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Saving Electricity in Transport

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ABSTRACT: As a result of the analysis, the optimal energy-saving modes in transport using sodium-sulfur batteries are considered.

KEYWORDS: Electric car, batteries, pulse duration, hydrogen, sodium-sulfur battery, regenerative braking.

I.INTRODUCTION

Reducing the energy consumption of electric vehicles and increasing their efficiency is an urgent problem of our modern development. Electric vehicles replace fossil fuel vehicles and take their place in transport. It will be necessary to technically improve electric cars in the city and beyond.

II. SIGNIFICANCE OF THE SYSTEM

The most practical task is to achieve a distance of at least 160 km on a single charge of electric vehicle batteries traveling outside the city at a speed of 80-100 km / h. To do this, reduce the total road resistance and power dissipation of the electric vehicle from auxiliary connections; This is achieved by increasing the efficiency of batteries, electric motors, transmission and communication devices of electric vehicles and power cables. The key problem here is reducing energy consumption and overcoming power losses in auxiliary equipment and improving the braking system in overcoming the overall road resistance. The coefficient of air resistance for electric vehicles should not exceed 0.2 - 0.3, which is a complex but solvable problem. Using regenerative braking is the best way to save energy. During regenerative braking, all kinetic energy of an electric vehicle is converted into electrical energy and returned to the batteries. Although various types of batteries are currently being developed for individual electric vehicles, the only ones actually used in electric vehicles are lead-acid batteries. Their mass is almost equal to the mass of electric vehicles. Therefore, reducing their mass remains an urgent design problem.

III. LITERATURE SURVEY

The use of AC motors with serial drive in electric vehicles has some advantages compared to the use of other types of electric motors. Because in this type of electric motors it is possible to generate a torque equal to the required values at low speeds, as well as the small torque required at high speeds. It is easy to operate and can be connected directly to the battery. Speed control can be controlled using a pulse width controller. In addition, the mechanical speed control of an electric vehicle, that is, with a gearbox, also reduces the energy loss in electric vehicles. The power of the electric motor used in electric vehicles for smooth roads is determined by the following formula (W):

$$\mathrm{P} = C_1 V + C_2 W V^2 + C_d A V^2,$$

where V- is the maximum speed of the electric vehicle, m/s;
W- is the weight of the electric vehicle, N;
A - the front surface of the electric vehicle, M^2 (usually 0.5 - 1.4 M^2);
C_1- is a constant coefficient that takes into account friction during rocking and power dissipation in the moving part (usually 0.03-0.9 N for every 1 N of electric vehicle weight);
C_2 is a constant coefficient that takes into account heat dissipation due to friction compression (usually 0.06 - 0.12 N for every 1 N of electric vehicle weight at a speed of 1 m/s);

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C_d - coefficient of air resistance (usually 0.2 - 0.5).
The maximum engine speed is limited by the amount of mechanical stress at the edge of the rotor. Typically, the rotor diameter of an AC motor is smaller than the rotor diameter of an AC motor. Therefore, the rotation speed is high.

IV. METHODOLOGY

The average speed of 4000 - 4500 rpm and the maximum value of 5000 - 6000 rpm allow optimal engine operation at power. The current value in electric motors is limited to 50A, and the voltage should not exceed 400V.

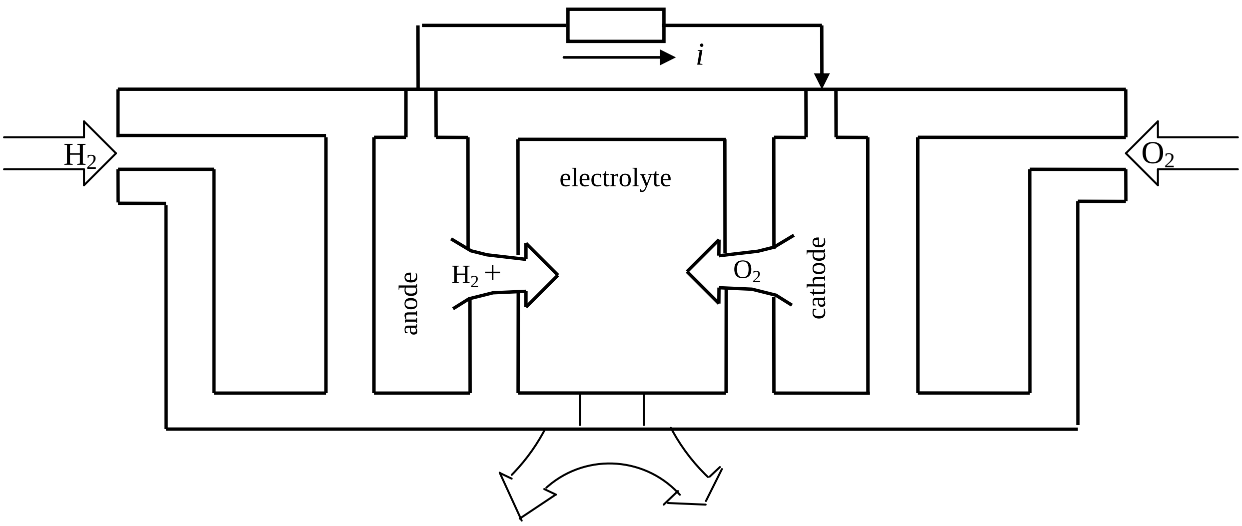

Figure 1. Fuel cell operation diagram

In the future, fuel cells can be used as a source of electricity. The operation of a fuel cell is similar to that of a battery. The simplest fuel cell uses pure hydrogen as fuel and pure oxygen as an oxidizing agent. Two gases pass through the porous material and interact in the electrolyte solution with the formation of direct current, and the final reaction product is water (Fig. 1).During the process, heat is generated. Such power sources can be used in electric vehicles due to the following advantages:
fuel is not burned, but is directly converted into electricity, the ecological state of the environment is not violated;
a fuel cell does not require a cooling device;
the process of using the fuel cell is silent;
Different power of fuel cells expands the scope of their application.
The efficiency of the fuel cells currently produced is above 35% (if the heat generated in the fuel cell system is reused by the heat pump, the total efficiency of the power plant can reach 94%).In the future, it is possible to use other types of fuel for fuel cells. Due to the fact that the use of lead-acid batteries in electric vehicles does not fully meet the requirements for electric vehicles, research is underway to create a fundamentally new type of battery. Promising batteries for use in electric vehicles are currently sodium-sulfur batteries (Figure 2).Between the cathode is a solid electrolyte — liquid sodium and liquid sulfur — the anode. The electrolyte acts only as a filter through which sodium ions pass. Sodium ions react with sulfur and form a potential difference between electrolytes. Sodium polysulfite is formed only during the operation of the electric motor, i.e. when current flows through an electrical circuit. The results of road studies show that an electric van with a sodium-sulfur battery with a single charge can travel 96-120 km, depending on the condition of the road and traffic conditions. Currently, the energy consumption of one element of a sulfuric battery is increased to 550 W * h.90 of these batteries are enough to power the electric motor.

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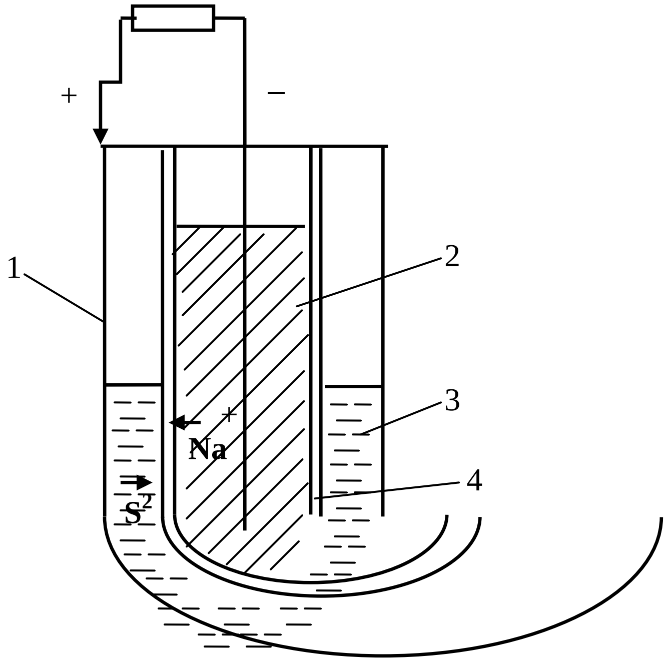

Figure 2. The structure of the sulfur-sodium battery

1 - stainless steel case, which acts as a collector of the anode of liquid sulfur;2 - liquid sodium (soluble at 980C); 3 - liquid sulfur (soluble at 119^0C);4 - is a solid electrolyte based on alumina *β*, which acts as a solid electrolyte that passes sodium ions, separating sulfur and sodium.

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