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Research status and Development prospects of Extended Range Electric Vehicle

Yuanchao Mu[1], Lingshan Chen[2]

[1](School of Automotive Engineering, Shanghai University of Engineering Science, China)
[2](School of Automotive Engineering, Shanghai University of Engineering Science, China)

ABSTRACT:-This article describes the definition and structure of the EREV, the working modes and the research status of the EREV are described in detail, and describes the advantages of the EREV. Finally, this article forecasts the development and application prospects of the EREV.

Keywords-development prospects, electric vehicle (EV), range extender (RE), research status, working modes

I. INTRODUCTION

China's energy and environment is facing a severe challenge for the rapid growth of car ownership and automotive industry. Energy and environmental issues have become the two major problems restrict the sustainable development of the automotive industry, the development of electric vehicles has become an important way of guaranteeing china's energy security and transformation of low carbon economy.But at this stage, the factors of battery energy density, lifetime and cost of electric vehicle limit the market process and industrial development.As a pure electric vehicle which can increase the driving range,at this st-age,EREV become the most likely to a pure electric car product of entering domestic use and industrial prospects.Thus it also becomes a new energy automotive product of the research hot spot and the key development of automotive industry at home and abroad presently.

II. DEFINITION AND WORKING MODES OF EREV

2.1 The definition of EREV

EREV is an electric vehicle with characteristics of series hybrid electric vehicle, and driven by a motor vehicle, the car carrying two sets of energy storage devices, which are power batteries and range extender (engine generator systems), to drive the motor provide energy. Electric energy is the main energy of the EREV, the fuel is the spare energy, only when the battery power is low, the range extender begins to run to provide extra energy for the motor to drive the vehicle to continue running, increases vehicle mileage, so that it can be arrived in charge or refueling sites, and not breakdown phenomenon[1].

As EREV's auxiliary power unit (APU), in RE, the engine and the generator transmit power by rigid connections, external connections are not mechanically connected to the drive wheels, but transfer the power to the motor in the form of the engine fuel combustion to drive generator to generate electric energy. The dynamic

System structure shown in Figure 1.

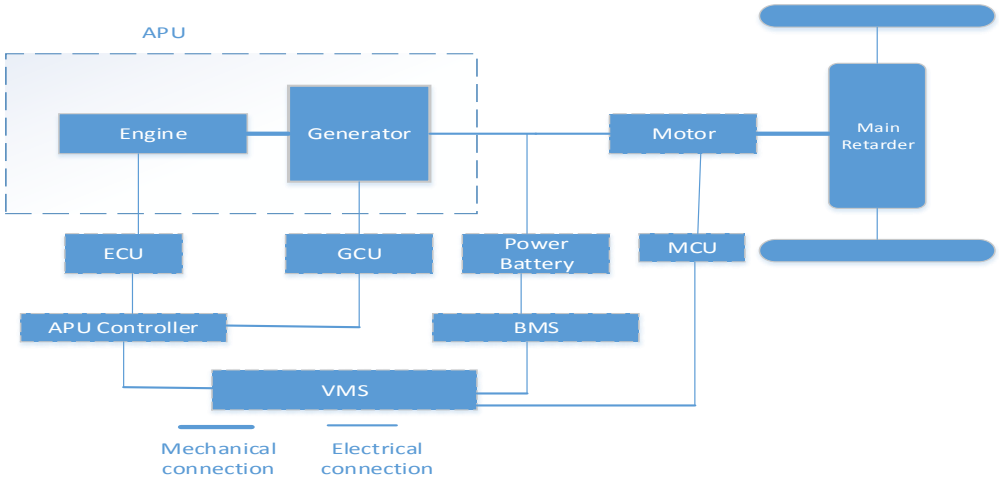

Figure 1 EREV'S dynamic system structure

2.2 EREV's working mode

According to different operating conditions, EREV can transform working modes flexibly to achieve the best fuel efficiency. It includes the following two main modes.

(1) Pure electric mode: Battery charging by charging pile ,and in the battery capacity range ,EREV is pure electric mode, where it is equivalent to a pure electric vehicle, range extender system does not start[2].

(2) Hybrid mode: When the high power condition or low battery, the range extender system start to provide power for driving motor or battery charging.

The two operating modes of EREV overcome the problem of the short distance of the pure electric car , which has become a development direction of new energy vehicles.Due to the pure electric vehicle's charging pile network is still unable to cover a wide range with the gas station network, but the EREV could take advantage of the gas station network,it seems to have become a transition product of the pure electric vehicle.

III. ADVANTAGES OF EREV

(1) High saving rate: The only function of the small internal-combustion engine in the auxiliary power system (APU) is to drive the generator to generate electricity. In the power generation conditions, the internal-combustion engine is set to work in the best operating range, to output constant power and torque, and to achieve the oil-electric energy conversion process. At this time, the internal-combustion engine's work efficiency, emission and reliability are in the best working condition, the system has a higher saving rate[3].

(2) Low cost:The production and use of EREV is low cost, which can be charged by the vehicle-mounted generator sets at any time , therefore, the vehicle-mounted power battery only need to configure 30%-40% of the same level pure electric vehicle battery usage[3]. When the RE and the power battery pack work together, the charge and discharge rate of vehicle-mounted power battery pack is greatly reduced, so it can help to extend battery life and use cycle, and the cost of manufacture and use of vehicles can also be greatly reduced.

IV. RESEARCH STATUS AT HOME AND ABROAD

4.1 Domestic research status

Due to the domestic market factors and subject to weak technology accumulation, companies that are involved in the development of EREV are not much, they are mainly some bus production enterprises.

At present, some domestic company has developed 2 models of EREV, respectively using the company's S18 platform and A21 platform, the driving system is equipped with a extended-range electric driving system developed by the company. The electric vehicle is equipped with a specially developed extended-range generator sets, which has characteristics of little vibration, low fuel consumption and low noise. When the mileage is less than 100km,the electric vehicle can completely rely only on-board battery to drive. When the limit protection state of the battery pack is reached, the RE can start automatically, and can be started manually according to the customers' wishes, so as to provide continuous power for the automobile driving system.

4.2 Foreign research status

In 2007, DOE invested $ 58 million to support the research and development of key technology of EREV and the vehicle's demonstration run. The driving motor peak power of GM Chevrolet VOLT is 110kW, it's peak torque reaches 370Nm. It uses a 16kWh lithium battery, when the battery is fully charged, it can meet the vehicle power performance and the requirement of 64 km pure electric mileage. And it integrated engine-generator integrated technology, the gasoline engine displacement is 1.0L, while mileage is longer, the engine starts to provide power, which can ensure VOLT continue driving.

The European Opel car company developed EREV called Viraro E-Concept electric version of the van and Ampera car, which rely on the EREV technology of its parent company GM.

V. DEVELOPMENT PROSPECT

Nowadays, the development of electric vehicles in various countries has experienced the development from the ordinary hybrid electric vehicle to the plug-in hybrid electric vehicle, and to EREV, and then the development path of transition to the pure electric vehicle [4].

In China, the development of EREV is still in the initial stage. During the research of EREV, you need to consider the vehicle for different purposes, the use of different features and application environment factors, in particular, to pay attention to the range extender system matching, energy-saving mechanism and working characteristics of power batter-y, vehicle control strategy, vehicle safety and reliability for more in-depth research.

EREV have a low-cost, high fuel economy, low emissions, less investment in infrastructure and many other advantages, before battery technology bottlenecks unresolved, it is the best technical solution for the transition to a pure electric vehicle. Therefore it will be subject to extensive attention from all sectors of society, and with the popularization and application.

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