

Design of Electric Hybrid Vehicles

Akriti Singhal¹

(Automotive Design Engineer, University of Petroleum and Energy studies, India)

Abstract: An electric hybrid car is one which runs on electric motor and does not consume fuel. It does not involve the complication of harmful emissions and is thus environment friendly. It utilizes batteries which generate 200-300 volts or more of electricity. The battery is charged through regenerative braking which converts the car's kinetic energy to electrical energy. Electric Hybrid Vehicles can be classified by the degree of hybridization as full hybrid and mild hybrid. Full hybrid vehicles include the type which run by only batteries, only engine, or a combination of batteries and engine. The examples of this type are: Ford Fusion Hybrid and Toyota Prius. Whereas in a mild hybrid vehicle the electric motor does not have enough power to drive the vehicle hence it cannot be driven only on its electric motor. Examples of this type are : Chevrolet Silverado Hybrid.

Keywords: Electric Motor Drive, Electrocutation, Powertrain, Regenerative Braking, Shutoff

I. Introduction

A conventional vehicle, either gasoline or diesel, utilizes a large amount of fuel in order to run thereby causing a problem of environmental pollution and a threat to human life. Also the consumption of a large amount of fuel leads to its deterioration which is believed to be exterminated in the coming future. Hence the use of electric hybrid vehicles can contribute to the improvement of the environment.

Electric motor drive include the types of cars which are meant for improving the economy of the fuel or supply better performance characteristics. The two main types of hybrid cars are mild and full hybrid.

The most sophisticated of all hybrid systems are full hybrid cars which can be powered only by the electric motor, the combustion engine or by both. The car is generally powered by the electric motor only during starting and low speed driving and no carbon dioxide emissions are produced. The most suitable power source is skillfully selected by the full hybrid system. The battery is charged through regenerative braking which charges the battery and powers the electric motors used in the car.

II. Evaluation Of Risk

Large battery packs are required for powering the electric hybrid cars. Some of these batteries generate 200-300 volts of electricity or even more. In case of detection of a short circuit or a collision, the power is shut off.

The possible danger could take place if the batteries containing nickel-metal hydride come in contact with water and result in the formation of hydrogen. Formation of enough hydrogen could result in an explosion. This risk of an explosion happens in the case of a ruptured battery.

The electric motors and high voltage batteries used in hybrid vehicles to achieve benefits of fuel economy are more than enough to give a shock to anyone who accidentally comes into contact with the high voltage battery, wiring or powertrain components. The high voltage secondary ignition system can give you a nasty shock.

The ownership of hybrid vehicles increase the risk for the passengers during an accident due to the presence of electric motor and electrocution. The passengers hence face difficulty in getting out of the vehicle.

III. Possible Solutions

Bare hands and uninsulated tools must be avoided in order to avoid shock from the battery. The high voltage battery connections must be handled with utmost care and using insulated tools. Other electrical components used in the design must also be used with caution.

Prior to any electrical work, the high voltage hybrid battery must be disconnected. The recommended protection is to wear insulated gloves Class 0 rated, which are rated to 1000 volts AC, and must not have any cuts, tears or pinholes.

Also, before starting any electrical or mechanical repairs on any hybrid powertrain components, it must be made sure that the vehicle is OFF. In the event of a collision sufficient to activate the supplemental restraint systems, hybrid vehicles utilize safety switches to automatically cut high voltage power to the system. A fuse will open cutting off high voltage power from the battery if the system short circuits.

The positive and negative cables are isolated from the chassis to prevent any type of electrocution hazard from touching the chassis itself.

To ensure safety, always treat high voltage cables as if they are energized. The high voltage cables and batteries are placed by the manufacturers in locations that we generally do not consider cut points. The possibility must always be considered by the rescuer that the vehicle which has suffered grave collision, damage may have high-voltage components closer to necessary cut points.

In case of hybrid vehicles, never approach from the front or the rear until being sure that it has been immobilized and disabled. In order to achieve immobilization choke the vehicle, place it in park and then set the emergency brake. Several models including those produced by Ford, Mercury, Toyota, Lexus have ready light indicators on the dashboard to alert the occupant that the vehicle is in its "ready mode" and will move if the accelerator is depressed.

IV. Benefits

Fully Hybrid-electric vehicles (F-HEVs) include the benefits of electric motors and can be configured to obtain different objectives, such as low CO₂ emissions, less burning of fossil fuels etc. Electric hybrid vehicles have a potential significance for the environment as well as the vehicle owners.

4.1 Benefits for Owners

- Fuel costs can be reduced to a large amount in hybrid vehicles i.e. 20-40% in comparison to conventional vehicles.
- The drivers obtain the benefits of predictable energy costs which are stable compared to the volatile oil prices.
- The consumers of hybrid vehicles are saved from large fluctuations in gasoline prices thereby improving the economy.
- Electric vehicles also include the benefits of a quiet ride and increased convenience.
- Lower operating costs
- Lower maintenance costs
- Opportunity to make a "green" choice

4.2 Potential Benefits for the Environment

- Increase in energy efficiency
- Reduction in oil dependency
- Reduction in vehicle noise
- Emissions of harmful air pollutants is reduced to a large extent.

V. Conclusion

Electric Vehicles have a long way to go in every aspect, from technical updates to manufacturing techniques on a commercial scale for the betterment of the environment and providing people a means of easy transportations over long distances at affordable prices without affecting the environment.

Apart from this, increased CO₂ emissions, global warming, Green House Effect and increased temperature levels have caused a threat to the existence of life on earth. Thus vehicles which do not emit any harmful elements into the atmosphere must be encouraged for daily use purposes to prevent the end of life on Earth.

With increase in technological advancements, electric vehicles will surely be produced at affordable prices at commercial scale in the near future. Moreover, when no more fossil fuels will be left, Electric Vehicles will be the only mode of transportation left for people.

References

Books:

- [1]. Plug-in Hybrids by Sherry Boschert
- [2]. The Electric Car by Michael Hereward Westbrook

Websites:

- [3]. http://www.emergencytrainingsolutions.com/downloads/pdfs/ETS_FDIC_%20Hybrid_Vehicle_Article.pdf
- [4]. <http://www.pilotsystemsinternational.com/hybrid-vehicle-safety.html>