in the near future as a power source. Lithium-ion batteries are

usually classified by the electrochemical properties of their electrodes. Depending on the intended use case of the lithium-ion battery, different chemistries are used.<sup>5</sup>

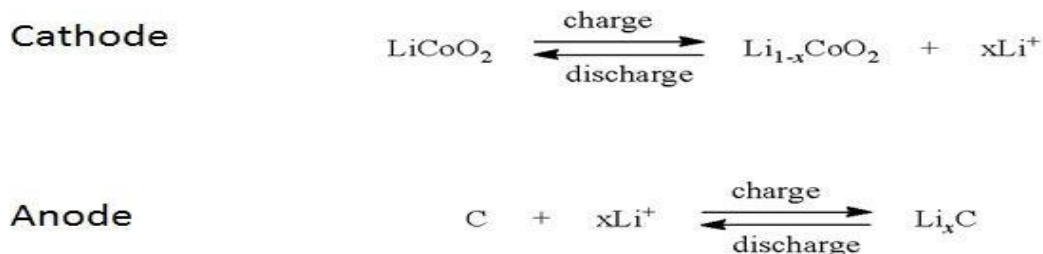
Electric Vehicles (EVs) are becoming a reality mainly because of the falling price of traction batteries. EV's acceptability is growing with increasing drive range per recharge. Desired attributes of EV batteries include: high energy density, power density, cycle life, safety and low cost. New cell chemistries are being introduced for making batteries smaller, lighter and to store enough energy so that EVs can compete with conventional fossil fuel vehicles. Lithium-ion batteries are currently the most popular EV batteries available in the market. Lithium-ion refers to a large family of cell chemistries, which are characterized by the cathode material and the transfer of lithium ions between the electrodes during the charge/discharge reactions.<sup>6</sup>

### **Electrochemistry of Li Ion Battery**

The reactants in the electrochemical reactions in a lithium-ion cell are materials of anode and cathode, both of which are compounds containing lithium atoms. During discharge, an oxidation half-reaction at the anode produces positively charged lithium ions and negatively charged electrons. The oxidation half-reaction may also produce uncharged material that remains at the anode. Lithium ions move through the electrolyte, electrons move through the external circuit and then they recombine at the cathode (together with the cathode material) in a reduction half-reaction. The electrolyte and external circuit provide conductive media for lithium ions and electrons, respectively, but do not partake in the electrochemical reaction. During discharge, electrons flow from the negative electrode (anode) towards the positive electrode (cathode) through the external circuit. The reactions during discharge lower the chemical potential of the cell, so discharging transfers energy from the cell to wherever the electric current dissipates its energy, mostly in the external circuit. During charging these reactions and transports go in the opposite direction: electrons move from the positive electrode to the negative electrode through the external circuit. To charge the cell the external circuit has to provide electric energy. This energy is then stored as chemical energy in the cell (with some loss, e. g. due to columbic efficiency lower than 1). Both electrodes allow lithium ions to move in and out of their structures with a process called insertion (intercalation) or extraction (deintercalation), respectively.

As the lithium ions "rock" back and forth between the two electrodes, these batteries are also known as "rocking-chair batteries" or "swing batteries".<sup>7-8</sup> The positive electrode (cathode) half-reaction in the lithium-doped cobalt oxide substrate is<sup>9-10</sup>

The following equations exemplify the chemistry.



### Advantages of lithium-ion batteries for vehicle use

Lithium-ion batteries are the most suitable existing technology for electric vehicles because they can output high energy and power per unit of battery mass, allowing them to be lighter and smaller than other rechargeable batteries. These features also explain why lithium ion batteries are already widely used for consumer electronics such as cell phones, laptop computers, digital cameras/video cameras, and portable audio/game players.<sup>11</sup>

### Conclusion

Fossil Fuels (Petrol and Diesel) are the limited non renewable source of energy at the earth. Combustion of Fossil Fuels (Petrol and Diesel) is hazardous for nature in the various forms of pollutions. Now a day electrochemical cells are used in electrical vehicle as a power source with good efficiency. Electrical vehicles are eco-friendly vehicle. So now a day the era is of Batteries as a power source in electrical vehicle and so on in sustainable development. This paper has provided an overview of uses of Li-ion batteries as a method for power source for electrical vehicles.

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