

ELECTRIC VEHICLES. ARE THEY A BETTER SOLUTION FOR OUR FUTURE?

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Abstract. *This article reflects the particularities of the electric vehicles, which are powered by one or more electric engines and gain electricity autonomously from the battery or from extravehicular sources of electricity. The author explains their pros and cons, their influence on the ecology and possible future events, as these cars are not as eco-friendly to the environment as most people think. He also hopes that solving the current problems related to electric cars will make their future as realistic as it was predicted.*

Keywords: *battery, ecology, recycling, technology.*

Introduction

Electric vehicles (EV), according to source [1] and [2], are vehicles which are powered by one or more electric engines and gain electricity autonomously from the battery or from extravehicular sources of electricity. Electric cars are different, as a concept, from cars equipped with internal fuel combustion engines, trolleybuses, electric aircrafts, rail vehicles and electric space crafts.

Nowadays, electric vehicles more and more influence the production aspects of car manufacturers, people's desire to purchase cars and the economics of the countries. About 15 years ago nobody believed in the future of the electric cars, but the things have changed a lot, and it is impossible to ignore them now. They have become more and more popular around the world and the wealthiest countries change the law and invest huge amounts of money to develop them. Electric vehicles have a lot of benefits and it is commonly believed that the ecology depends on refusing the classical ones with engines based on internal fuel combustion and transferring to the production of electric cars.

This article tries to answer two simple questions. Why did people start to produce in mass electrical vehicles, which were invented earlier than gas cars in the last two decades? Will their future be as realistic as it is expected?

Pros and cons

The benefits of electrical vehicles are:

1. Zero emissions – It's the main benefit, which excludes harmful gas pollution in densely populated areas;
2. Buying incentives – Almost all the countries have such incentives, which decrease the total cost of EV;
3. Low running costs – In Moldova, according to sources [3] and [4] for March 2022, the cost for Hyundai Ioniq, a standard sedan is $21 \text{ lei} \cdot 100^{-1} \text{ km}^{-1}$ in comparison with a sedan with a gasoline engine Hyundai Accent $161 \text{ lei} \cdot 100^{-1} \cdot \text{ km}^{-1}$. EVs have less maintenance cost due to the absence of: the exhaust system, cooling system, starter, gearbox, filters. Also, less oil is necessary and the construction of an engine is simple and smaller;
4. Tax benefits;
5. Comfort – It is almost silent and the vibration from engine is missing;
6. Acceleration.

The cons are:

1. Charging points – The infrastructure isn't at the necessary level of coverage area and governments can't manage to develop it in time;
2. Charging time – It requires a lot of hours to charge fully the car from the 0, in comparison with refueling, which takes less than 5 minutes;
3. Battery range – It is less, most of the electric cars have a range up to 300 km only. It depends on the weather; batteries being influenced by low temperature, which reduces their capacity;
4. Purchase price – It is about 30-50% more expensive than gas cars.

Main ecological problems of the lithium-ion battery

The main points of increasing the EV's popularity are the ecological requirements and the continuous growth of the prices for fuel. The benefits of using an electrical vehicle are obviously good arguments in choosing them, but in overall it isn't such a good alternative as people believe.

Firstly, lithium-ion batteries, the most used type, are environmentally harmful. The process of producing these batteries for one electric vehicle is as toxic as the exhaust gases which are produced by one gas car for several years. The number of batteries is monstrous and the process of producing isn't safe. It's toxic for the factory workers and it includes a lot of toxic elements like cobalt, nickel and lithium.

It is suggested that in 2025 there will be a global lithium crisis, and right now there is a lack of lithium on the global market. In the process of using the battery the car makes zero emission, but the electricity obtained is made from electrical stations which emit harmful gases. There are stations which are based on renewable energy, but their influence is not as big as it is needed. The trend of building and improving electrical stations with renewable energy is growing, but it needs more time and finances. The batteries have the property to auto drain even though the car is not used, increasing the electricity consumption.

The end of the battery life path is sad. All the battery elements are very harmful to the soil, and they can't be thrown away as usual rubbish. The recycling system of lithium-ion batteries isn't effective. For example, in Japan, the United States and most of Europe, almost 100% of lead-acid batteries are collected for recycling, which recovers more than 98% of the total mass of batteries. Therefore, other methods are required for lithium-ion devices – redox reactions, dissolution, or the use of electrostatic and magnetic properties to separate the materials that make up the cells. The lack of labeling is another major obstacle to an efficient recycling system. Unlike lead-acid batteries, lithium devices come in a variety of chemistries and architectures, such as NCA, NMC, LMO, LCO, and LFP batteries. Cells can also have different shapes (prism, cylinder, etc.). There isn't an international standard for the construction of lithium-ion batteries, and every car manufacturer does it in his own way. The automation process isn't available due to various types of batteries, but the manual disassembly is too expensive, inefficient and dangerous.

Recycling batteries are not the main goal for the battery manufacturers. That is why hydrometallurgy, which includes grinding and acidizing; and Pyro metallurgy, which includes energy-intensive smelting, have become the most common methods for processing lithium-ion batteries. These methods are obviously not as effective as it should be theoretically, and this is shown in figure 1.

The future of the electric cars

The current problems are important because they influence the environment, but there are positive aspects too. We can say that this type of vehicles is at the beginning of its path, and a lot of work and finances should be taken into consideration to make them better. The lithium-ion battery is already at the end of the path, and right now the world is investing a lot of money in the development of other types of batteries. One day, thanks to the development of legislation the incentivize manufacturers will be able to recycle the end-of-life batteries. This will introduce standardization, reduce prices, create loosed loop partnerships and so on. There is already much better recycling than shredding as separation of the electrode material which is effective up to 70% compared to never used materials.

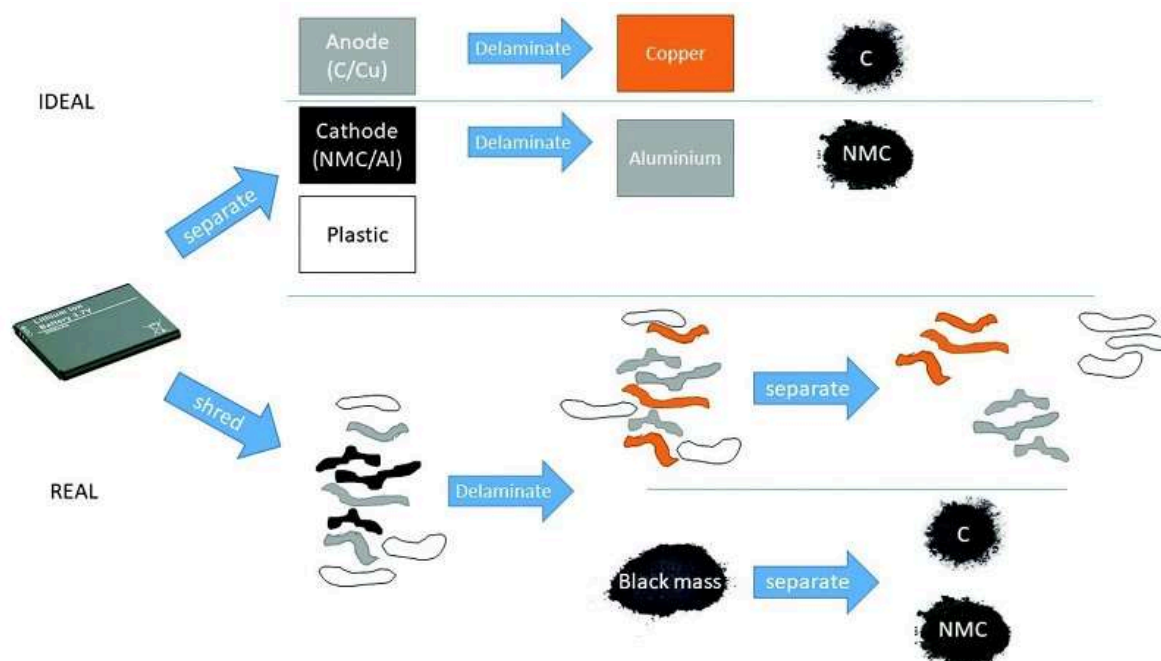


Figure 1. Scheme of ideal and real lithium-ion battery recycling

Investors and government believe in the success of the electric cars. It is obvious that nobody will give up easily in this domain full of manufacturers who compete with each other for the clients. Europe tries to avoid being dependent on oil countries, invest in renewable sources, encourage manufacturers by laws, and the European countries are ready to change the infrastructure to be up to date with new the technologies and trends. The entire world is fond of electric cars, and of course one day they will start to be eco-friendlier than gas cars, even though it will be hard.

Conclusions

The electric vehicle problems should to be solved as soon as possible, because if there are no more problems, the cars will become almost ecologically safe. To reach that, we need a long and hard path to pass, with a lot of problems to solve and belief in the future. Right now, the electric cars are more dangerous for the environment than gas cars, but I hope this will no longer be in this way. It is wrong to say that the electric cars are better for the environment, but we can say that finding a solution for their batteries will make this statement true and their future will be as realistic as it was predicted.

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