Application of solar energy technology in the field of new energy vehicles in China

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Abstract. This paper analyzes the development status of solar cars and the main application of solar energy in the field of new energy vehicles. Solar energy application in the field of new energy vehicles there are two main ways: first, as a driving force of the car; Second, as an auxiliary energy for cars.

1. The introduction

With the development of society and the progress of science and technology, people pay more and more attention to the basic necessities of life, especially daily travel. In today's society, the number of private cars is increasing, which brings about more and more social problems. The consumption of oil and energy is increasing day by day, and the emission of automobile exhaust leads to more and more serious greenhouse effect. How to reduce the emission of carbon dioxide in automobile exhaust, reduce the consumption of traditional energy and realize the sustainable development of human society is the main problem facing today's society. Want to solve this problem must be for the automotive industry has developed a new environmentally friendly and efficient clean energy, solar energy as a representative of the new energy is inexhaustible, so utilizing solar energy in the automotive industry, the energy consumption and environmental problems caused by the automobile industry can be effectively controlled [1].

2. Development status of solar cars

2.1. Foreign development status of solar cars

The world's first solar-powered car was developed in Britain in 1978, when it reached speeds of 13 kilometers per hour [2]. In 1982, a new type of solar car was developed in Mexico. It looks like a tricycle and has a solar panel on the roof. Under the sun's rays, the solar panels charge the cars, which can reach speeds of up to 40 kilometers per hour. But the solar car has a big drawback. The car can only run for 40 minutes a day, so it can't run long distances [3]. In May 1999, researchers at the university of Sao Paulo in Brazil developed a new type of solar car. The new solar car has a top speed of more than 100km/h, but this new energy vehicle is not put into use. In 2003, a new type of solar car was unveiled at the Australian solar car race. It was the Dutch-made "nuna" solar car and won the championship. It covered a distance of 3010 kilometers in 30 hours and 54 minutes, setting a new world record of 170 kilometers per hour for a solar car [2]. On July 4, 2013, a team of researchers from the university of technology in Eindhoven, the Netherlands, demonstrated Stella, the world's first solar-powered family car. According to the introduction, "Stella" adopts high-efficiency solar cells and
lightweight body design, with a total weight of 380kg. It has a real cab and rear seat, which can accommodate a family of four [4].

2.2. Domestic development status of solar cars
The domestic research on solar car started relatively late. The first solar car was successfully developed in September 1984. The car was developed by several members of the metal research institute of Hubei Technology development company over 56 days and nights and was eventually named Sun. In 1996, Tsinghua University award for solar car series, developed a of solar car, the solar car named "chase", used in the solar cars we developed the fifth generation of solar panels, but on the day of the solar energy conversion rate is relatively low, only about 14%, "chasing" top speed can reach 80 km/h, but the weight is 800 kg, producing a costs $78000[5].

In 2001, China's first manned solar car was successfully developed by Shanghai jiaotong university. The solar car was named siyuan. Siyuan is a solar-powered car driven entirely by solar energy. After three or four hours in the sun, you can easily drive more than 10km. Sun yat-sen university has since developed a new solar-powered electric car that looks a bit like a park battery car. It can carry six passengers but can only reach a top speed of 48 km/h and last for one hour [5].

3. Application of solar energy in automobile new energy field

3.1. Solar energy as the driving force of the car
Using the solar energy as the driving force of the car only needs to install about two square meters of solar battery pack, can obtain sufficient electric energy, and the actual utilization efficiency is as high as 90%. However, the energy conversion rate of ordinary cars is far less than that of solar cars. Only about 30% of the energy is used to drive cars, and most of the energy is consumed by other driving parts [6]. Its working principle is to use solar panels to absorb solar energy, and through a series of devices to convert solar energy into electricity stored in the battery, when the car is driving, the battery discharge drive car forward. According to the utilization of solar energy, it can be divided into the following two situations:

1) Use solar energy as the primary driver of your car. Taking solar energy as the first driving force of automobile is to completely use solar energy instead of traditional oil energy as the driving force of automobile. Compared with traditional fuel automobile, this kind of solar energy automobile is obviously different in appearance and structure principle. While a conventional fuel car usually consists of an engine, chassis, body, gearbox, and electrical equipment, a solar car has no engine, gearbox, or other components, but consists of solar panels, batteries, and electric motors [7]. The solar energy is absorbed by the solar panel to convert it into electric energy and stored in the battery. When the car is driving, the electric energy is released and converted into mechanical energy by the motor to drive the car forward. In the process of driving, the speed of the car can be controlled by controlling the current input of the motor.

2) Solar power is mixed with other energy sources as the driving force. Solar power, along with other energy sources, is the driving force of the car, which is not too different from conventional fuel cars in terms of appearance and structure. In terms of design, the solar car is basically the same as the traditional fuel car. It is different from the fuel car in that the sunroof or windshield is replaced by solar panels to absorb the solar energy. In terms of structure, compared with traditional fuel cars, this kind of solar car does not change much in structure, but only increases the electric motor used to convert solar energy into electrical energy and then into mechanical energy to drive the car forward [8].

3.2. As the auxiliary energy of automobile
With the continuous development of science and technology, the electric components of modern cars are more and more, and the consumption of electric energy is also increasing day by day, which makes various traditional fuels constantly consumed. In the face of this situation, solar energy as an auxiliary energy for cars to provide a variety of auxiliary electrical energy consumption, not only can effectively
alleviate this situation, but also more environmental protection. Solar energy as an auxiliary energy for cars can be divided into the following situations:

1) Use solar energy to power the air conditioning system.

With the continuous improvement of people's life quality, people have higher and higher requirements for automobile comfort. Therefore, air conditioning system has become an indispensable part of modern cars. Modern car air conditioning systems are often powered by fuel combustion, which not only increases fuel consumption but also renders the air conditioning system unusable when the car is not started. Using solar energy to power the air conditioning system can effectively solve this problem. When the vehicle is not running, solar panels can be used to convert solar energy into electricity and store it in the battery. When air conditioning is used, batteries power the air conditioning system. This method can not only reduce the consumption of traditional fuel but also save energy and environmental protection [9].

2) Use solar energy to power the vehicle data recorder.

Vehicle traveling data recorder in modern society has become an indispensable part of the vehicle traveling data recorder of the car when it is provided by fuel burning energy, and at the time of parking due to engine is not running, vehicle traveling data recorder is in not working condition, in this case if vehicles appear some unexpected circumstances, not through the vehicle traveling data recorder to find clues. By using solar energy as auxiliary energy to power the auto data recorder, the auto data recorder can be kept in working state when the car stops running, providing clues for the occurrence of some accidents. And solar energy can be said to be an inexhaustible clean energy, the use of solar energy as an auxiliary energy can not only reduce the consumption of traditional energy and more environmental protection.

3) Power the blower of the car

Install the blower in the car, according to the solar cell on the sunroof as the power supply, introduce the cold air outside the car, reduce the temperature inside the car, reduce the number of air conditioning applications. This can not only reduce energy consumption, but also avoid the release of harmful gases and ensure the safety of the environment [10].

4. Problems in the development of solar cars

The use of solar energy as the driving force of cars, the source can be said to be inexhaustible, the use of solar energy can not only reduce the consumption of traditional energy, but also can reduce the emission of pollutants. Therefore, it can be said that solar cars have unique advantages, but to large-scale promotion of solar cars, we have to overcome several problems, the specific analysis is as follows:

1) High manufacturing cost. In order to make the solar car lightweight and have a higher speed, solar car body materials generally use relatively high price of aerospace materials, which makes the cost is very expensive. Take the "chasing the sun" of tsinghua university as an example, its weight is about 800kg, but its cost is very expensive. The cost of producing one set is up to $78,000 [5].

2) Low solar energy conversion rate. Solar panels now have a relatively low conversion rate, which limits the range of solar cars.

5. Conclusions

This paper analyzes the present situation of the development of solar energy vehicles, describes the application of solar energy in the field of new energy vehicles. Nowadays, solar energy is mainly used as driving force and auxiliary energy in new energy vehicles. Although solar energy vehicles have made great progress, there are still problems such as low solar energy conversion rate and high manufacturing cost.

Reference

[1] Shen Guiying 2017 The auto industry long-term development planning, release Journal of fine and specialty chemicals 25 (5) : 23
[2] Zhou Junchao FanWei, Zhou Xiaopei 2010 The research and application of solar car Journal of information science and technology of China 01 : 37-38
[3] Yu Changyuan 2011 Centered on solar energy ecological transportation research Shenyang university of aeronautics and astronauts
[4] Zhu Zegang 2018 Energy saving and environmental friendly solar car Power world 07:46-51
[5] Wu Huimin 2014 The analysis of the present situation and prospects of new energy vehicles Jilin university
[6] Li Jianghua 2018 Practice and exploration of solar energy technology in the field of new energy of automobiles Science and technology 35 7
[7] Jiang Yuting 2017 Solar technology in the field of new energy automobile application Journal of age of the car 16 : 28-29
[8] Xiao Pan, Wang Haobo 2017 Application of solar energy technology in automobile new energy industry Computer fan 03:25-26
[9] Zhao Yanjie 2018 Solar technology in the field of new energy automobile skill study The car driving and maintenance (maintenance) 4 : 89-90
[10] Li Han 2018 Car solar technology in the field of new energy use analysis Journal of internal combustion engine and accessories 03 : 212-213